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-20131126BYZ

SECTION I - APPLICANT FEE INFORMATION

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

Entercom Communications Corp.

MAILING ADDRESS (Line 1) (Maximum 35 characters)
401 E. City Avenue

MAILING ADDRESS (Line 2) (Maximum 35 characters)
Suite 809

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Bala Cynwyd	PA	19004

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(610) 660-5610	WMFS(AM)	34374

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	$ 635	

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

(A)	(B)	(C)	FOR FCC USE ONLY
M O R	0 0 0 1	$ 730	

	TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.	$ 1,365	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Entercom License, LLC		
MAILING ADDRESS 401 E. City Avenue, Suite 809		
CITY Bala Cynwyd	STATE PA	ZIP CODE 19004

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
WMFS(AM)	Memphis, TN	BP-20101022AAH		March 9, 2014

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

☐ Yes ☑ No

If No, explain in an Exhibit.

Exhibit No. See Engineering Statement

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

☑ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

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

☐ Yes ☑ No

If Yes, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☐ No

☑ Does not apply

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☑ No

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

Exhibit No.

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

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

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

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

CERTIFICATION

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

☑ Yes ☐ No

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

Name	Signature	
Andrew P. Sutor, IV		
Title	Date	Telephone Number
Senior VP/General Counsel	11/25/2013	610-660-5610

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

Entercom License, LLC.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

[X] Station License [ ] Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
WMFS	BP-20101022AAH	680 kHz	UNLIMITED	5.0	8.0

2. Station location

State	City or Town
TENNESSEE	MEMPHIS

3. Transmitter location

State	County	City or Town	Street address (or other identification)
TN	SHELBY	MEMPHIS	3627 BENJESTOWN RD

4. Main studio location

State	County	City or Town	Street address (or other identification)
TN	SHELBY	MEMPHIS	1835 Moriah Woods Blvd

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

State	County	City or Town	Street address (or other identification)
TN	SHELBY	MEMPHIS	1835 Moriah Woods Blvd

6. Has type-approved stereo generating equipment been installed? [ ] Yes [X] No

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

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

SEE ENGINEERING REPORT

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
10.39 Amps	12.65 Amps

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
50.0	50.0	+/-j0.0	+/-j0.0

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
TOWER #1 WEST	76.0°		0.910			
TOWER #2 SOUTH	0.0°		1.000			
TOWER #3 EAST	-14.5°		0.920			
TOWER #4 NORTH	76.3°		0.948			

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

SECTION III - Page 2

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
UNIFORM CROSS SECTION GUYED TOWERS	ENG RPT	ENG RPT	ENG RPT	Exhibit No. ENG RPT

Excitation [X] Series [ ] Shunt

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

North Latitude				West Longitude			
	35 °	13 '	22 "		90 °	02 '	37 "

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

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

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

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

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below)
STEPHEN S. LOCKWOOD, P.E.	
Address (include ZIP Code) HATFIELD & DAWSON CONSULTING ENGINEERS 9500 GREEENWOOD AVE N SEATTLE, WA 98103	Date 21 Nov 2013 Telephone No. (Include Area Code) 206 783 9151

[ ] Technical Director

[X] Registered Professional Engineer

[ ] Chief Operator

[ ] Technical Consultant

[ ] Other (specify)

BENJAMIN F. DAWSON III, PE
THOMAS M. ECKELS, PE
STEPHEN S. LOCKWOOD, PE
DAVID J. PINION, PE
ERIK C. SWANSON, PE

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JAMES B. HATFIELD, PE
CONSULTANT

MAURY L. HATFIELD, PE
(1942-2009)
PAUL W. LEONARD, PE
(1925-2011)

Engineering Report:

APPLICATION FOR STATION LICENSE

Proof of Performance

WMFS, 680 kHz

8 kW Daytime 5 kW Nighttime DAN

Facility ID 34374

Memphis, Tennessee

Entercom License, LLC.

November 2013

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Purpose of Application

This Engineering Report is part of an application for Station License by Entercom License, LLC., licensee of WMFS-AM, Memphis, TN.

Background

WMFS employs a non-directional daytime antenna and a four tower nighttime directional antenna array. The daytime power is 8 kW and the nighttime power is 5 kW.

Information is provided herein demonstrating that the directional antenna parameters for the permitted pattern have been determined in accordance with the requirements of section §73.151(c) of the Commission's Rules. The system has been adjusted to produce antenna monitor parameters within ± 5 % of ratio and ± 3° of phase of the modeled values, as required by the Rules.

The field strength measurements used in this report were taken by Entercom's Technical Director for Memphis Mr. Mike Schwartz, in September 2013.

Stephen S. Lockwood, P.E.

21 November 2013

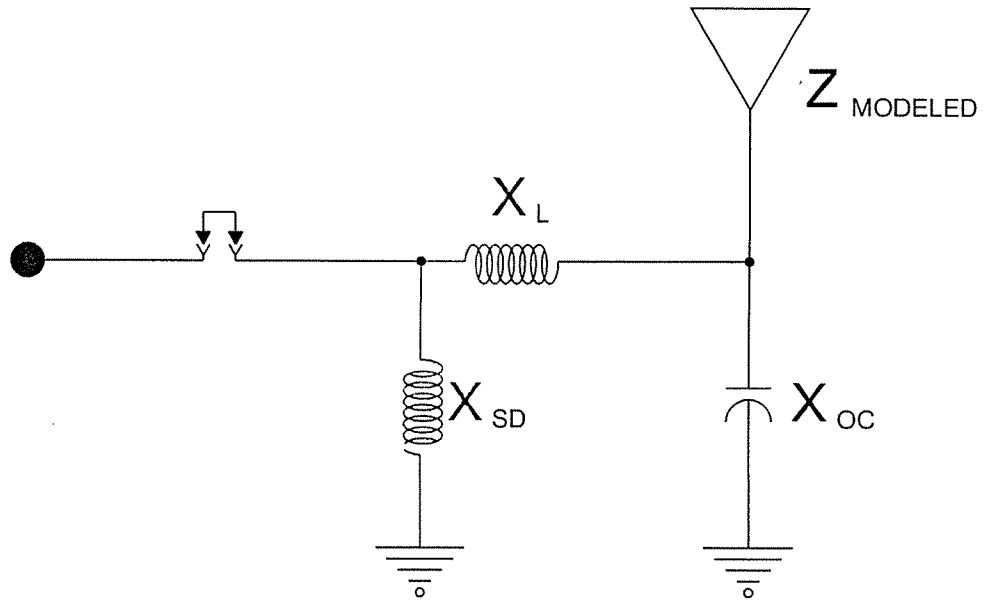
Hatfield & Dawson Consulting Engineers

ITEM 1 - Tower Impedance Measurements and Model Verification

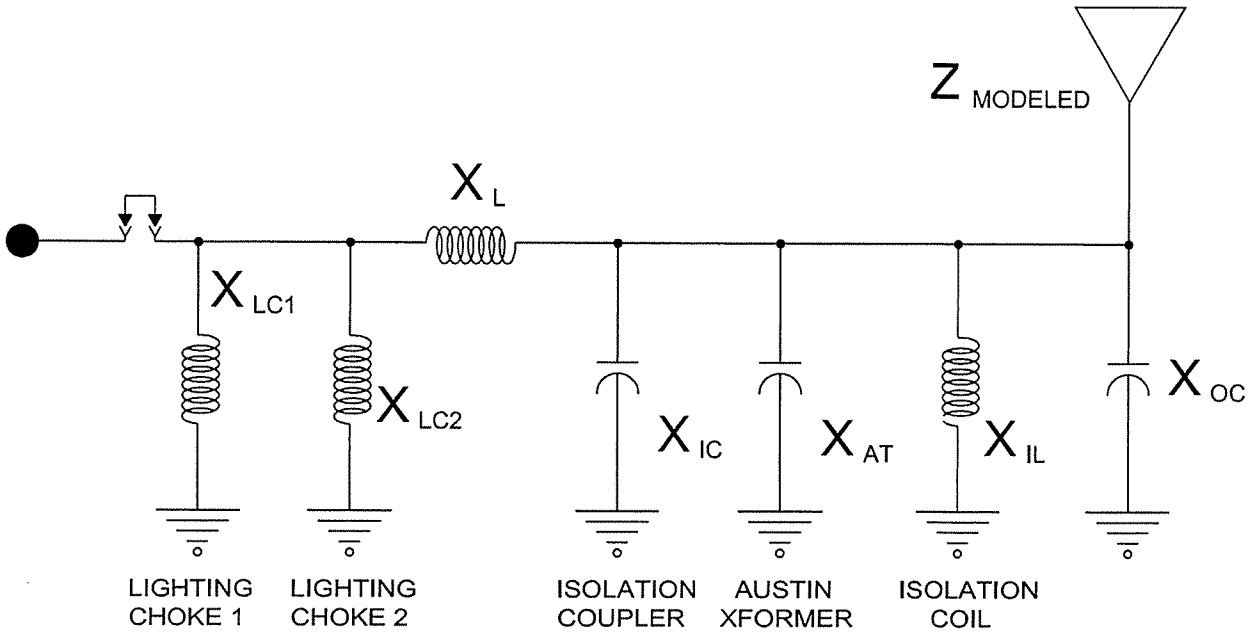
Tower Base Impedance measurements were made at the reference point at the output of each of the Antenna Tuning Units (ATUs). These measurements were made using an HP 8751A Network Analyzer in a calibrated measurement system. The other towers within the array were in the open circuit condition (at the reference point).

