



David G. O'Neil
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August 11, 2017

VIA FEDERAL EXPRESS

U.S. Bank
St. Louis, MO 979089

**Re: Hoosier AM/FM, LLC
FRN Number 0018502534
WIOU(AM), Kokomo, Indiana
Facility Id. No. 41849
Application for License**

Dear Sir or Madam:

Hoosier AM/FM, LLC, by their counsel, hereby submits this application for license for WIOU(AM) along with a completed FCC Form 159 in the amount of \$1,505. Also enclosed is a prepaid Federal Express envelope for return of the date stamped copy to this office.

Please contact the undersigned directly if there are any questions concerning this matter.

Respectfully submitted,

David G. O'Neil

DGO:do
Enclosure

{00026092.DOC.1}

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-20170817ABF

SECTION I - APPLICANT FEE INFORMATION

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

Hoosier AM/FM, LLC

MAILING ADDRESS (Line 1) (Maximum 35 characters)

550 Cochituate Road

MAILING ADDRESS (Line 2) (Maximum 35 characters)

Suite 25

CITY

Framingham

STATE OR COUNTRY (if foreign address)

MA

ZIP CODE

01701

TELEPHONE NUMBER (include area code)

5086508777

CALL LETTERS

WIOU(AM)

OTHER FCC IDENTIFIER (If applicable)

41849

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 | | |
|---------------|---|---|
| M | M | R |

(B)

| FEE MULTIPLE | | | |
|--------------|---|---|---|
| 0 | 0 | 0 | 1 |

(C)

| FEE DUE FOR FEE TYPE CODE IN COLUMN (A) |
|---|
| \$ 700 |

FOR FCC USE ONLY

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

(A)

| | | |
|---|---|---|
| M | O | R |
|---|---|---|

(B)

| | | | |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
|---|---|---|---|

(C)

| |
|--------|
| \$ 805 |
|--------|

FOR FCC USE ONLY

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

\$ 1505

FOR FCC USE ONLY

2017 AUG 17 P 3:20

| | | |
|--|-------------|-------------------|
| SECTION II - APPLICANT INFORMATION | | |
| 1. NAME OF APPLICANT Hoosier AM/FM, LLC | | |
| MAILING ADDRESS 550 Cochituate Road, Suite 25 | | |
| CITY Framingham | STATE MA | ZIP CODE 01701 |

2. This application is for:

- ☒ Commercial
 ☐ Noncommercial
☒ AM Directional
 ☐ AM Non-Directional

| | | | | |
|----------------------|------------------------------------|-------------------------------------|--|--|
| Call letters WIOU | Community of License Kokomo, IN | Construction Permit File No. N/A | Modification of Construction Permit File No(s). N/A | Expiration Date of Last Construction Permit N/A |
|----------------------|------------------------------------|-------------------------------------|--|--|

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

☒ Yes ☐ No

If No, explain in an Exhibit.

Exhibit No.
N/A

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

☐ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.
N/A

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

☐ Yes ☐ No

If Yes, explain in an Exhibit.

Exhibit No.
N/A

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

☐ Yes ☐ No

☒ 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.
N/Ap

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

☐ Yes ☒ No

If Yes, provide particulars as an Exhibit.

Exhibit No.
N/A

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


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

CERTIFICATION

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

☒ Yes ☐ No

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

| | | |
|--|---|--------------------------------|
| Name Bruce G. Danziger | Signature  | |
| Title Managing Member of Parent Company | Date 8/9/2017 | Telephone Number 5086506777 |

**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

Hoosier AM / FM, LLC

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)



Station License



Direct Measurement of Power

1. Facilities authorized in construction permit

| Call Sign | File No. of Construction Permit (if applicable) | Frequency (kHz) | Hours of Operation | Power in kilowatts | |
|-----------|--|--------------------|--------------------|--------------------|---------|
| WIOU | N/A | 1350 | U | Night 1.0 | Day 5.0 |

2. Station location

| | |
|---------|--------------|
| State | City or Town |
| Indiana | Kokomo |

3. Transmitter location

| | | | |
|-------|--------|--------------|---|
| State | County | City or Town | Street address (or other identification) |
| IN | Howard | Kokomo | 671 East 400 South |

4. Main studio location

| | | | |
|-------|--------|--------------|---|
| State | County | City or Town | Street address (or other identification) |
| IN | Howard | Kokomo | 671 East 400 South |

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

| | | | |
|-------|--------|--------------|---|
| State | County | City or Town | Street address (or other identification) |
| | N/A | | |

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.
E-2

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 | |
| 3.93 | | 8.78 | |
| Measured antenna or common point resistance (in ohms) at operating frequency | | Measured antenna or common point reactance (in ohms) at operating frequency | |
| Night 70.0 | Day 70.0 | Night $+j0.0$ | Day $+j0.0$ |

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 |
| 1 | 178.9 | -139.8 | 0.599 | 0.439 | | |
| 2 | 0.0 | 0.0 | 1.000 | 1.000 | | |
| 3 | 154.5 | 132.9 | 1.013 | 0.841 | | |
| 4 | -36.9 | -91.7 | 0.470 | 0.228 | | |
| | | | | | | |
| | | | | | | |

Manufacturer and type of antenna monitor: Potomac Instruments AM-19(204), S/N 512

SECTION III - Page 2

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

| | | | | |
|--|---|--|--|--|
| Type Radiator Uniform cross section guyed | Overall height in meters of radiator above base insulator, or above base, if grounded. #1, #2, #3: 61.0 m #4: 66.0 m | Overall height in meters above ground (without obstruction lighting) #1, #2, #4: 63.4 m #4: 68.3 m | Overall height in meters above ground (include obstruction lighting) #1, #2, #3: 64.3 m #4: 68.3 m | If antenna is either top loaded or sectionalized, describe fully in an Exhibit. <div>Exhibit No. N/A</div> |
|--|---|--|--|--|

Excitation ☒ Series ☐ Shunt ASRN: #1: 1031394 #3: 1031396
#2: 1031395 #4: 1031397

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

| | | | |
|----------------|-------------|----------------|-------------|
| North Latitude | 40° 25' 01" | West Longitude | 86° 06' 49" |
|----------------|-------------|----------------|-------------|

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.
N/A

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system.

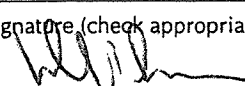
Exhibit No.
N/A

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

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

Transmission and sample line replacement to Tower 1 and 2,
and modification of feeder system

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) Derek R. Gorman | Signature (check appropriate box below)  |
| Address (include ZIP Code) P.O. Box 807 2324 N. Cleveland-Massillon Rd. Bath, OH 44210 | Date 8/7/2017 |
| | Telephone No. (Include Area Code) 330/659-4440 |

☐ Technical Director

☐ Registered Professional Engineer

☐ Chief Operator

☒ Technical Consultant

☐ Other (specify)

ENGINEERING EXHIBIT E-2
APPLICATION FOR STATION LICENSE
(METHOD OF MOMENTS PROOF)
WIOU(AM) - KOKOMO, IN
Hoosier AM/FM, LLC
Kokomo, IN

August 7, 2017

Prepared For: Mr. Steve La Mar
General Manager
Hoosier AM/FM, LLC
671 East 400 South
Kokomo, IN 46902

CARL E. SMITH CONSULTING ENGINEERS

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Roy P. Stype, III
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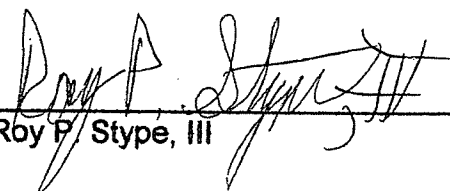
Fig. 5.3 - WIOU Feeder System

ENGINEERING AFFIDAVIT

State of Ohio)
) ss:
County of Summit)

Roy P. Stype, III, being duly sworn, deposes and states that he is a graduate Electrical Engineer, a qualified and experienced Communications Consulting Engineer whose works are a matter of record with the Federal Communications Commission and that he is a member of the Firm of "Carl E. Smith Consulting Engineers" located at 2324 North Cleveland-Massillon Road in the Township of Bath, County of Summit, State of Ohio, and that the Firm has been retained by Hoosier AM/FM, LLC to prepare the attached "Engineering Exhibit E-2."

The deponent states that the Exhibit was prepared by him or under his direction and is true of his own knowledge, except as to statements made on information and belief and as to such statements, he believes them to be true.



Roy P. Stype, III

Subscribed and sworn to before me on **August 7, 2017**.



Notary Public

/SEAL/

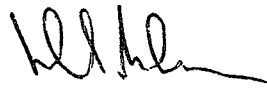
Nancy A. Adams, Notary Public
Residence - Cuyahoga County
State Wide Jurisdiction, Ohio
My Commission Expires Sept. 27, 2020

ENGINEERING AFFIDAVIT

State of Ohio)
) ss:
County of Summit)


Derek R. Gorman, being duly sworn, deposes and states that he is a qualified and experienced Communications Consulting Engineer whose works are a matter of record with the Federal Communications Commission and that he is a member of the Firm of "Carl E. Smith Consulting Engineers" located at 2324 North Cleveland-Massillon Road in the Township of Bath, County of Summit, State of Ohio, and that the Firm has been retained by Hoosier AM/FM, LLC to prepare the attached "Engineering Exhibit E-2."

The deponent states that the Exhibit was prepared by him or under his direction and is true of his own knowledge, except as to statements made on information and belief and as to such statements, he believes them to be true.



Derek R. Gorman

Subscribed and sworn to before me on **August 7, 2017**.



Notary Public

/SEAL/

Nancy A. Adams, Notary Public
Residence - Cuyahoga County
State Wide Jurisdiction, Ohio
My Commission Expires Sept. 27, 2020

ENGINEERING STATEMENT

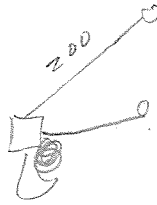
1.0 GENERAL

This engineering exhibit is prepared on behalf of Hoosier AM/FM, LLC, licensee of Radio Station WIOU(AM) - Kokomo, Indiana, in support of an application for a modified station license. It details the results of a recent proof of performance conducted on the WIOU daytime and nighttime directional antenna systems utilizing the computer modeling method of moments (MoM) technique outlined in Section 73.151(c) of the FCC rules. WIOU's daytime and nighttime directional antenna systems are eligible to use this proof methodology since they employ a standard ground system and all the elements are series fed.

WIOU operates full time on 1350 kHz utilizing a four tower directional antenna daytime and nighttime. The ground system for the WIOU directional antenna system consists of 120 equally spaced #10 AWG copper radials, each 55.5 meters in length, buried approximately 10 cm deep about the base of each tower. These radials are truncated where they intersect a transverse copper strap running between adjacent towers. A 14.6 meter square expanded mesh copper ground screen is installed at the base of each tower. In addition, an auxiliary FM antenna for WZWZ(FM) (BLH-19951025KB) is installed on Tower 2 and an antenna for a Remote Pickup Station is installed on Tower 4 of the directional antenna system. The transmission lines for these antennas are isolated across the tower bases by the use of isocouplers. The ground system description, and the FM and RPU antennas, remain unchanged from what is currently on file, and is provided only for clarity purposes.

Pursuant to the FCC's October 29, 2009 Public Notice (DA 09-2340), no

surveyor's certification is required to verify the locations of the WIOU towers since this application is re-licensing an existing licensed antenna system without making any changes. The data contained in this exhibit shows that the WIOU daytime and nighttime directional patterns are in proper adjustment based on a Method of Moments analysis.



2.0 SAMPLE SYSTEM

The sample system for the WIOU directional antenna system is in full compliance with Section 73.151(c)(2)(i) of the FCC rules with regard to sample systems for directional antenna systems utilizing the computer modeling method of moments technique. The sample system consists of current transformers used as the sample elements, equal electrical lengths of sample line, and a Potomac Instruments antenna monitor.

The sample elements utilized in the WIOU sample system are Delta Electronics TCT-3 toroidal current transformers mounted adjacent to the feed at each tower. Each sample element was field verified to be within the manufacturers specifications of $\pm 2\%$ ratio and ± 3 degree phase accuracy by placing them in series with a common reference signal and using the antenna monitor to compare the ratio and phase of the output sample from the sample element from tower 2 to the output sample from each of the other sample elements. The results of this field verification are tabulated in Table 2.0 and confirms that the ratio and phase of the outputs of all of these sample elements are well within the manufacturer's specifications.

The sample lines utilized in the WIOU sample system consist of four equal electrical length runs. The sample lines to towers 1 and 2 are each 476'/145.1m of RFS FLC38-50J foam Flexwell coaxial cable. The sample lines to towers 3 and 4 are each 438'/133.5m of Cablewave Systems FCC38-50J foam Flexwell coaxial cable. The runs from the transmitter building to the towers are buried and the excess cable lengths are coiled in the ATU buildings. Impedance measurements were conducted on this sample system as required by Section 73.153(c)(2)(i) of the FCC Rules using an Agilent Technologies model 8753ES Vector Network Analyzer (VNA), S/N MY40002631, an

Electronic Navigation Industries (ENI) model 310L linear amplifier, S/N 654, and a Tunwall Radio directional coupler, S/N DC11, as a calibrated measurement system. These measurements were conducted both with the sample lines open circuited and with them connected to the sample elements.

The frequencies above and below the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, were found and are listed in Table 2.1. These frequencies of resonance occur at odd multiples of 90 degrees electrical length, and the sample line length at the resonant frequency above the carrier frequency, which is the closest one to the carrier frequency, was found to be 270 electrical degrees. The electrical lengths of these sample lines at the carrier frequency are tabulated in Table 2.1 and were calculated utilizing the ratio between the frequencies.

To determine the characteristic impedance values of the sample lines, open circuit measurements were conducted on frequencies offset to result in electrical lengths ± 45 degrees from the electrical length at this resonant frequency. The characteristic impedance was calculated using the following formula, where $R_1 + jX_1$ and $R_2 + jX_2$ are the measured impedances at the +45 and -45 degree offset frequencies, respectively:

$$Z_0 = ((R_1^2 + X_1^2)^{1/2} \times (R_2^2 + X_2^2)^{1/2})^{1/2}$$

These measured offset frequencies, along with the calculated characteristic impedance of each sample line, are also tabulated in Table 2.1. These measured values comply with the requirement that the measured characteristic impedance of each sample line be within two ohms of the measured characteristic impedance of every other sample line in the antenna system.

The antenna monitor utilized with WIOU's directional antenna system is a type accepted Potomac Instruments AM-19(204), S/N 512. This antenna monitor was field verified to be within the manufacturers specifications of $\pm 1.5\%$ ratio accuracy and ± 1 degree phase accuracy.

TABLE 2.0

WIOU
SAMPLE ELEMENT MEASUREMENTS
Hoosier AM/FM, LLC
Kokomo, IN

| <u>Tower</u> | <u>Sample Element *</u> | | <u>Measured Ratio</u> | <u>Measured Phase (degrees)</u> |
|--------------|-------------------------|----------------------|---------------------------|---|
| | <u>Model</u> | <u>Serial Number</u> | | |
| 1 | TCT-3 | 18364 | 1.000 | 0.2 |
| 2 | TCT-3 | 261 | 1.000 | 0.0 |
| 3 | TCT-3 | 268 | 1.003 | 0.5 |
| 4 | TCT-3 | 18365 | 0.999 | 0.2 |

* Sample Elements Manufactured By Delta Electronics, Inc.