Standard electrical circuit calculations were used to relate the measured impedance ($Z_{ATU\ Measured}$) to the moment method base modeled impedance ($Z_{Modeled}$). X_L and X_C are assumed stray base capacitance and lead inductance for each tower. The measured reactance (X_{SD}) for the static drain coils are included in this model. The non-directional tower's base model includes reactance for: sample loop isolation coil, Austin transformer, FM antenna isolation coupler, and two tower lighting isolation chokes. The non-directional tower is not used in the directional array. This tower is de-tuned using a variable capacitor at the base. There is a sample loop on this tower at 1/3 of the tower height and the base termination reactance is tuned for minimum current when the system is in the directional antenna mode.

The modeled ($Z_{ATU\ Modeled}$) and measured ($Z_{ATU\ Measured}$) base impedance at each ATU output with the other towers open circuited at their ATU outputs agree within ± 2 ohms and ± 4 % for resistance and reactance.



TOWER	X_{SD} (Ω)	X_L (Ω)	X_{OC} (Ω)	$Z_{MODELED}$ (Ω)	$Z_{ATU\ MODELED}$ (Ω)	$Z_{ATU\ MEASURED}$ (Ω)
TWR #1	+j7000	+j35	-j6000	75.3 +j100.3	74.9 +j134.2	74.0 +j134.3
TWR #2	+j8100	+j26	-j2000	71.8 +j103.3	77.2 +j130.5	76.9 +j130.1
TWR #3	+j6500	+j29	-j1750	74.4 +j100.7	80.3 +j130.5	80.0 +j131.0
TWR #4	+j8900	+j41	-j10000	82.6 +j107.4	81.6 +j147.2	77.8 +j151.0



TOWER	X_{LC1} (Ω)	X_{LC2} (Ω)	X_{IC} (Ω)	X_{AT} (Ω)	X_{IL} (Ω)	$Z_{MODELED}$ (Ω)	$Z_{ATU\ MODELED}$ (Ω)	$Z_{ATU\ MEASURED}$ (Ω)
TWR #5	+j10700	+j10700	-j2340	-j15500	+j256.4	767.0 +j343.8	63.1 +j233.7	58.8 +j226.5

TOWER	X_L (Ω)	X_{OC}
TWR #5	+j1	-j12500

Bob Allen, H&D 10/22/2013 2:01 PM WMFS CIRCUIT MOM TABLE.dwg PDF FILE: WMFS TWR 5 MOM TABLE.pdf

HATFIELD & DAWSON
CONSULTING ENGINEERS

TOWER #5

WMFS (AM) 680kHz MEMPHIS, TN 10/2013

ITEM 2 - Derivation of Operating Parameters for Directional Antenna

Pspice, an analog circuit simulator computer program, was used to model the circuit conditions around the tower bases to derive the antenna monitor parameters. This program calculates the voltages and currents of a circuit under a variety of different excitation circumstances, such as DC, AC, and in time using nodal and mesh analysis applications of Kirchhoff's laws (among other features). The current at the sample toroidal current transformer location was calculated using the tower base currents calculated by the moment method model and the base region circuit model. The 1999 Orcad version of this program was used for this simulation.

Nighttime Currents From MiniNEC

C:\AM\WMFS\MNEC\WMFS Z Model 2013 DA 09-23-2013 07:47:30

CURRENT rms
Frequency = 680 KHz
Input power = 5,000. watts
Efficiency = 96.04 %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.72479	87.2	.232498	4.71907
2	0	0	4.83333	4.88124	86.8	.268758	4.87383
3	0	0	9.66667	4.94116	86.7	.288345	4.93274
4	0	0	14.5	4.95775	86.5	.302808	4.94849
5	0	0	19.3333	4.93597	86.4	.313166	4.92602
6	0	0	24.1667	4.87846	86.2	.319899	4.86796
7	0	0	29.	4.78685	86.1	.323232	4.77592
8	0	0	33.8333	4.66237	86.	.323294	4.65114
9	0	0	38.6667	4.5062	85.9	.32017	4.49481
10	0	0	43.5	4.31953	85.8	.313924	4.30811
11	0	0	48.3333	4.10358	85.7	.304612	4.09226
12	0	0	53.1667	3.85967	85.7	.29229	3.84858
13	0	0	58.	3.58914	85.6	.277013	3.57843
14	0	0	62.8333	3.2934	85.5	.258839	3.28321
15	0	0	67.6667	2.97382	85.4	.237826	2.96429
16	0	0	72.5	2.63172	85.3	.214024	2.623
17	0	0	77.3333	2.26819	85.3	.187472	2.26043
18	0	0	82.1667	1.88387	85.2	.158172	1.87722
19	0	0	87.	1.47844	85.1	.126042	1.47306
20	0	0	91.8333	1.0492	85.	.0907911	1.04526
21	0	0	96.6667	.58834	85.	.0516747	.586066
END	0	0	101.5	0	0	0	0
GND	-95.022	-31.7939	0	5.32129	9.5	5.24803	.879959

23	-95.022	-31.7939	4.83333	5.54896	6.5	5.51299	.630838
24	-95.022	-31.7939	9.66667	5.65216	4.9	5.63157	.482026
25	-95.022	-31.7939	14.5	5.7027	3.6	5.69157	.356069
26	-95.022	-31.7939	19.3333	5.70643	2.5	5.70112	.246198
27	-95.022	-31.7939	24.1667	5.66631	1.5	5.66434	.149302
28	-95.022	-31.7939	29.	5.58399	.7	5.58362	.0639886
29	-95.022	-31.7939	33.8333	5.46073	359.9	5.46072	-.0104508
30	-95.022	-31.7939	38.6667	5.29771	359.2	5.29719	-.0744032
31	-95.022	-31.7939	43.5	5.09617	358.6	5.09456	-.128101
32	-95.022	-31.7939	48.3333	4.85742	358.	4.85438	-.171703
33	-95.022	-31.7939	53.1667	4.58288	357.4	4.57828	-.205339
34	-95.022	-31.7939	58.	4.27411	356.9	4.26796	-.229137
35	-95.022	-31.7939	62.8333	3.93271	356.5	3.92519	-.243232
36	-95.022	-31.7939	67.6667	3.56032	356.	3.55168	-.247767
37	-95.022	-31.7939	72.5	3.15847	355.6	3.14911	-.242892
38	-95.022	-31.7939	77.3333	2.72848	355.2	2.71888	-.228743
39	-95.022	-31.7939	82.1667	2.27115	354.8	2.26184	-.205407
40	-95.022	-31.7939	87.	1.78609	354.4	1.7777	-.172844
41	-95.022	-31.7939	91.8333	1.27004	354.1	1.2633	-.130666
42	-95.022	-31.7939	96.6667	.713559	353.7	.709313	-.0777238
END	-95.022	-31.7939	101.5	0	0	0	0
GND	-33.1413	-216.579	0	4.89934	354.7	4.87803	-.456545
44	-33.1413	-216.579	4.83333	5.11386	351.3	5.055	-.77366
45	-33.1413	-216.579	9.66667	5.21311	349.5	5.12527	-.952975
46	-33.1413	-216.579	14.5	5.26373	348.	5.14869	-1.09447
47	-33.1413	-216.579	19.3333	5.27095	346.8	5.13089	-1.20698
48	-33.1413	-216.579	24.1667	5.2374	345.7	5.07486	-1.29469
49	-33.1413	-216.579	29.	5.16455	344.7	4.98237	-1.35959
50	-33.1413	-216.579	33.8333	5.05348	343.9	4.85487	-1.40284
51	-33.1413	-216.579	38.6667	4.90527	343.1	4.69366	-1.42522
52	-33.1413	-216.579	43.5	4.72099	342.4	4.50005	-1.42734
53	-33.1413	-216.579	48.3333	4.50187	341.8	4.27544	-1.40977
54	-33.1413	-216.579	53.1667	4.24921	341.1	4.02125	-1.37306
55	-33.1413	-216.579	58.	3.96444	340.6	3.73902	-1.31776
56	-33.1413	-216.579	62.8333	3.64905	340.1	3.43029	-1.24446
57	-33.1413	-216.579	67.6667	3.30455	339.6	3.0966	-1.15374
58	-33.1413	-216.579	72.5	2.93241	339.1	2.73944	-1.04618
59	-33.1413	-216.579	77.3333	2.53386	338.7	2.36005	-.922279
60	-33.1413	-216.579	82.1667	2.10963	338.2	1.9592	-.78235
61	-33.1413	-216.579	87.	1.65941	337.8	1.53668	-.626281
62	-33.1413	-216.579	91.8333	1.18017	337.4	1.08982	-.452879
63	-33.1413	-216.579	96.6667	.663175	337.	.610667	-.258626
END	-33.1413	-216.579	101.5	0	0	0	0
GND	61.8109	-184.733	0	4.91215	87.5	.21626	4.90739
65	61.8109	-184.733	4.90952	5.15692	87.3	.238451	5.1514
66	61.8109	-184.733	9.81905	5.26682	87.3	.250102	5.26088
67	61.8109	-184.733	14.7286	5.32234	87.2	.258274	5.31606
68	61.8109	-184.733	19.6381	5.33095	87.2	.263593	5.32443
69	61.8109	-184.733	24.5476	5.29645	87.1	.266354	5.28975
70	61.8109	-184.733	29.4571	5.22103	87.1	.266693	5.21421