TABLE 2.1

WIOU
SAMPLE LINE MEASUREMENTS

Hoosier AM/FM, LLC
Kokomo, IN

$$\frac{267.5}{360} \times \frac{300}{1.35} = 216.3$$

$$\frac{133.5}{360} \times \frac{300}{1.35} = 235.1$$

| <u>Tower</u> | <u>Resonant Frequency (kHz) Below 1350 kHz</u> | <u>Resonant Frequency (kHz) Above 1350 kHz</u> | <u>Calculated Electrical Length At 1350 kHz (degrees)</u> | <u>Measured Impedance Connected To Sample Element At 1350 kHz (ohms)</u> |
|--------------|--|--|---|--|
| 1 | 449.09 | 1362.67 | 267.5 | 53.3-j3.5 |
| 2 | 450.62 | 1362.67 | 267.5 | 53.0-j2.5 |
| 3 | 450.96 | 1363.69 | 267.3 | 51.0-j2.7 |
| 4 | 450.28 | 1363.69 | 267.3 | 51.5-j2.8 |

2'
4 1/2'

| <u>Tower</u> | <u>-45 Degree Offset Frequency (kHz)</u> | <u>-45 Degree Offset Impedance (ohms)</u> | <u>+45 Degree Offset Frequency (kHz)</u> | <u>+45 Degree Offset Impedance (ohms)</u> | <u>Calculated Characteristic Impedance (ohms)</u> |
|--------------|--|---|--|---|---|
| 1 | 1139.29 | 4.3-j49.8 | 1584.18 | 7.5+j49.2 | 49.9 |
| 2 | 1140.48 | 4.3-j49.8 | 1586.39 | 7.5+j49.3 | 49.9 |
| 3 | 1137.25 | 4.1-j49.8 | 1590.30 | 7.4+j49.3 | 49.9 |
| 4 | 1139.63 | 4.1-j49.8 | 1590.30 | 7.3+j49.4 | 50.0 |

3.0 ANTENNA SYSTEM MODELING

The WIOU antenna system was modeled using Expert MININEC Broadcast Professional Version 23. The tower heights of the towers in the WIOU antenna system are unequal, towers 1, 2, and 3, are 98.8 electrical degrees in height, and tower 4 is 107.0 electrical degrees in height. One wire was used to represent each tower, and each wire was modeled using multiple wire segments to meet the requirement that wire segments be no longer than 10 electrical degrees in length. The top and bottom end points of each wire were specified in electrical degrees at 1350 kHz.

All towers in the WIOU antenna system have a uniform triangular cross section with a face width of 20" (0.508m). Each tower's modeled height, relative to its physical height, falls within the required range of 75 to 125 percent of its physical height. Each tower's modeled radius, relative to the radius of a circle having a circumference equal to the sum of the widths of the physical tower sides, falls within the required range of 80 to 150 percent of its physical radius. Table 3.0 details the characteristics of each tower in the MoM model of the WIOU antenna system.

The individual characteristics of each tower were adjusted to provide a match of its modeled impedance with its measured impedance, when presented to a circuit model that includes base region stray capacity, a tower feed, and a static drain choke, at the antenna tuning unit (ATU) output. Each tower in the array was driven individually with all towers in the MoM model and all non-driven towers loaded with their open circuit impedance computed from the circuit model. Each tower has a specified base region stray capacity of 250 pF or less and a tower feed inductance of 10uH or less, as required by the rules.

The measured impedances were determined using a Delta Electronics OIB-3 impedance bridge, S/N 1411, driven by the station's Harris MW-5A transmitter, with all non-driven towers open circuited. Table 3.1 presents all of the individual tower MoM model data and measurements and Figure 3.1 details the tower base circuit diagram used in the MoM model. Tables 3.2 to 3.9 present in detail the MoM calculations and base circuit analysis for each tower driven individually. As shown in Table 3.1, the measured and modeled ATU output impedances agree within ± 2 ohms and ± 4 percent for resistance and reactance as required by the rules.

Once the MoM model was developed and verified with the measured impedances, it was synthesized with the theoretical parameters for the daytime directional array as specified on the station's license. The results of this synthesis with the MoM model driven as a directional array are presented in Tables 3.10 and 3.11. Additionally, Table 3.11 presents the daytime directional array admittance and impedance matrixes resulting from the MoM model.

After the daytime directional array was synthesized, the resulting MoM base voltage and current for each tower was presented to the same circuit model used in verifying the individual tower impedance to calculate the current at the ATU output where the sample element to drive the antenna monitor is located. Once these currents were calculated, they were normalized to the tower used as the reference tower for the daytime directional array. Tables 3.12 to 3.15 present in detail the base circuit analysis for each tower resulting from the array synthesis. Table 3.16 presents the calculated sample element current for all towers and the resulting normalized antenna monitor parameters. These normalized antenna monitor parameters were established on the antenna monitor as the operating parameters for the daytime directional array.

Similarly, the MoM model was synthesized with the theoretical parameters for the nighttime directional array as specified on the station's license. The results of this synthesis with the MoM model driven as a directional array are presented in Tables 3.17 and 3.18. Additionally, Table 3.18 presents the nighttime directional array admittance and impedance matrixes resulting from the MoM model.

After the nighttime directional array was synthesized, the resulting MoM base voltage and current for each tower was presented to the same circuit model used in verifying the individual tower impedance to calculate the current at the ATU output where the sample element to drive the antenna monitor is located. Once these currents were calculated, they were normalized to the tower used as the reference tower for the nighttime directional array. Tables 3.19 to 3.22 present in detail the base circuit analysis for each tower resulting from the array synthesis. Table 3.23 presents the calculated sample element current for all towers and the resulting normalized antenna monitor parameters. These normalized antenna monitor parameters were established on the antenna monitor as the operating parameters for the nighttime directional array.

TABLE 3.0

WIOU
INDIVIDUAL TOWER
MoM MODEL DETAILS
Hoosier AM/FM, LLC
Kokomo, IN

| <u>Tower</u> | <u>Physical Height (degrees)</u> | <u>Modeled Height (degrees)</u> | <u>Modeled Percent Of Height (%)</u> | <u>Modeled Radius (meters)</u> | <u>Percent Equivalent Radius (%)</u> |
|--------------|--|---|--|--|--|
| 1 | 98.8 | 105.5 | 106.8 | 0.250 | 102.9 |
| 2 | 98.8 | 106.7 | 108.0 | 0.310 | 127.6 |
| 3 | 98.8 | 105.4 | 106.7 | 0.230 | 94.7 |
| 4 | 107.0 | 111.7 | 104.4 | 0.280 | 115.2 |

| <u>Tower</u> | <u>Wire Number</u> | <u>Number Of Segments</u> | <u>Base Segment Number</u> |
|--------------|------------------------|-------------------------------|--------------------------------|
| 1 | 1 | 13 | 1 |
| 2 | 2 | 13 | 14 |
| 3 | 3 | 13 | 27 |
| 4 | 4 | 14 | 40 |

$$\lambda = \frac{c}{f}$$

$$\frac{\lambda}{360} = \frac{300}{\left(\frac{c}{f}\right) 1.35 \text{ MHz}}$$

TABLE 3.1

WIOU INDIVIDUAL
TOWER IMPEDANCE MEASUREMENTS
TO VERIFY MoM MODEL
Hoosier AM/FM, LLC
Kokomo, IN

| <u>Tower</u> | Measured | Specified | | Specified | | Modeled |
|--------------|--------------------|-----------------|---------------|-----------------|---------------|--------------------|
| | X_{SD} (ohms) | X_F (ohms) | L_F (uH) | X_S (ohms) | C_S (pF) | X_{OC} (ohms) |
| 1 | -j100,000 | j35.0 | 4.13 | -j11,789 | 10.0 | -j10,545 |
| 2 | -j100,000 | j35.0 | 4.13 | -j11,789 | 10.0 | -j10,545 |
| 3 | -j98,000 | j35.0 | 4.13 | -j11,789 | 10.0 | -j10,523 |
| 4 | -j98,000 | j35.0 | 4.13 | -j5,895 | 20.0 | -j5,560 |

| <u>Tower</u> | Measured | Modeled | Modeled |
|--------------|---------------------|---------------------|---------------------|
| | Z_{ATU} (ohms) | Z_{ATU} (ohms) | Z_{ANT} (ohms) |
| 1 | 73.5+j140.8 | 73.6+j140.8 | 72.0+j105.2 |
| 2 | 78.0+j144.2 | 77.8+j144.2 | 76.2+j108.5 |
| 3 | 69.0+j141.8 | 69.0+j141.8 | 67.6+j106.1 |
| 4 | 102.0+j178.9 | 102.0+j178.6 | 96.8+j141.6 |

TABLE 3.2

WIOU
TOWER 1 MoM SUMMARY
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
current nodes = 53

| | minimum | maximum |
|------------------|------------|------------|
| Individual wires | wire value | wire value |
| segment length | 4 7.97857 | 2 8.20769 |
| radius | 3 .23 | 2 .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| no. | frequency | step | no. of steps | segment length (wavelengths) |
|--------|-----------|------|--------------|------------------------------|
| lowest | | | | minimum maximum |
| 1 | 1.35 | 0 | 1 | .0221627 .0227992 |

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 | 14 | 0 | -10,545. | 0 | 0 | 0 |
| 2 | 27 | 0 | -10,523. | 0 | 0 | 0 |
| 3 | 40 | 0 | -5,560. | 0 | 0 | 0 |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|------------------------------|---------------|--------------|--------------|-------------|--------|---------|---------|
| source = 1; node 1, sector 1 | | | | | | | |
| 1.35 | 72.048 | 105.16 | 127.47 | 55.6 | 5.0048 | -3.5184 | -2.5555 |