71	61.8109	-184.733	34.3667	5.10626	87.	.264687	5.0994
72	61.8109	-184.733	39.2762	4.95358	87.	.260387	4.94674
73	61.8109	-184.733	44.1857	4.76437	86.9	.253832	4.7576
74	61.8109	-184.733	49.0952	4.54004	86.9	.245056	4.53342
75	61.8109	-184.733	54.0048	4.2821	86.9	.234092	4.2757
76	61.8109	-184.733	58.9143	3.99212	86.8	.220977	3.986
77	61.8109	-184.733	63.8238	3.67172	86.8	.205748	3.66595
78	61.8109	-184.733	68.7333	3.32249	86.7	.18844	3.31714
79	61.8109	-184.733	73.6429	2.94601	86.7	.16909	2.94115
80	61.8109	-184.733	78.5524	2.54356	86.7	.14772	2.53926
81	61.8109	-184.733	83.4619	2.11595	86.6	.124324	2.1123
82	61.8109	-184.733	88.3714	1.66292	86.6	.0988351	1.65998
83	61.8109	-184.733	93.281	1.1815	86.6	.0710275	1.17936
84	61.8109	-184.733	98.1905	.662967	86.5	.0403162	.66174
END	61.8109	-184.733	103.1	0	0	0	0
GND	-23.1209	-107.85	0	1.98893	77.1	.442435	1.93909
86	-23.1209	-107.85	4.81613	1.60077	77.1	.357741	1.56028
87	-23.1209	-107.85	9.63226	1.36084	77.	.30533	1.32614
88	-23.1209	-107.85	14.4484	1.14939	77.	.25908	1.11981
89	-23.1209	-107.85	19.2645	.956093	76.9	.216736	.931203
90	-23.1209	-107.85	24.0807	.776305	76.8	.177284	.755791
91	-23.1209	-107.85	28.8968	.608098	76.7	.140299	.591692
92	-23.1209	-107.85	33.7129	.450625	76.4	.105591	.43808
93	-23.1209	-107.85	38.529	.303593	76.1	.0730915	.294663
94	-23.1209	-107.85	43.3452	.166993	75.2	.0427888	.161418
95	-23.1209	-107.85	48.1613	.0411785	69.1	.0147022	.0384645
96	-23.1209	-107.85	52.9774	.0748463	261.4	-.0111337	-.0740136
97	-23.1209	-107.85	57.7936	.179195	258.8	-.0346789	-.175807
98	-23.1209	-107.85	62.6097	.272507	258.2	-.055893	-.266713
99	-23.1209	-107.85	67.4258	.354517	257.8	-.0747391	-.346549
100	-23.1209	-107.85	72.2419	.425066	257.6	-.0911857	-.41517
101	-23.1209	-107.85	77.0581	.484044	257.4	-.105204	-.472473
102	-23.1209	-107.85	81.8742	.531393	257.3	-.116774	-.518403
103	-23.1209	-107.85	86.6903	.567102	257.2	-.125878	-.552955
104	-23.1209	-107.85	91.5065	.591217	257.	-.132503	-.576178
105	-23.1209	-107.85	96.3226	.603829	256.9	-.136638	-.588167
106	-23.1209	-107.85	101.139	.605079	256.8	-.138272	-.589068
107	-23.1209	-107.85	105.955	.595147	256.7	-.137394	-.579071
108	-23.1209	-107.85	110.771	.574249	256.5	-.13399	-.558399
109	-23.1209	-107.85	115.587	.542621	256.4	-.128037	-.527299
110	-23.1209	-107.85	120.403	.500501	256.2	-.119502	-.486026
111	-23.1209	-107.85	125.219	.448096	256.	-.108333	-.434804
112	-23.1209	-107.85	130.036	.385522	255.8	-.0944419	-.373775
113	-23.1209	-107.85	134.852	.312674	255.6	-.0776707	-.302873
114	-23.1209	-107.85	139.668	.228886	255.4	-.0577028	-.221493
115	-23.1209	-107.85	144.484	.132269	255.2	-.0338816	-.127856
END	-23.1209	-107.85	149.3	0	0	0	0

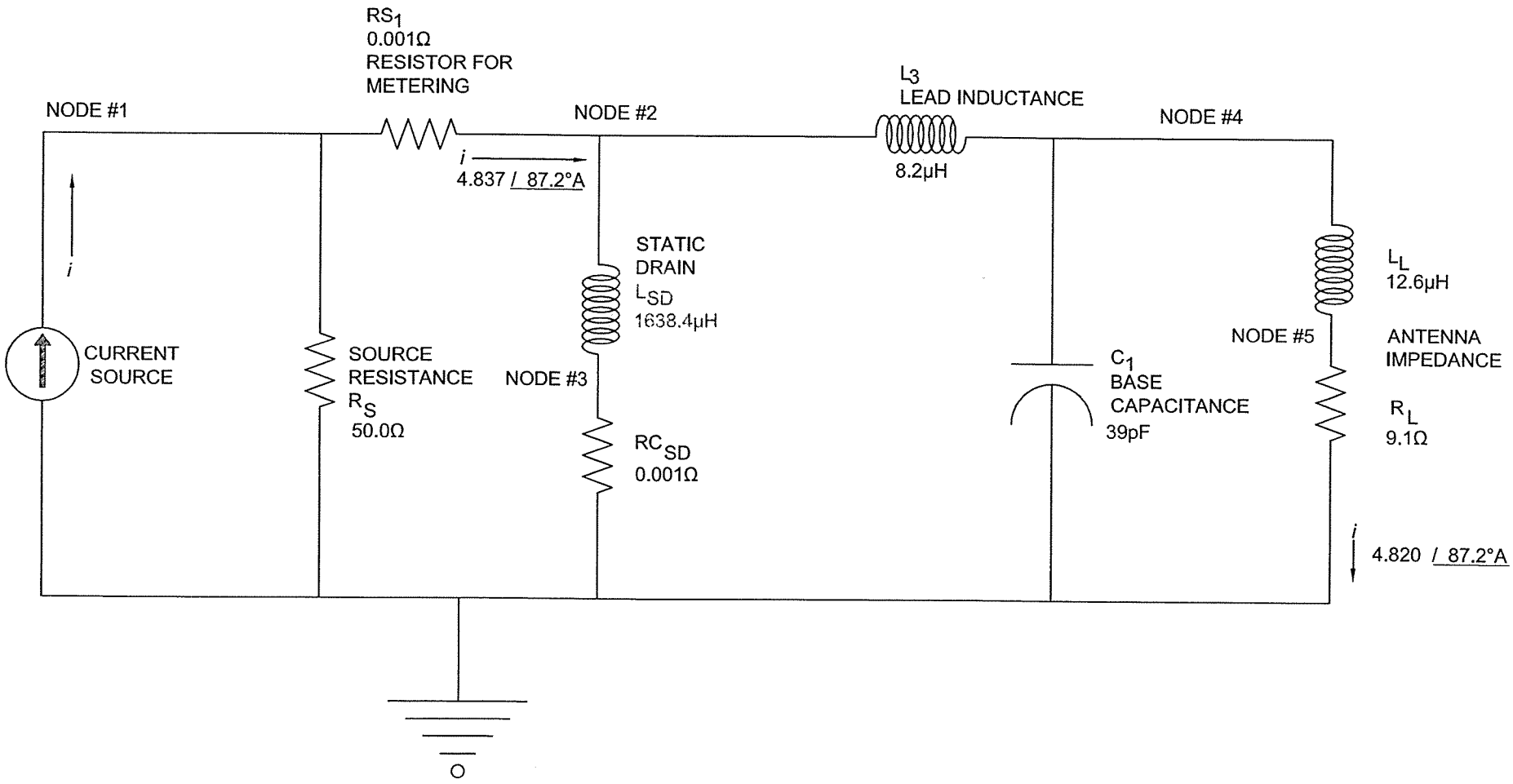
Nighttime Tower 1

Input

```
## WMFS NIGHTTIME TOWER 1 BASE MODEL
.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 680kHz 680kHz

IIN     1       0       AC 10.27028 -36.57
rs      1       0       50.0ohms
rs1     1       2       .001ohms
LSD     2       3       1638.4uH
RCSD    3       0       .001ohms

L3      2       4       8.2uH
C1      4       0       39pF

LL      4       5       12.6uH
RL      5       0       9.1ohms

.PRINT AC VM(2,0) VP(2,0) VM(4,0) VP(4,0)
.PRINT AC IM(RS1) IP(RS1) IM(RL) IP(RL)
##.PROBE
.END
```

Output

FREQ	IM(RS1)	IP(RS1)	IM(RL)	IP(RL)
6.800E+05	4.837E+00	8.722E+01	4.820E+00	8.720E+01



Bob Allen, H&D 9/26/2013 11:36 AM wmfs TOWER CIRCUITS.dwg

HATFIELD & DAWSON CONSULTING ENGINEERS	WMFS(AM) TOWER #1 NIGHT PSPICE MODEL WMFS(AM) 680kHz MEMPHIS, TN 11/2013	

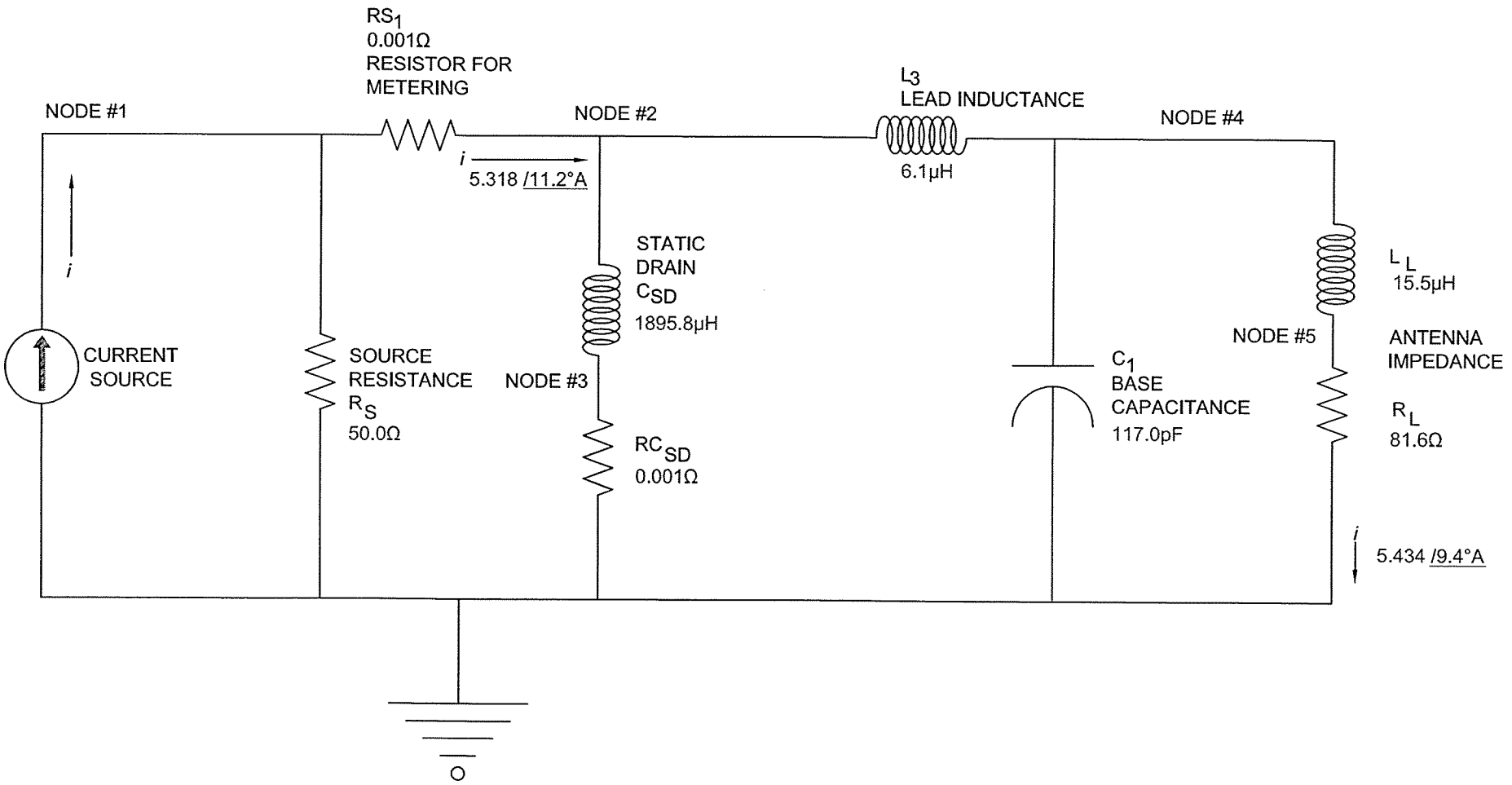
Nighttime Tower 2

Input

```
## WMFS NIGHTTIME TOWER 2 BASE MODEL
.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 680kHz 680kHz

IIN     1       0       AC 17.32119 225.085
rs      1       0       50.0ohms
rs1     1       2       .001ohms
LSD     2       3       1895.8uH
RCSD    3       0       .001ohms

L3      2       4       6.1uH
C1      4       0       117pF

LL      4       5       15.5uH
RL      5       0       81.6ohms

.PRINT AC VM(2,0) VP(2,0) VM(4,0) VP(4,0)
.PRINT AC IM(RS1) IP(RS1) IM(RL) IP(RL)
##.PROBE
.END
```

Output

FREQ	IM(RS1)	IP(RS1)	IM(RL)	IP(RL)
6.800E+05	5.318E+00	1.121E+01	5.434E+00	9.400E+00



Bob Allen, H&D 11/11/2013 1:36 PM wmfs TOWER CIRCUITS.dwg

HATFIELD & DAWSON CONSULTING ENGINEERS	WMFS(AM) TOWER #2 NIGHT PSPICE MODEL WMFS(AM) 680kHz MEMPHIS, TN 11/2013	

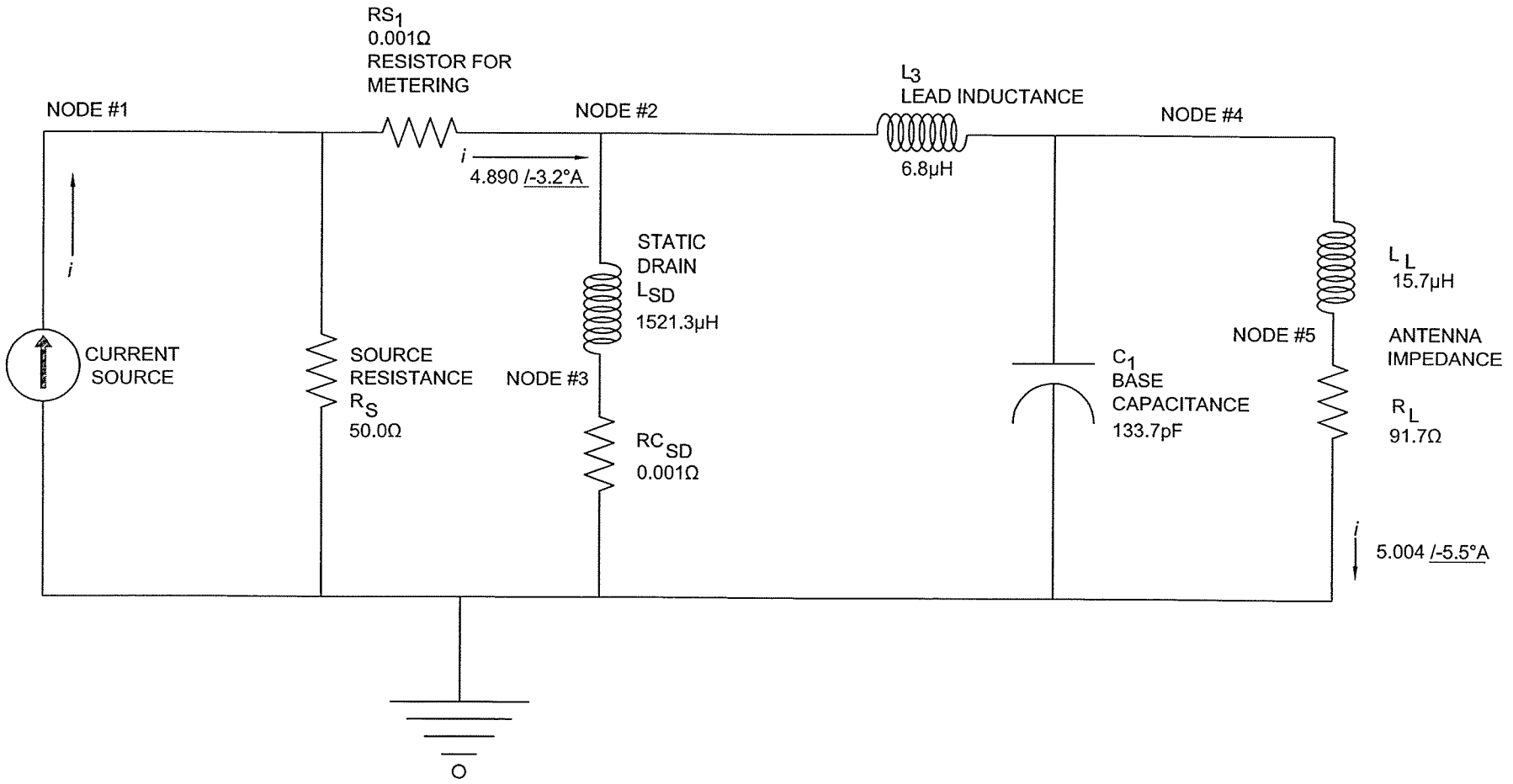
Nighttime Tower 3

Input

```
## WMFS NIGHTTIME TOWER 3 BASE MODEL
.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 680kHz 680kHz

IIN     1       0       AC 16.95269 -150.587
rs      1       0       50.0ohms
rs1     1       2       .001ohms

LSD     2       3       1521.3uH
RCSD    3       0       .001ohms

L3      2       4       6.8uH
C1      4       0       133.7pF
LL      4       5       15.7uH
RL      5       0       91.6ohms

.PRINT AC VM(2,0) VP(2,0) VM(4,0) VP(4,0)
.PRINT AC IM(RS1) IP(RS1) IM(RL) IP(RL)
##.PROBE
.END
```