CURRENT rms

Frequency = 1.35 MHz
Input power = .00221699 watts
Efficiency = 100. %
coordinates in degrees

TABLE 3.2 (cont'd)

| current no. | X | Y | Z | mag (amps) | phase (deg) | real (amps) | imaginary (amps) |
|----------------|----------|----------|---------|---------------|----------------|----------------|---------------------|
| GND | 0 | 0 | 0 | 5.55E-03 | 304.4 | 3.14E-03 | -4.58E-03 |
| 2 | 0 | 0 | 8.11539 | 6.E-03 | 301.3 | 3.11E-03 | -5.13E-03 |
| 3 | 0 | 0 | 16.2308 | 6.19E-03 | 299.5 | 3.05E-03 | -5.39E-03 |
| 4 | 0 | 0 | 24.3462 | 6.23E-03 | 298.1 | 2.93E-03 | -5.49E-03 |
| 5 | 0 | 0 | 32.4615 | 6.12E-03 | 297. | 2.78E-03 | -5.45E-03 |
| 6 | 0 | 0 | 40.5769 | 5.89E-03 | 296.1 | 2.59E-03 | -5.29E-03 |
| 7 | 0 | 0 | 48.6923 | 5.53E-03 | 295.3 | 2.36E-03 | -5.E-03 |
| 8 | 0 | 0 | 56.8077 | 5.05E-03 | 294.6 | 2.1E-03 | -4.59E-03 |
| 9 | 0 | 0 | 64.9231 | 4.47E-03 | 293.9 | 1.81E-03 | -4.08E-03 |
| 10 | 0 | 0 | 73.0385 | 3.78E-03 | 293.4 | 1.5E-03 | -3.47E-03 |
| 11 | 0 | 0 | 81.1539 | 3.E-03 | 292.8 | 1.16E-03 | -2.77E-03 |
| 12 | 0 | 0 | 89.2692 | 2.14E-03 | 292.3 | 8.11E-04 | -1.98E-03 |
| 13 | 0 | 0 | 97.3846 | 1.18E-03 | 291.8 | 4.38E-04 | -1.09E-03 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 2.79E-05 | 164.7 | -2.69E-05 | 7.37E-06 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 2.94E-04 | 164.7 | -2.83E-04 | 7.76E-05 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 4.5E-04 | 164.7 | -4.34E-04 | 1.19E-04 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 5.64E-04 | 164.7 | -5.44E-04 | 1.49E-04 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 6.43E-04 | 164.7 | -6.21E-04 | 1.69E-04 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 6.89E-04 | 164.8 | -6.65E-04 | 1.81E-04 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 7.04E-04 | 164.8 | -6.79E-04 | 1.84E-04 |
| 21 | -89.6575 | -7.84403 | 57.4539 | 6.89E-04 | 164.9 | -6.65E-04 | 1.8E-04 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 6.44E-04 | 164.9 | -6.22E-04 | 1.68E-04 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 5.73E-04 | 165. | -5.53E-04 | 1.48E-04 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 4.75E-04 | 165. | -4.58E-04 | 1.23E-04 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 3.51E-04 | 165.1 | -3.39E-04 | 9.04E-05 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 2.01E-04 | 165.1 | -1.95E-04 | 5.17E-05 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 1.85E-05 | 82.6 | 2.38E-06 | 1.83E-05 |
| 28 | -179.315 | -15.6881 | 8.10769 | 1.74E-04 | 82.5 | 2.26E-05 | 1.73E-04 |
| 29 | -179.315 | -15.6881 | 16.2154 | 2.7E-04 | 82.4 | 3.55E-05 | 2.68E-04 |
| 30 | -179.315 | -15.6881 | 24.3231 | 3.41E-04 | 82.3 | 4.55E-05 | 3.38E-04 |
| 31 | -179.315 | -15.6881 | 32.4308 | 3.9E-04 | 82.2 | 5.3E-05 | 3.86E-04 |
| 32 | -179.315 | -15.6881 | 40.5385 | 4.2E-04 | 82.1 | 5.8E-05 | 4.16E-04 |
| 33 | -179.315 | -15.6881 | 48.6462 | 4.3E-04 | 81.9 | 6.07E-05 | 4.26E-04 |
| 34 | -179.315 | -15.6881 | 56.7539 | 4.23E-04 | 81.7 | 6.08E-05 | 4.18E-04 |
| 35 | -179.315 | -15.6881 | 64.8615 | 3.97E-04 | 81.6 | 5.83E-05 | 3.92E-04 |
| 36 | -179.315 | -15.6881 | 72.9692 | 3.54E-04 | 81.4 | 5.31E-05 | 3.5E-04 |
| 37 | -179.315 | -15.6881 | 81.0769 | 2.94E-04 | 81.2 | 4.52E-05 | 2.9E-04 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.18E-04 | 80.9 | 3.43E-05 | 2.15E-04 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.24E-04 | 80.7 | 2.01E-05 | 1.23E-04 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 3.52E-05 | 346.6 | 3.43E-05 | -8.17E-06 |
| 41 | -268.973 | -23.5321 | 7.97857 | 2.03E-04 | 346.5 | 1.98E-04 | -4.73E-05 |
| 42 | -268.973 | -23.5321 | 15.9571 | 3.06E-04 | 346.5 | 2.97E-04 | -7.16E-05 |
| 43 | -268.973 | -23.5321 | 23.9357 | 3.83E-04 | 346.4 | 3.72E-04 | -9.03E-05 |
| 44 | -268.973 | -23.5321 | 31.9143 | 4.39E-04 | 346.2 | 4.27E-04 | -1.04E-04 |
| 45 | -268.973 | -23.5321 | 39.8929 | 4.76E-04 | 346.1 | 4.62E-04 | -1.14E-04 |
| 46 | -268.973 | -23.5321 | 47.8714 | 4.95E-04 | 346. | 4.8E-04 | -1.2E-04 |
| 47 | -268.973 | -23.5321 | 55.85 | 4.95E-04 | 345.9 | 4.8E-04 | -1.21E-04 |
| 48 | -268.973 | -23.5321 | 63.8286 | 4.77E-04 | 345.7 | 4.62E-04 | -1.18E-04 |
| 49 | -268.973 | -23.5321 | 71.8071 | 4.42E-04 | 345.6 | 4.28E-04 | -1.1E-04 |
| 50 | -268.973 | -23.5321 | 79.7857 | 3.89E-04 | 345.4 | 3.77E-04 | -9.82E-05 |
| 51 | -268.973 | -23.5321 | 87.7643 | 3.21E-04 | 345.2 | 3.11E-04 | -8.19E-05 |
| 52 | -268.973 | -23.5321 | 95.7429 | 2.37E-04 | 345. | 2.29E-04 | -6.11E-05 |
| 53 | -268.973 | -23.5321 | 103.721 | 1.36E-04 | 344.8 | 1.31E-04 | -3.54E-05 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.3

WIOU
TOWER 1 BASE CIRCUIT ANALYSIS
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 72.05, 105.16 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | 73.35 | 105.65 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1.233 | 7.23 |
| 2 | 1.000 | 0.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---|-----------|------------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 0.443E-02 | -0.637E-02 | 0.776E-02 | 304.81 |
| OUTPUT CURRENT I2 (AMPS): | 0.443E-02 | -0.647E-02 | 0.784E-02 | 304.42 |
| MODELED ATU OUTPUT IMPEDANCE V1/I1 (OHMS): | 73.55 | 140.80 | 158.85 | 62.42 |

TABLE 3.4

WIOU
TOWER 2 MoM SUMMARY
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
current nodes = 53

| | minimum | | maximum | |
|------------------|---------|---------|---------|---------|
| Individual wires | wire | value | wire | value |
| segment length | 4 | 7.97857 | 2 | 8.20769 |
| radius | 3 | .23 | 2 | .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| frequency | | | no. of steps | segment length (wavelengths) | |
|-----------|--------|------|-----------------|------------------------------|----------|
| no. | lowest | step | | minimum | maximum |
| 1 | 1.35 | 0 | 1 | .0221627 | .0227992 |

Sources

| source node | sector | magnitude | phase | type |
|-------------|--------|-----------|-------|---------|
| 1 14 | 1 | 1. | 0 | voltage |