Output

```
      FREQ         IM(RS1)      IP(RS1)      IM(RL)       IP(RL)
      6.800E+05    4.890E+00  -3.244E+00    5.004E+00  -5.500E+00
```



Bob Allen, H&D 11/11/2013 1:36 PM wmfs TOWER CIRCUITS.dwg

HATFIELD & DAWSON
CONSULTING ENGINEERS

WMFS(AM) TOWER #3 NIGHT PSPICE MODEL

WMFS(AM) 680kHz MEMPHIS, TN 11/2013

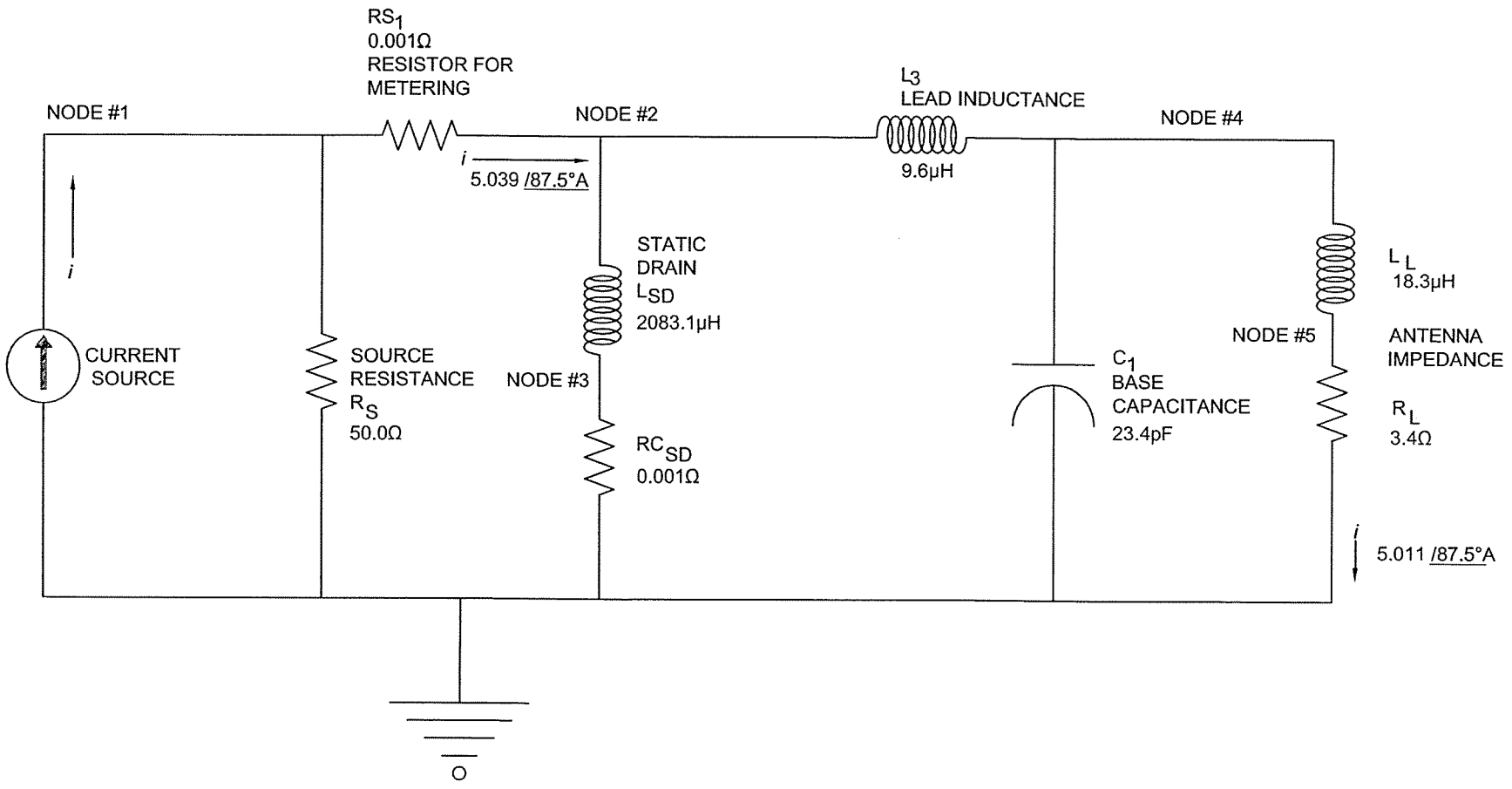
Nighttime Tower 4

Input

```
## WMFS NIGHTTIME TOWER 4 BASE MODEL
.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 680kHz 680kHz

IIN     1       0       AC 13.07195 -26.79
rs      1       0       50.0ohms
rs1     1       2       .001ohms

LSD     2       3       2083.1uH
RCSD    3       0       .001ohms

L3      2       4       9.6uH
C1      4       0       23.4pF
LL      4       5       18.3uH
RL      5       0       3.4ohms

.PRINT AC VM(2,0) VP(2,0) VM(4,0) VP(4,0)
.PRINT AC IM(RS1) IP(RS1) IM(RL) IP(RL)
##.PROBE
.END
```

Output

FREQ	IM(RS1)	IP(RS1)	IM(RL)	IP(RL)
6.800E+05	5.039E+00	8.750E+01	5.011E+00	8.750E+01



Bob Allen, H&D 11/11/2013 1:36 PM wmfs TOWER CIRCUITS.dwg

HATFIELD & DAWSON
CONSULTING ENGINEERS

WMFS(AM) TOWER #4 NIGHT PSPICE MODEL

WMFS(AM) 680kHz MEMPHIS, TN 11/2013

Calculated Antenna Monitor Parameters

Nighttime

	Modeled Current Pulse	Sample Current Calculated at TCT (Amps)		Antenna Monitor Parameters	
		Magnitude	Phase (°)	Ratio	Phase (°)
Tower 1 West	Node 1	4.837	87.2°	0.910	76.0°
Tower 2 South	Node 22	5.318	11.3°	1.000	0.0°
Tower 3 East	Node 43	4.890	-3.0°	0.920	-14.5°
Tower 4 North	Node 64	5.039	87.5°	0.948	76.3°

ITEM 3- Moment Method Model for Tower Driven Individually

Expert MININEC Broadcast Professional Version 14.0 was used to model the WMFS array. The antenna model was adjusted to match the measured matrix impedances. The wire coordinates used are in electrical degrees and wire radius is in meters. Tower #4 has an 1/4 wave isolation section for an FM antenna. Tower #5 is used for the non-directional operation and has two FM stations mounted on the structure. The following adjusted parameters were used for the model:

- on towers #1, #2, and #3 electrical height on towers was adjusted to 102% of the physical height (from 99.5° to 101.5°) and on tower #4 the antenna electrical height was adjusted to 103.6% of the physical height (from 99.5° to 103.1°)
- tower #5 electrical height is the same as the physical height (149.3°)
- all five towers were modeled at 100.0% of the equivalent radius of each tower: All towers have a face width 48" and an equivalent radius of 58 cm
- 21 segments per antenna element (4.7° per segment) were used for tower #1, #2, #3, and #4. 31 segments were used for tower #5 (4.8° per segment)

West Tower #1 Model

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:13:39

WMFS

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	21
		0	0	101.5		
2	none	100.2	161.5	0	.58	21
		100.2	161.5	101.5		
3	none	219.1	98.7	0	.58	21
		219.1	98.7	101.5		
4	none	194.8	71.5	0	.58	21
		194.8	71.5	103.1		
5	none	110.3	102.1	0	.58	31
		110.3	102.1	149.3		

Number of wires = 5
current nodes = 115

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	5	4.81613	4	4.90952
radius	1	.58	1	.58

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	680.	0	1	.0133781	.0136376

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	22	0	-2,653.	0	0	0
2	43	0	-2,390.8	0	0	0
3	64	0	84,430.9	0	0	0
4	85	0	-1,231.	0	0	0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:14:15

IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
680.	75.301	100.25	125.38	53.1	4.6231	-3.8179	-2.3296

South Tower #2 Model

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:17:10

WMFS

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	21
		0	0	101.5		
2	none	100.2	161.5	0	.58	21
		100.2	161.5	101.5		
3	none	219.1	98.7	0	.58	21
		219.1	98.7	101.5		
4	none	194.8	71.5	0	.58	21
		194.8	71.5	103.1		
5	none	110.3	102.1	0	.58	31
		110.3	102.1	149.3		

Number of wires = 5
current nodes = 115

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	5	4.81613	4	4.90952
radius	1	.58	1	.58

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	680.	0	1	.0133781	.0136376

Sources

source	node	sector	magnitude	phase	type
1	22	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-40,781.4	0	0	0
2	43	0	-2,390.8	0	0	0
3	64	0	84,430.9	0	0	0
4	85	0	-1,231.	0	0	0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:17:10

IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 22, sector 1							
680.	71.801	103.33	125.83	55.2	4.9024	-3.5939	-2.4959