Lumped loads

| load | node | resistance (ohms) | reactance (ohms) | inductance (mH) | capacitance (uF) | passive circuit |
|------|------|----------------------|---------------------|--------------------|---------------------|--------------------|
| 1 | 1 | 0 | -10,545. | 0 | 0 | 0 |
| 2 | 27 | 0 | -10,523. | 0 | 0 | 0 |
| 3 | 40 | 0 | -5,560. | 0 | 0 | 0 |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|-------------------------------|------------------|-----------------|-----------------|----------------|--------|-----------|-----------|
| source = 1; node 14, sector 1 | | | | | | | |
| 1.35 | 76.18 | 108.5 | 132.58 | 54.9 | 5.0737 | -3.4693 | -2.5952 |

CURRENT rms

Frequency = 1.35 MHz

Input power = .0021671 watts

Efficiency = 100. %

coordinates in degrees

| current | | | | mag | phase | real | imaginary |
|---------|---|---|---|--------|-------|--------|-----------|
| no. | X | Y | Z | (amps) | (deg) | (amps) | (amps) |

TABLE 3.4 (cont'd)

| | | | | | | | |
|-----|----------|----------|---------|----------|-------|-----------|-----------|
| GND | 0 | 0 | 0 | 2.68E-05 | 165.3 | -2.59E-05 | 6.77E-06 |
| 2 | 0 | 0 | 8.11539 | 2.6E-04 | 165.3 | -2.52E-04 | 6.58E-05 |
| 3 | 0 | 0 | 16.2308 | 4.02E-04 | 165.3 | -3.88E-04 | 1.02E-04 |
| 4 | 0 | 0 | 24.3462 | 5.05E-04 | 165.4 | -4.89E-04 | 1.28E-04 |
| 5 | 0 | 0 | 32.4615 | 5.77E-04 | 165.4 | -5.58E-04 | 1.46E-04 |
| 6 | 0 | 0 | 40.5769 | 6.19E-04 | 165.4 | -5.99E-04 | 1.56E-04 |
| 7 | 0 | 0 | 48.6923 | 6.33E-04 | 165.4 | -6.13E-04 | 1.59E-04 |
| 8 | 0 | 0 | 56.8077 | 6.2E-04 | 165.5 | -6.E-04 | 1.56E-04 |
| 9 | 0 | 0 | 64.9231 | 5.8E-04 | 165.5 | -5.62E-04 | 1.45E-04 |
| 10 | 0 | 0 | 73.0385 | 5.15E-04 | 165.5 | -4.99E-04 | 1.29E-04 |
| 11 | 0 | 0 | 81.1539 | 4.27E-04 | 165.6 | -4.14E-04 | 1.06E-04 |
| 12 | 0 | 0 | 89.2692 | 3.16E-04 | 165.7 | -3.06E-04 | 7.81E-05 |
| 13 | 0 | 0 | 97.3846 | 1.8E-04 | 165.7 | -1.75E-04 | 4.44E-05 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 5.33E-03 | 305.1 | 3.06E-03 | -4.37E-03 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 5.83E-03 | 301.5 | 3.04E-03 | -4.97E-03 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 6.05E-03 | 299.5 | 2.98E-03 | -5.26E-03 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 6.1E-03 | 298. | 2.87E-03 | -5.39E-03 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 6.02E-03 | 296.9 | 2.72E-03 | -5.37E-03 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 5.81E-03 | 295.9 | 2.53E-03 | -5.22E-03 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 5.46E-03 | 295. | 2.31E-03 | -4.95E-03 |
| 21 | -89.6575 | -7.84403 | 57.4539 | 5.E-03 | 294.2 | 2.05E-03 | -4.56E-03 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 4.43E-03 | 293.6 | 1.77E-03 | -4.06E-03 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 3.76E-03 | 292.9 | 1.47E-03 | -3.46E-03 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 2.99E-03 | 292.4 | 1.14E-03 | -2.77E-03 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 2.13E-03 | 291.8 | 7.94E-04 | -1.98E-03 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 1.19E-03 | 291.3 | 4.31E-04 | -1.1E-03 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 2.37E-05 | 171.2 | -2.35E-05 | 3.64E-06 |
| 28 | -179.315 | -15.6881 | 8.10769 | 2.24E-04 | 171.2 | -2.21E-04 | 3.42E-05 |
| 29 | -179.315 | -15.6881 | 16.2154 | 3.46E-04 | 171.2 | -3.42E-04 | 5.27E-05 |
| 30 | -179.315 | -15.6881 | 24.3231 | 4.36E-04 | 171.3 | -4.31E-04 | 6.61E-05 |
| 31 | -179.315 | -15.6881 | 32.4308 | 4.99E-04 | 171.3 | -4.93E-04 | 7.5E-05 |
| 32 | -179.315 | -15.6881 | 40.5385 | 5.35E-04 | 171.4 | -5.29E-04 | 8.E-05 |
| 33 | -179.315 | -15.6881 | 48.6462 | 5.47E-04 | 171.5 | -5.41E-04 | 8.11E-05 |
| 34 | -179.315 | -15.6881 | 56.7539 | 5.36E-04 | 171.6 | -5.3E-04 | 7.86E-05 |
| 35 | -179.315 | -15.6881 | 64.8615 | 5.02E-04 | 171.7 | -4.96E-04 | 7.28E-05 |
| 36 | -179.315 | -15.6881 | 72.9692 | 4.46E-04 | 171.8 | -4.41E-04 | 6.39E-05 |
| 37 | -179.315 | -15.6881 | 81.0769 | 3.69E-04 | 171.9 | -3.65E-04 | 5.22E-05 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.72E-04 | 172. | -2.7E-04 | 3.8E-05 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.55E-04 | 172.1 | -1.54E-04 | 2.14E-05 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 4.08E-05 | 78.2 | 8.32E-06 | 3.99E-05 |
| 41 | -268.973 | -23.5321 | 7.97857 | 2.35E-04 | 78.2 | 4.82E-05 | 2.3E-04 |
| 42 | -268.973 | -23.5321 | 15.9571 | 3.53E-04 | 78.1 | 7.3E-05 | 3.46E-04 |
| 43 | -268.973 | -23.5321 | 23.9357 | 4.42E-04 | 78. | 9.21E-05 | 4.32E-04 |
| 44 | -268.973 | -23.5321 | 31.9143 | 5.06E-04 | 77.9 | 1.07E-04 | 4.95E-04 |
| 45 | -268.973 | -23.5321 | 39.8929 | 5.48E-04 | 77.7 | 1.17E-04 | 5.36E-04 |
| 46 | -268.973 | -23.5321 | 47.8714 | 5.68E-04 | 77.6 | 1.22E-04 | 5.55E-04 |
| 47 | -268.973 | -23.5321 | 55.85 | 5.67E-04 | 77.4 | 1.23E-04 | 5.54E-04 |
| 48 | -268.973 | -23.5321 | 63.8286 | 5.46E-04 | 77.3 | 1.2E-04 | 5.33E-04 |
| 49 | -268.973 | -23.5321 | 71.8071 | 5.05E-04 | 77.1 | 1.12E-04 | 4.92E-04 |
| 50 | -268.973 | -23.5321 | 79.7857 | 4.44E-04 | 77. | 1.E-04 | 4.33E-04 |
| 51 | -268.973 | -23.5321 | 87.7643 | 3.66E-04 | 76.8 | 8.35E-05 | 3.56E-04 |
| 52 | -268.973 | -23.5321 | 95.7429 | 2.69E-04 | 76.6 | 6.23E-05 | 2.62E-04 |
| 53 | -268.973 | -23.5321 | 103.721 | 1.53E-04 | 76.4 | 3.6E-05 | 1.49E-04 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.5

WIOU
TOWER 2 BASE CIRCUIT ANALYSIS
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 76.18, 108.50 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | 77.60 | 109.00 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1.223 | 7.13 |
| 2 | 1.000 | 0.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---|-----------|------------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 0.433E-02 | -0.608E-02 | 0.746E-02 | 305.49 |
| OUTPUT CURRENT I2 (AMPS): | 0.433E-02 | -0.617E-02 | 0.754E-02 | 305.07 |
| MODELED ATU OUTPUT IMPEDANCE V1/I1 (OHMS): | 77.82 | 144.15 | 163.81 | 61.64 |

TABLE 3.6

WIOU
TOWER 3 MoM SUMMARY
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
current nodes = 53

| | minimum | | maximum | |
|------------------|---------|---------|---------|---------|
| Individual wires | wire | value | wire | value |
| segment length | 4 | 7.97857 | 2 | 8.20769 |
| radius | 3 | .23 | 2 | .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| frequency | | | no. of steps | segment length (wavelengths) | |
|-----------|--------|------|-----------------|------------------------------|----------|
| no. | lowest | step | | minimum | maximum |
| 1 | 1.35 | 0 | 1 | .0221627 | .0227992 |

Sources

| source node | sector | magnitude | phase | type |
|-------------|--------|-----------|-------|---------|
| 1 27 | 1 | 1. | 0 | voltage |

Lumped loads

| load | node | resistance (ohms) | reactance (ohms) | inductance (mH) | capacitance (uF) | passive circuit |
|------|------|----------------------|---------------------|--------------------|---------------------|--------------------|
| 1 | 1 | 0 | -10,545. | 0 | 0 | 0 |
| 2 | 14 | 0 | -10,545. | 0 | 0 | 0 |
| 3 | 40 | 0 | -5,560. | 0 | 0 | 0 |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|-------------------------------|------------------|-----------------|-----------------|----------------|--------|-----------|-----------|
| source = 1; node 27, sector 1 | | | | | | | |
| 1.35 | 67.584 | 106.06 | 125.76 | 57.5 | 5.2288 | -3.3637 | -2.6835 |

CURRENT rms

Frequency = 1.35 MHz

Input power = .00213664 watts

Efficiency = 100. %

coordinates in degrees

current

| no. | X | Y | Z | mag (amps) | phase (deg) | real (amps) | imaginary (amps) |
|-----|---|---|---|---------------|----------------|----------------|---------------------|
|-----|---|---|---|---------------|----------------|----------------|---------------------|

TABLE 3.6 (cont'd)

| | | | | | | | |
|-----|----------|----------|---------|----------|-------|-----------|-----------|
| GND | 0 | 0 | 0 | 1.87E-05 | 80.7 | 3.03E-06 | 1.84E-05 |
| 2 | 0 | 0 | 8.11539 | 1.81E-04 | 80.6 | 2.96E-05 | 1.79E-04 |
| 3 | 0 | 0 | 16.2308 | 2.81E-04 | 80.5 | 4.63E-05 | 2.77E-04 |
| 4 | 0 | 0 | 24.3462 | 3.54E-04 | 80.4 | 5.91E-05 | 3.49E-04 |
| 5 | 0 | 0 | 32.4615 | 4.05E-04 | 80.2 | 6.85E-05 | 3.99E-04 |
| 6 | 0 | 0 | 40.5769 | 4.35E-04 | 80.1 | 7.48E-05 | 4.29E-04 |
| 7 | 0 | 0 | 48.6923 | 4.46E-04 | 79.9 | 7.79E-05 | 4.39E-04 |
| 8 | 0 | 0 | 56.8077 | 4.38E-04 | 79.8 | 7.76E-05 | 4.31E-04 |
| 9 | 0 | 0 | 64.9231 | 4.11E-04 | 79.6 | 7.41E-05 | 4.04E-04 |
| 10 | 0 | 0 | 73.0385 | 3.66E-04 | 79.4 | 6.71E-05 | 3.6E-04 |
| 11 | 0 | 0 | 81.1539 | 3.05E-04 | 79.3 | 5.68E-05 | 2.99E-04 |
| 12 | 0 | 0 | 89.2692 | 2.26E-04 | 79.1 | 4.28E-05 | 2.22E-04 |
| 13 | 0 | 0 | 97.3846 | 1.29E-04 | 78.9 | 2.5E-05 | 1.27E-04 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 2.5E-05 | 168.6 | -2.45E-05 | 4.95E-06 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 2.63E-04 | 168.6 | -2.58E-04 | 5.2E-05 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 4.04E-04 | 168.6 | -3.96E-04 | 7.95E-05 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 5.06E-04 | 168.7 | -4.96E-04 | 9.92E-05 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 5.77E-04 | 168.8 | -5.66E-04 | 1.12E-04 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 6.18E-04 | 168.8 | -6.06E-04 | 1.2E-04 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 6.31E-04 | 168.9 | -6.2E-04 | 1.21E-04 |
| 21 | -89.6575 | -7.84403 | 57.4539 | 6.17E-04 | 169. | -6.06E-04 | 1.18E-04 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 5.78E-04 | 169.1 | -5.67E-04 | 1.09E-04 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 5.13E-04 | 169.2 | -5.04E-04 | 9.6E-05 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 4.25E-04 | 169.3 | -4.18E-04 | 7.87E-05 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 3.15E-04 | 169.5 | -3.09E-04 | 5.76E-05 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 1.81E-04 | 169.6 | -1.78E-04 | 3.27E-05 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 5.62E-03 | 302.5 | 3.02E-03 | -4.74E-03 |
| 28 | -179.315 | -15.6881 | 8.10769 | 6.07E-03 | 299.6 | 3.E-03 | -5.28E-03 |
| 29 | -179.315 | -15.6881 | 16.2154 | 6.25E-03 | 298. | 2.94E-03 | -5.52E-03 |
| 30 | -179.315 | -15.6881 | 24.3231 | 6.29E-03 | 296.7 | 2.83E-03 | -5.62E-03 |
| 31 | -179.315 | -15.6881 | 32.4308 | 6.18E-03 | 295.7 | 2.68E-03 | -5.57E-03 |
| 32 | -179.315 | -15.6881 | 40.5385 | 5.94E-03 | 294.9 | 2.5E-03 | -5.39E-03 |
| 33 | -179.315 | -15.6881 | 48.6462 | 5.57E-03 | 294.1 | 2.28E-03 | -5.09E-03 |
| 34 | -179.315 | -15.6881 | 56.7539 | 5.09E-03 | 293.5 | 2.03E-03 | -4.67E-03 |
| 35 | -179.315 | -15.6881 | 64.8615 | 4.5E-03 | 292.9 | 1.75E-03 | -4.14E-03 |
| 36 | -179.315 | -15.6881 | 72.9692 | 3.8E-03 | 292.3 | 1.44E-03 | -3.52E-03 |
| 37 | -179.315 | -15.6881 | 81.0769 | 3.02E-03 | 291.8 | 1.12E-03 | -2.8E-03 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.14E-03 | 291.3 | 7.8E-04 | -2.E-03 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.18E-03 | 290.9 | 4.2E-04 | -1.1E-03 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 5.88E-05 | 162. | -5.59E-05 | 1.82E-05 |
| 41 | -268.973 | -23.5321 | 7.97857 | 3.39E-04 | 162. | -3.22E-04 | 1.05E-04 |
| 42 | -268.973 | -23.5321 | 15.9571 | 5.08E-04 | 162. | -4.83E-04 | 1.57E-04 |
| 43 | -268.973 | -23.5321 | 23.9357 | 6.34E-04 | 162. | -6.03E-04 | 1.96E-04 |
| 44 | -268.973 | -23.5321 | 31.9143 | 7.25E-04 | 162. | -6.9E-04 | 2.24E-04 |
| 45 | -268.973 | -23.5321 | 39.8929 | 7.83E-04 | 162.1 | -7.45E-04 | 2.41E-04 |
| 46 | -268.973 | -23.5321 | 47.8714 | 8.1E-04 | 162.1 | -7.71E-04 | 2.49E-04 |
| 47 | -268.973 | -23.5321 | 55.85 | 8.06E-04 | 162.2 | -7.68E-04 | 2.47E-04 |
| 48 | -268.973 | -23.5321 | 63.8286 | 7.74E-04 | 162.2 | -7.37E-04 | 2.36E-04 |
| 49 | -268.973 | -23.5321 | 71.8071 | 7.13E-04 | 162.3 | -6.79E-04 | 2.17E-04 |
| 50 | -268.973 | -23.5321 | 79.7857 | 6.25E-04 | 162.3 | -5.96E-04 | 1.9E-04 |
| 51 | -268.973 | -23.5321 | 87.7643 | 5.13E-04 | 162.4 | -4.89E-04 | 1.55E-04 |
| 52 | -268.973 | -23.5321 | 95.7429 | 3.76E-04 | 162.4 | -3.59E-04 | 1.13E-04 |
| 53 | -268.973 | -23.5321 | 103.721 | 2.14E-04 | 162.5 | -2.04E-04 | 6.43E-05 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.7