East Tower #3 Model

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:26:44

WMFS

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	21
		0	0	101.5		
2	none	100.2	161.5	0	.58	21
		100.2	161.5	101.5		
3	none	219.1	98.7	0	.58	21
		219.1	98.7	101.5		
4	none	194.8	71.5	0	.58	21
		194.8	71.5	103.1		
5	none	110.3	102.1	0	.58	31
		110.3	102.1	149.3		

Number of wires = 5
current nodes = 115

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	5	4.81613	4	4.90952
radius	1	.58	1	.58

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	680.	0	1	.0133781	.0136376

Sources

source	node	sector	magnitude	phase	type
1	43	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-40,781.4	0	0	0
2	22	0	-2,653.	0	0	0
3	64	0	84,430.9	0	0	0
4	85	0	-1,231.	0	0	0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:26:44

IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 43, sector 1							
680.	74.405	100.66	125.17	53.5	4.6694	-3.7788	-2.3576

North Tower #4 Model

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:24:17

WMFS

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	21
		0	0	101.5		
2	none	100.2	161.5	0	.58	21
		100.2	161.5	101.5		
3	none	219.1	98.7	0	.58	21
		219.1	98.7	101.5		
4	none	194.8	71.5	0	.58	21
		194.8	71.5	103.1		
5	none	110.3	102.1	0	.58	31
		110.3	102.1	149.3		

Number of wires = 5
current nodes = 115

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	5	4.81613	4	4.90952
radius	1	.58	1	.58

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	680.	0	1	.0133781	.0136376

Sources

source	node	sector	magnitude	phase	type
1	64	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-40,781.4	0	0	0
2	22	0	-2,653.	0	0	0
3	43	0	-2,390.8	0	0	0
4	85	0	-1,231.	0	0	0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:24:17

IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 64, sector 1							
680.	82.594	107.38	135.47	52.4	4.8429	-3.6394	-2.4609

Center Tower #5 Model

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:29:33

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	21
		0	0	101.5		
2	none	100.2	161.5	0	.58	21
		100.2	161.5	101.5		
3	none	219.1	98.7	0	.58	21
		219.1	98.7	101.5		
4	none	194.8	71.5	0	.58	21
		194.8	71.5	103.1		
5	none	110.3	102.1	0	.58	31
		110.3	102.1	149.3		

Number of wires = 5
current nodes = 115

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	5	4.81613	4	4.90952
radius	1	.58	1	.58

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	680.	0	1	.0133781	.0136376

Sources

source	node	sector	magnitude	phase	type
1	85	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-40,781.4	0	0	0
2	22	0	-2,653.	0	0	0
3	43	0	-2,390.8	0	0	0
4	64	0	84,430.9	0	0	0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 Matrix 10-22-2013 13:29:33

IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 85, sector 1							
680.	766.96	343.82	840.5	24.1	18.433	-.94337	-7.0942

ITEM 4 - Moment Method Model for Directional Array

Nighttime Summary File:

```
C:\AM\WMFS\MNEC\WMFS Z Model 2013 DA  11-11-2013   09:33:26
WMFS

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0            0            .58          21
           0            0            101.5
 2    none 100.2        161.5        0            .58          21
           100.2        161.5        101.5
 3    none 219.1        98.7         0            .58          21
           219.1        98.7         101.5
 4    none 194.8        71.5         0            .58          21
           194.8        71.5         103.1
 5    none 110.3        102.1        0            .58          31
           110.3        102.1        149.3

Number of wires          =  5
          current nodes  =  115

                          minimum                    maximum
Individual wires       wire    value              wire  value
segment length          5      4.81613             4    4.90952
radius                  1      .58                 1    .58

ELECTRICAL DESCRIPTION
Frequencies (KHz)
     frequency                 no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   680.         0             1      .0133781       .0136376
Sources
source node    sector  magnitude      phase          type
 1      1       1       370.709        167.6          voltage
 2      22      1       806.472        48.5           voltage
 3      43      1       802.81         30.8           voltage
 4      64      1       554.187        175.           voltage
Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     85    0             288.1         0           0            0

C:\AM\WMFS\MNEC\WMFS Z Model 2013 DA  11-11-2013   09:38:25

IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(KHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 1, sector 1
680.     9.0785   53.69    54.452   80.4     11.956  -1.4564  -5.4529
```

source = 2; node 22, sector 1

680.	81.595	66.195	105.07	39.1	2.9836	-6.0565	-1.2375

source = 3; node 43, sector 1

680.	91.577	67.164	113.57	36.3	3.033	-5.9498	-1.2732

source = 4; node 64, sector 1

680.	3.4143	78.228	78.303	87.5	50.54	-.34377	-11.186

C:\AM\WMFS\MNEC\WMFS Z Model 2013 DA 11-11-2013 09:38:25

CURRENT rms
Frequency = 680 KHz
Input power = 5,000. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.81992	87.2	.235672	4.81415
2	0	0	4.83333	4.97977	86.9	.272704	4.97229
3	0	0	9.66667	5.04105	86.7	.292721	5.03254
4	0	0	14.5	5.05808	86.5	.307514	5.04872
5	0	0	19.3333	5.03596	86.4	.318127	5.0259
6	0	0	24.1667	4.97738	86.3	.325046	4.96676
7	0	0	29.	4.88398	86.1	.328503	4.87292
8	0	0	33.8333	4.75704	86.	.328628	4.74568
9	0	0	38.6667	4.59776	85.9	.325508	4.58622
10	0	0	43.5	4.40735	85.8	.319208	4.39578
11	0	0	48.3333	4.18706	85.8	.309784	4.17559
12	0	0	53.1667	3.93823	85.7	.297293	3.92699
13	0	0	58.	3.66223	85.6	.28179	3.65137
14	0	0	62.8333	3.36049	85.5	.263334	3.35016
15	0	0	67.6667	3.03442	85.4	.241983	3.02476
16	0	0	72.5	2.68538	85.3	.21779	2.67653
17	0	0	77.3333	2.31445	85.3	.190791	2.30657
18	0	0	82.1667	1.92231	85.2	.160988	1.91556
19	0	0	87.	1.50861	85.1	.128298	1.50315
20	0	0	91.8333	1.07062	85.	.0924258	1.06662
21	0	0	96.6667	.600356	85.	.05261	.598046
END	0	0	101.5	0	0	0	0
GND	-95.022	-31.7939	0	5.43422	9.4	5.3605	.892101
23	-95.022	-31.7939	4.83333	5.66721	6.5	5.63122	.637639
24	-95.022	-31.7939	9.66667	5.77287	4.8	5.7524	.485678
25	-95.022	-31.7939	14.5	5.8247	3.5	5.81374	.357099
26	-95.022	-31.7939	19.3333	5.82868	2.4	5.82353	.244986
27	-95.022	-31.7939	24.1667	5.78785	1.4	5.786	.146162
28	-95.022	-31.7939	29.	5.70388	.6	5.70357	.059203
29	-95.022	-31.7939	33.8333	5.57808	359.8	5.57806	-.0166157
30	-95.022	-31.7939	38.6667	5.41165	359.1	5.41104	-.0816907
31	-95.022	-31.7939	43.5	5.20586	358.5	5.20407	-.13626
32	-95.022	-31.7939	48.3333	4.96203	357.9	4.95875	-.180487
33	-95.022	-31.7939	53.1667	4.68165	357.4	4.67673	-.214508
34	-95.022	-31.7939	58.	4.36628	356.9	4.35976	-.238453
35	-95.022	-31.7939	62.8333	4.01756	356.4	4.00962	-.252462
36	-95.022	-31.7939	67.6667	3.63717	356.	3.6281	-.256684
37	-95.022	-31.7939	72.5	3.22668	355.5	3.21688	-.251271
38	-95.022	-31.7939	77.3333	2.78744	355.1	2.7774	-.236366
39	-95.022	-31.7939	82.1667	2.32024	354.8	2.31053	-.212058
40	-95.022	-31.7939	87.	1.82471	354.4	1.81598	-.178304