WIOU
TOWER 3 BASE CIRCUIT ANALYSIS
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 67.58, 106.06 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 68.81 | 106.62 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1.241 | 6.92 |
| 2 | 1.000 | 0.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-----------|------------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 0.427E-02 | -0.661E-02 | 0.787E-02 | 302.88 |
| OUTPUT CURRENT I2 (AMPS): | 0.427E-02 | -0.671E-02 | 0.795E-02 | 302.51 |

MODELED ATU OUTPUT

| | | | | |
|-------------------------|-------|--------|--------|-------|
| IMPEDANCE V1/I1 (OHMS): | 69.01 | 141.78 | 157.69 | 64.04 |
|-------------------------|-------|--------|--------|-------|

TABLE 3.8

WIOU
TOWER 4 MoM SUMMARY
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
current nodes = 53

| | minimum | | maximum | |
|------------------|---------|---------|---------|---------|
| Individual wires | wire | value | wire | value |
| segment length | 4 | 7.97857 | 2 | 8.20769 |
| radius | 3 | .23 | 2 | .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| frequency | | | no. of steps | segment length (wavelengths) | |
|-----------|--------|------|-----------------|------------------------------|----------|
| no. | lowest | step | | minimum | maximum |
| 1 | 1.35 | 0 | 1 | .0221627 | .0227992 |

Sources

| source node | sector | magnitude | phase | type |
|-------------|--------|-----------|-------|---------|
| 1 40 | 1 | 1. | 0 | voltage |

Lumped loads

| load | node | resistance (ohms) | reactance (ohms) | inductance (mH) | capacitance (uF) | passive circuit |
|------|------|----------------------|---------------------|--------------------|---------------------|--------------------|
| 1 | 1 | 0 | -10,545. | 0 | 0 | 0 |
| 2 | 14 | 0 | -10,545. | 0 | 0 | 0 |
| 3 | 27 | 0 | -10,523. | 0 | 0 | 0 |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|-------------------------------|------------------|-----------------|-----------------|----------------|--------|-----------|-----------|
| source = 1; node 40, sector 1 | | | | | | | |
| 1.35 | 96.79 | 141.61 | 171.53 | 55.6 | 6.4407 | -2.7192 | -3.3224 |

CURRENT rms

Frequency = 1.35 MHz

Input power = .0016449 watts

Efficiency = 100. %

coordinates in degrees

current

| no. | X | Y | Z | mag (amps) | phase (deg) | real (amps) | imaginary (amps) |
|-----|---|---|---|---------------|----------------|----------------|---------------------|
|-----|---|---|---|---------------|----------------|----------------|---------------------|

| | | | | | | | |
|-----|----------|----------|---------|----------|-------|-----------|-----------|
| GND | 0 | 0 | 0 | 1.36E-05 | 347.2 | 1.33E-05 | -3.02E-06 |
| 2 | 0 | 0 | 8.11539 | 1.32E-04 | 347.1 | 1.29E-04 | -2.95E-05 |
| 3 | 0 | 0 | 16.2308 | 2.05E-04 | 347. | 1.99E-04 | -4.61E-05 |
| 4 | 0 | 0 | 24.3462 | 2.58E-04 | 346.9 | 2.52E-04 | -5.86E-05 |
| 5 | 0 | 0 | 32.4615 | 2.96E-04 | 346.8 | 2.88E-04 | -6.78E-05 |
| 6 | 0 | 0 | 40.5769 | 3.19E-04 | 346.6 | 3.1E-04 | -7.38E-05 |
| 7 | 0 | 0 | 48.6923 | 3.28E-04 | 346.5 | 3.18E-04 | -7.66E-05 |
| 8 | 0 | 0 | 56.8077 | 3.22E-04 | 346.3 | 3.13E-04 | -7.62E-05 |
| 9 | 0 | 0 | 64.9231 | 3.03E-04 | 346.2 | 2.94E-04 | -7.25E-05 |
| 10 | 0 | 0 | 73.0385 | 2.71E-04 | 346. | 2.63E-04 | -6.56E-05 |
| 11 | 0 | 0 | 81.1539 | 2.26E-04 | 345.8 | 2.19E-04 | -5.53E-05 |
| 12 | 0 | 0 | 89.2692 | 1.68E-04 | 345.6 | 1.62E-04 | -4.17E-05 |
| 13 | 0 | 0 | 97.3846 | 9.63E-05 | 345.4 | 9.32E-05 | -2.43E-05 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 1.64E-05 | 78.1 | 3.37E-06 | 1.6E-05 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 1.73E-04 | 78. | 3.58E-05 | 1.69E-04 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 2.65E-04 | 78. | 5.54E-05 | 2.59E-04 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 3.33E-04 | 77.8 | 7.02E-05 | 3.26E-04 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 3.81E-04 | 77.7 | 8.1E-05 | 3.72E-04 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 4.09E-04 | 77.6 | 8.8E-05 | 4.E-04 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 4.19E-04 | 77.4 | 9.12E-05 | 4.09E-04 |
| 21 | -89.6575 | -7.84403 | 57.4539 | 4.11E-04 | 77.3 | 9.07E-05 | 4.01E-04 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 3.86E-04 | 77.1 | 8.63E-05 | 3.76E-04 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 3.44E-04 | 76.9 | 7.8E-05 | 3.35E-04 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 2.86E-04 | 76.7 | 6.59E-05 | 2.79E-04 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 2.13E-04 | 76.5 | 4.97E-05 | 2.07E-04 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 1.23E-04 | 76.3 | 2.91E-05 | 1.19E-04 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 2.24E-05 | 164.5 | -2.16E-05 | 6.E-06 |
| 28 | -179.315 | -15.6881 | 8.10769 | 2.11E-04 | 164.5 | -2.04E-04 | 5.66E-05 |
| 29 | -179.315 | -15.6881 | 16.2154 | 3.27E-04 | 164.5 | -3.15E-04 | 8.77E-05 |
| 30 | -179.315 | -15.6881 | 24.3231 | 4.12E-04 | 164.4 | -3.97E-04 | 1.11E-04 |
| 31 | -179.315 | -15.6881 | 32.4308 | 4.72E-04 | 164.4 | -4.54E-04 | 1.27E-04 |
| 32 | -179.315 | -15.6881 | 40.5385 | 5.07E-04 | 164.4 | -4.88E-04 | 1.36E-04 |
| 33 | -179.315 | -15.6881 | 48.6462 | 5.18E-04 | 164.4 | -4.99E-04 | 1.39E-04 |
| 34 | -179.315 | -15.6881 | 56.7539 | 5.08E-04 | 164.4 | -4.89E-04 | 1.36E-04 |
| 35 | -179.315 | -15.6881 | 64.8615 | 4.76E-04 | 164.4 | -4.58E-04 | 1.28E-04 |
| 36 | -179.315 | -15.6881 | 72.9692 | 4.23E-04 | 164.4 | -4.07E-04 | 1.13E-04 |
| 37 | -179.315 | -15.6881 | 81.0769 | 3.5E-04 | 164.5 | -3.37E-04 | 9.39E-05 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.59E-04 | 164.5 | -2.49E-04 | 6.92E-05 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.47E-04 | 164.5 | -1.42E-04 | 3.94E-05 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 4.12E-03 | 304.4 | 2.33E-03 | -3.4E-03 |
| 41 | -268.973 | -23.5321 | 7.97857 | 4.61E-03 | 300.1 | 2.31E-03 | -3.99E-03 |
| 42 | -268.973 | -23.5321 | 15.9571 | 4.86E-03 | 297.8 | 2.27E-03 | -4.29E-03 |
| 43 | -268.973 | -23.5321 | 23.9357 | 4.98E-03 | 296.2 | 2.19E-03 | -4.47E-03 |
| 44 | -268.973 | -23.5321 | 31.9143 | 4.99E-03 | 294.8 | 2.09E-03 | -4.53E-03 |
| 45 | -268.973 | -23.5321 | 39.8929 | 4.89E-03 | 293.7 | 1.97E-03 | -4.48E-03 |
| 46 | -268.973 | -23.5321 | 47.8714 | 4.69E-03 | 292.8 | 1.82E-03 | -4.33E-03 |
| 47 | -268.973 | -23.5321 | 55.85 | 4.4E-03 | 291.9 | 1.64E-03 | -4.08E-03 |
| 48 | -268.973 | -23.5321 | 63.8286 | 4.02E-03 | 291.2 | 1.45E-03 | -3.75E-03 |
| 49 | -268.973 | -23.5321 | 71.8071 | 3.55E-03 | 290.5 | 1.24E-03 | -3.32E-03 |
| 50 | -268.973 | -23.5321 | 79.7857 | 3.E-03 | 289.9 | 1.02E-03 | -2.82E-03 |
| 51 | -268.973 | -23.5321 | 87.7643 | 2.38E-03 | 289.4 | 7.91E-04 | -2.25E-03 |
| 52 | -268.973 | -23.5321 | 95.7429 | 1.7E-03 | 288.8 | 5.48E-04 | -1.61E-03 |
| 53 | -268.973 | -23.5321 | 103.721 | 9.41E-04 | 288.3 | 2.96E-04 | -8.93E-04 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.9