41	-95.022	-31.7939	91.8333	1.29751	354.	1.2905	-.134707
42	-95.022	-31.7939	96.6667	.728997	353.7	.724585	-.0800814
END	-95.022	-31.7939	101.5	0	0	0	0
GND	-33.1413	-216.579	0	5.00478	354.5	4.9821	-.475922
44	-33.1413	-216.579	4.83333	5.22437	351.2	5.16276	-.799972
45	-33.1413	-216.579	9.66667	5.32599	349.4	5.23446	-.983155
46	-33.1413	-216.579	14.5	5.37789	347.9	5.25834	-1.12763
47	-33.1413	-216.579	19.3333	5.38542	346.7	5.24014	-1.24244
48	-33.1413	-216.579	24.1667	5.35127	345.6	5.18288	-1.33186
49	-33.1413	-216.579	29.	5.27692	344.6	5.0884	-1.39791
50	-33.1413	-216.579	33.8333	5.16354	343.8	4.95816	-1.4418
51	-33.1413	-216.579	38.6667	5.01217	343.	4.79349	-1.46432
52	-33.1413	-216.579	43.5	4.82394	342.3	4.59575	-1.46611
53	-33.1413	-216.579	48.3333	4.60009	341.7	4.36635	-1.44772
54	-33.1413	-216.579	53.1667	4.34197	341.1	4.10675	-1.40974
55	-33.1413	-216.579	58.	4.05102	340.5	3.8185	-1.35272
56	-33.1413	-216.579	62.8333	3.72878	340.	3.5032	-1.27727
57	-33.1413	-216.579	67.6667	3.37679	339.5	3.16242	-1.18399
58	-33.1413	-216.579	72.5	2.99654	339.	2.79766	-1.07347
59	-33.1413	-216.579	77.3333	2.58928	338.6	2.41019	-.946234
60	-33.1413	-216.579	82.1667	2.1558	338.1	2.00083	-.802584
61	-33.1413	-216.579	87.	1.69573	337.7	1.56933	-.642414
62	-33.1413	-216.579	91.8333	1.20601	337.3	1.11297	-.464503
63	-33.1413	-216.579	96.6667	.677701	337.	.623639	-.265242
END	-33.1413	-216.579	101.5	0	0	0	0
GND	61.8109	-184.733	0	5.01074	87.5	.218642	5.00597
65	61.8109	-184.733	4.90952	5.26083	87.4	.241133	5.2553
66	61.8109	-184.733	9.81905	5.37318	87.3	.252947	5.36722
67	61.8109	-184.733	14.7286	5.42999	87.2	.261239	5.4237
68	61.8109	-184.733	19.6381	5.43894	87.2	.266646	5.4324
69	61.8109	-184.733	24.5476	5.40388	87.1	.269465	5.39715
70	61.8109	-184.733	29.4571	5.32703	87.1	.269832	5.3202
71	61.8109	-184.733	34.3667	5.21005	87.1	.267828	5.20316
72	61.8109	-184.733	39.2762	5.05436	87.	.263501	5.04748
73	61.8109	-184.733	44.1857	4.86136	87.	.256892	4.85457
74	61.8109	-184.733	49.0952	4.63254	86.9	.248033	4.6259
75	61.8109	-184.733	54.0048	4.36941	86.9	.236959	4.36298
76	61.8109	-184.733	58.9143	4.07357	86.9	.223705	4.06742
77	61.8109	-184.733	63.8238	3.74667	86.8	.208308	3.74088
78	61.8109	-184.733	68.7333	3.39036	86.8	.190804	3.38499
79	61.8109	-184.733	73.6429	3.00622	86.7	.171229	3.00134
80	61.8109	-184.733	78.5524	2.59557	86.7	.149603	2.59125
81	61.8109	-184.733	83.4619	2.15924	86.7	.125921	2.15557
82	61.8109	-184.733	88.3714	1.69695	86.6	.100115	1.69399
83	61.8109	-184.733	93.281	1.20569	86.6	.0719545	1.20354
84	61.8109	-184.733	98.1905	.676549	86.5	.0408465	.675315
END	61.8109	-184.733	103.1	0	0	0	0
GND	-23.1209	-107.85	0	2.02652	77.1	.451414	1.97561
86	-23.1209	-107.85	4.81613	1.63102	77.1	.363301	1.59005
87	-23.1209	-107.85	9.63226	1.38656	77.1	.308805	1.35173
88	-23.1209	-107.85	14.4484	1.1711	77.1	.260746	1.14171
89	-23.1209	-107.85	19.2645	.97415	77.1	.216776	.949724
90	-23.1209	-107.85	24.0807	.790964	77.2	.175842	.771171
91	-23.1209	-107.85	28.8968	.619571	77.2	.137497	.604121
92	-23.1209	-107.85	33.7129	.459113	77.2	.101548	.447742
93	-23.1209	-107.85	38.529	.309286	77.3	.0679208	.301736
94	-23.1209	-107.85	43.3452	.170065	77.6	.0366023	.166079
95	-23.1209	-107.85	48.1613	.041595	79.5	7.61E-03	.0408925
96	-23.1209	-107.85	52.9774	.0760516	255.5	-.019013	-.0736366
97	-23.1209	-107.85	57.7936	.18249	256.3	-.0432338	-.177295

98	-23.1209	-107.85	62.6097	.277594	256.5	-.0650091	-.269875
99	-23.1209	-107.85	67.4258	.361169	256.5	-.084301	-.351193
100	-23.1209	-107.85	72.2419	.433061	256.5	-.101078	-.4211
101	-23.1209	-107.85	77.0581	.493162	256.5	-.115313	-.479491
102	-23.1209	-107.85	81.8742	.541411	256.4	-.126984	-.526309
103	-23.1209	-107.85	86.6903	.577803	256.4	-.136077	-.561551
104	-23.1209	-107.85	91.5065	.60238	256.3	-.142578	-.585264
105	-23.1209	-107.85	96.3226	.615239	256.2	-.146479	-.597547
106	-23.1209	-107.85	101.139	.616519	256.1	-.147771	-.598548
107	-23.1209	-107.85	105.955	.606407	256.	-.146445	-.588459
108	-23.1209	-107.85	110.771	.585121	255.9	-.142489	-.567507
109	-23.1209	-107.85	115.587	.552902	255.8	-.135882	-.535945
110	-23.1209	-107.85	120.403	.509991	255.6	-.126595	-.494029
111	-23.1209	-107.85	125.219	.4566	255.5	-.114573	-.441991
112	-23.1209	-107.85	130.036	.392844	255.3	-.0997301	-.379974
113	-23.1209	-107.85	134.852	.318618	255.1	-.0819045	-.30791
114	-23.1209	-107.85	139.668	.233242	254.9	-.0607672	-.225187
115	-23.1209	-107.85	144.484	.134788	254.7	-.0356352	-.129992
END	-23.1209	-107.85	149.3	0	0	0	0

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CURRENT MOMENTS(amp-degrees) rms

Frequency = 680 KHz
Input power = 5,000. watts

			vertical current moment	
wire	magnitude	phase (deg)	magnitude	phase (deg)
1	623.053	86.	623.053	86.
2	729.563	359.9	729.563	359.9
3	675.036	343.9	675.036	343.9
4	692.294	87.	692.294	87.
5	1.45257	166.7	1.45257	166.7

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

tower	magnitude	phase (deg)
1	623.053	86.
2	729.563	359.9
3	675.036	343.9
4	692.294	87.
5	1.45257	166.7

ITEM 5 - Sampling System Measurements

Measurements were made using an HP 8751A network analyzer, an ENI 403LA amplifier and custom manufactured directional couplers in a calibrated measurement system. The sample lines were found to be series resonant (an odd multiple of 90° which is an impedance zero - very low resistance and zero reactance) around 662 kHz which indicates the line is 450° in electrical length at this frequency. The characteristic impedance was calculated using the following formula, where $R_1 \pm jX_1$ and $R_2 \pm X_2$ are the measured impedances at the -45° and +45° offset frequencies:

$$Z_0 = \sqrt{\sqrt{R_1^2 + X_1^2} \cdot \sqrt{R_2^2 + X_2^2}}$$

The measured open circuit sample line impedances and characteristic impedance calculations are shown below:

Lines from ATUs to Transmitter Building

	Resonance Frequency (kHz)	-45° Offset (405°) Frequency (kHz)	-45° Offset Impedance ($R_1 \pm jX_1$) (Ohms)	+45° Offset 495° Frequency (kHz)	+45° Offset Impedance ($R_2 \pm jX_2$) (Ohms)	Characteristic Impedance (Z_0)
Sample Line 1 (West Tower)	662.357	596.121	13.1 - j 48.8	728.593	16.3 + j 48.3	50.8 ohms
Sample Line 2 (South Tower)	663.272	596.945	12.9 - j 48.4	729.599	16.2 + j 47.9	50.3 ohms
Sample Line 3 (East Tower)	662.544	596.290	13.0 - j 48.6	728.798	16.4 + j 48.3	50.7 ohms
Sample Line 4 (North Tower)	662.837	596.553	13.0 - j 48.5	729.121	16.4 + j 48.0	50.5 ohms

The sample line lengths calculated from the measurements above are:

Length in Electrical Degrees at 680 kHz	Length from ATU to Transmitter Building	Measured Impedance (Z_s) With TCT Attached
Sample Line 1	462.0°.	51.5 - j 3.7ohms
Sample Line 2	461.4°	50.8 - j 3.8 ohms
Sample Line 2	461.9°	51.0 - j 4.0 ohms
Sample Line 3	461.7°	50.5 - j 4.0 ohms

ITEM 6 - Reference Field Strength Measurements

Radial	Coordinates	Coordinates	Distance	Field Strength	Description
20 Degrees	35 16 58.2	90 01 00.5	7.13 km	13 mV/m	.1 Mile from 1420 Fite Rd Driveway at Bellsouth Marker
20 Degrees	35 19 11.3	90 00 01.7	11.5 km	3.5 mV/m	1890 Campbell Road at Driveway
20 Degrees	35 21 09.1	89 59 09.9	15.37 km	3.1 mV/m	2329 Woodstock Cuba Road at Driveway
49 Degrees	35 16 17.3	89 58 25.7	8.35 km	14 mV/m	2695 Fite Road Lucite International In front of Parking Lot
49 Degrees	35 17 37.5	89 56 38.7	12.03 km	5.4 mV/m	3605 Lucy Road at Driveway
49 Degrees	35 19 19.9	89 54 09.1	16.9 km	4.7 mV/m	Corner Baker and Hallbrook at 4815 Hallbrook
90.5 Degrees	35 13 18	89 59 37	4.55 km	20 mV/m	Corner Overton Crossing and Pueblo at 2100 Pueblo
90.5 Degrees	35 13 21	89 55 35.1	10.65 km	8.2 mV/m	3558 Monessen Drive at Driveway
90.5 Degrees	35 13 18.6	89 52 47.6	14.9 km	4.8 mV/m	Corner Pine Oak and Sugartree at 5503 Pine Oak
150 Degrees	35 10 02	90 00 14.3	7.13km	110 mV/m	1058 Avalon Road at Driveway
150 Degrees	35 08 20.9	89 59 06.6	10.7 km	80 mV/m	100 N Edgewood Drive at Driveway
150 Degrees	36 06 29.1	89 57 45.8	14.7 km	35 mV/m	Corner Park and Carson at Fire Hydrant
225 Degrees	35 09 12.5	90 07 45	10.9km	2.8 mV/m	On Petro Road across street from SpeedCo Truck Co.
225 Degrees	35 08 57.7	90 08 00.8	11.5 km	2.2 mV/m	South 55 Service road in Parking lot across Exit 4 sign
225 Degrees	35 08 36.3	90 8 25.7	12.5 km	3.2 mV/m	On Concrete Shoulder 400' from E Polk Rd on Martin Luther King Drive
271 Degrees	35 13 27.8	90 06 48.4	5.6 km	13 mV/m	.2 mile North of Marion Road on Gammon Road
271 Degrees	35 13 30	90 11 31.4	13.5 km	5.1 mV/m	623 N. Delta Street at Driveway
271 Degrees	35 13 30.5	90.11.56.3	14.1 km	3.5 mV/m	761 Cypress Road at Driveway
318 Degrees	35 14 03.1	90 03 22.9	1.72 km	59 mV/m	Old Cuba Benjestown Road .5 mile Past Billion Road
318 Degrees	35 19 26.9	90 09 16.9	15.14 km	3.4 mV/m	On Sulcer Road .3 miles from Old River Road Turnoff
318 Degrees	35 20 32.9	90 10 36.3	18 km	2.8 mV/m	On Sully-Carter Road .5 miles from Old River Road Turnoff

All Coordinates are WGS84

Mike Schwartz Technical Director - ENTERCOM MEMPHIS

Hatfield & Dawson Consulting Engineers

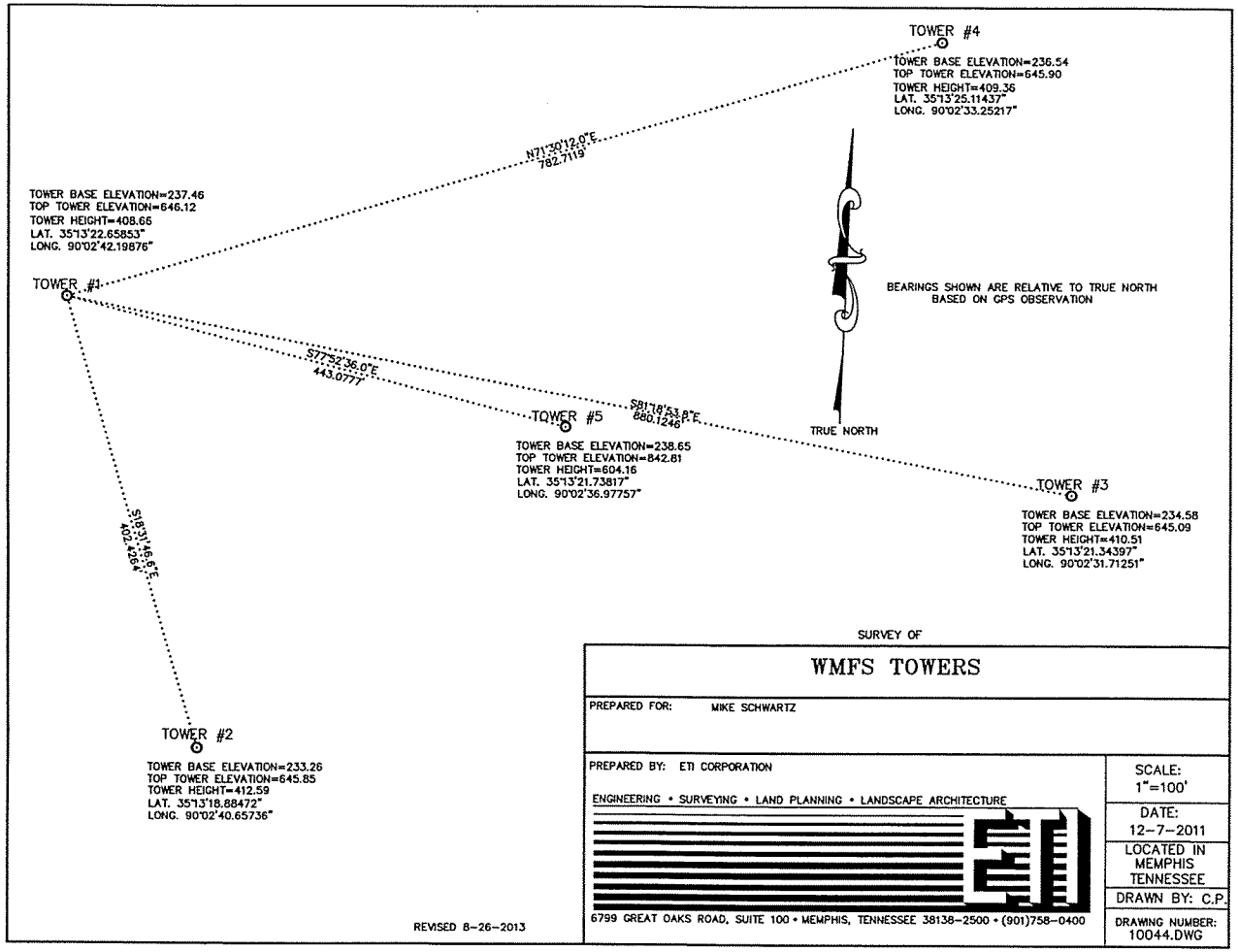
ITEM 7 - Direct Measurement of Power

Common point impedance measurements were made using an HP 8751A network analyzer in a calibrated measurement system. The measurements were made at the phasor cabinet input adjacent to the common point current meter that is used to determine operation power. The impedance measured at this point was adjusted to a value of 50 ± j0 for the directional antenna system.

ITEM 8 - Antenna Monitor and Sampling System

The sample system installed consists of Delta Electronics TCT-3 toroidal current transformers (TCT) installed inside the tuning houses at the base of each tower. All three TCTs have been compared with each other on the bench using the antenna monitor and found to be in good working order and within manufacturer's specifications. The TCTs are connected to a Potomac Instruments 1901 antenna monitor by equal lengths of 3/8 inch Andrew heliax coaxial cable. This cable has a foam dielectric, and solid copper inner and outer conductors. These lines were verified to have equal lengths within 1°. All excess cable is in the transmitter building antic. The antenna monitor was tested with a signal generator, a Tee connector and equal lengths of cable. The two signals were fed into the reference and sample inputs and the monitor was found to be in good working order and within manufacturer's specifications. There is no change to the ground system. The description contained in the current station license remains accurate.

Hatfield & Dawson Consulting Engineers


TOWER #4
TOWER BASE ELEVATION=236.54
TOP TOWER ELEVATION=645.90
TOWER HEIGHT=409.36
LAT. 35°13'25.11437"
LONG. 90°02'33.25217"
N71°30'12.0"E
782.7119
TOWER BASE ELEVATION=237.46
TOP TOWER ELEVATION=646.12
TOWER HEIGHT=408.66
LAT. 35°13'22.65853"
LONG. 90°02'42.19876"
TOWER #1
BEARINGS SHOWN ARE RELATIVE TO TRUE NORTH
BASED ON GPS OBSERVATION
S77°52'36.0"E
443.0777
S81°18'53.8"E
880.1246
TRUE NORTH
TOWER #5
TOWER BASE ELEVATION=238.65
TOP TOWER ELEVATION=842.81
TOWER HEIGHT=604.16
LAT. 35°13'21.73817"
LONG. 90°02'36.97757"
TOWER #3
TOWER BASE ELEVATION=234.58
TOP TOWER ELEVATION=645.09
TOWER HEIGHT=410.51
LAT. 35°13'21.34397"
LONG. 90°02'31.71251"
S18°31'46.6"E
402.4284
TOWER #2
TOWER BASE ELEVATION=233.26
TOP TOWER ELEVATION=645.85
TOWER HEIGHT=412.59
LAT. 35°13'18.88472"
LONG. 90°02'40.65736"
SURVEY OF
WMFS TOWERS
PREPARED FOR: MIKE SCHWARTZ
PREPARED BY: ETI CORPORATION
ENGINEERING • SURVEYING • LAND PLANNING • LANDSCAPE ARCHITECTURE
6799 GREAT OAKS ROAD, SUITE 100 • MEMPHIS, TENNESSEE 38138-2500 • (901)758-0400
SCALE: 1"=100'
DATE: 12-7-2011
LOCATED IN MEMPHIS TENNESSEE
DRAWN BY: C.P.
DRAWING NUMBER: 10044.DWG
REVISED 8-26-2013