WIOU
TOWER 4 BASE CIRCUIT ANALYSIS
DRIVEN INDIVIDUALLY
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -5895.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 96.79, 141.61 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 101.58 | 143.39 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1.168 | 5.66 |
| 2 | 1.000 | 0.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-----------|------------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 0.329E-02 | -0.463E-02 | 0.568E-02 | 305.38 |
| OUTPUT CURRENT I2 (AMPS): | 0.329E-02 | -0.481E-02 | 0.583E-02 | 304.35 |
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | 101.96 | 178.61 | 205.66 | 60.28 |

TABLE 3.10

WIOU DAYTIME
DIRECTIONAL ARRAY MoM SUMMARY
 Hoosier AM/FM, LLC
 Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
 current nodes = 53

| | minimum | | maximum | |
|------------------|---------|---------|---------|---------|
| Individual wires | wire | value | wire | value |
| segment length | 4 | 7.97857 | 2 | 8.20769 |
| radius | 3 | .23 | 2 | .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| no. | frequency | step | no. of steps | segment length (wavelengths) | |
|--------|-----------|------|--------------|------------------------------|----------|
| lowest | | | | minimum | maximum |
| 1 | 1.35 | 0 | 1 | .0221627 | .0227992 |

Sources

| source | node | sector | magnitude | phase | type |
|--------|------|--------|-----------|-------|---------|
| 1 | 1 | 1 | 3.90978 | 89.6 | voltage |
| 2 | 14 | 1 | 5.52168 | 213.1 | voltage |
| 3 | 27 | 1 | 3.04925 | 348.6 | voltage |
| 4 | 40 | 1 | .783917 | 123.9 | voltage |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|-------------------------------|---------------|--------------|--------------|-------------|--------|----------|---------|
| source = 1; node 1, sector 1 | | | | | | | |
| 1.35 | 3.0053 | 263.99 | 264.01 | 89.3 | 480.5 | -3.6E-02 | -20.814 |
| source = 2; node 14, sector 1 | | | | | | | |
| 1.35 | 47.794 | 158.15 | 165.22 | 73.2 | 12.388 | -1.4054 | -5.5837 |
| source = 3; node 27, sector 1 | | | | | | | |
| 1.35 | 26.771 | 105.7 | 109.03 | 75.8 | 10.655 | -1.6351 | -5.0342 |
| source = 4; node 40, sector 1 | | | | | | | |
| 1.35 | 25.26 | 99.422 | 102.58 | 75.7 | 10.213 | -1.7064 | -4.8823 |

TABLE 3.10 (cont'd)

CURRENT rms

Frequency = 1.35 MHz

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 | 3.78714 | .3 | 3.7871 | .0170011 |
| 2 | 0 | 0 | 8.11539 | 4.5875 | .1 | 4.58748 | .0110829 |
| 3 | 0 | 0 | 16.2308 | 5.01146 | .1 | 5.01146 | 6.99E-03 |
| 4 | 0 | 0 | 24.3462 | 5.2512 | 0.0 | 5.2512 | 3.47E-03 |
| 5 | 0 | 0 | 32.4615 | 5.32999 | 0.0 | 5.32999 | 4.81E-04 |
| 6 | 0 | 0 | 40.5769 | 5.25852 | 360. | 5.25852 | -1.93E-03 |
| 7 | 0 | 0 | 48.6923 | 5.04422 | 360. | 5.04422 | -3.7E-03 |
| 8 | 0 | 0 | 56.8077 | 4.69433 | 359.9 | 4.69433 | -4.8E-03 |
| 9 | 0 | 0 | 64.9231 | 4.21665 | 359.9 | 4.21665 | -5.24E-03 |
| 10 | 0 | 0 | 73.0385 | 3.61952 | 359.9 | 3.61952 | -5.08E-03 |
| 11 | 0 | 0 | 81.1539 | 2.91092 | 359.9 | 2.91092 | -4.42E-03 |
| 12 | 0 | 0 | 89.2692 | 2.09595 | 359.9 | 2.09594 | -3.35E-03 |
| 13 | 0 | 0 | 97.3846 | 1.1692 | 359.9 | 1.1692 | -1.95E-03 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 8.54671 | 139.9 | -6.53788 | 5.50476 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 9.7169 | 137.7 | -7.1892 | 6.53709 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 10.2698 | 136.6 | -7.46291 | 7.05502 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 10.5123 | 135.8 | -7.53633 | 7.3289 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 10.4797 | 135.2 | -7.43112 | 7.38936 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 10.1899 | 134.6 | -7.15933 | 7.25106 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 9.65683 | 134.2 | -6.73086 | 6.9246 |
| 21 | -89.6575 | -7.84403 | 57.4539 | 8.89458 | 133.8 | -6.1559 | 6.42017 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 7.91853 | 133.4 | -5.44553 | 5.74885 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 6.74487 | 133.1 | -4.61137 | 4.92226 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 5.38909 | 132.8 | -3.66443 | 3.95148 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 3.86088 | 132.6 | -2.61179 | 2.84341 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 2.15104 | 132.3 | -1.44786 | 1.59082 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 7.15177 | 272.9 | .356814 | -7.14286 |
| 28 | -179.315 | -15.6881 | 8.10769 | 7.70823 | 271.7 | .230835 | -7.70478 |
| 29 | -179.315 | -15.6881 | 16.2154 | 7.93069 | 271.1 | .146528 | -7.92933 |
| 30 | -179.315 | -15.6881 | 24.3231 | 7.95645 | 270.6 | .0765332 | -7.95608 |
| 31 | -179.315 | -15.6881 | 32.4308 | 7.80479 | 270.1 | .0180087 | -7.80477 |
| 32 | -179.315 | -15.6881 | 40.5385 | 7.48675 | 269.8 | -.0297756 | -7.48669 |
| 33 | -179.315 | -15.6881 | 48.6462 | 7.01204 | 269.5 | -.0668651 | -7.01172 |
| 34 | -179.315 | -15.6881 | 56.7539 | 6.39095 | 269.2 | -.0930792 | -6.39027 |
| 35 | -179.315 | -15.6881 | 64.8615 | 5.63484 | 268.9 | -.108179 | -5.6338 |
| 36 | -179.315 | -15.6881 | 72.9692 | 4.75566 | 268.7 | -.111932 | -4.75435 |
| 37 | -179.315 | -15.6881 | 81.0769 | 3.76486 | 268.4 | -.104117 | -3.76342 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.67016 | 268.2 | -.0844192 | -2.66882 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.46625 | 268. | -.052055 | -1.46533 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 1.95426 | 48.2 | 1.30292 | 1.45655 |
| 41 | -268.973 | -23.5321 | 7.97857 | 2.10882 | 47. | 1.43747 | 1.54299 |
| 42 | -268.973 | -23.5321 | 15.9571 | 2.17319 | 46.4 | 1.49975 | 1.57274 |
| 43 | -268.973 | -23.5321 | 23.9357 | 2.18828 | 45.8 | 1.52478 | 1.5696 |
| 44 | -268.973 | -23.5321 | 31.9143 | 2.15931 | 45.4 | 1.51682 | 1.53683 |
| 45 | -268.973 | -23.5321 | 39.8929 | 2.08918 | 45. | 1.47807 | 1.47647 |
| 46 | -268.973 | -23.5321 | 47.8714 | 1.98036 | 44.6 | 1.41022 | 1.39035 |
| 47 | -268.973 | -23.5321 | 55.85 | 1.83543 | 44.2 | 1.31497 | 1.28048 |
| 48 | -268.973 | -23.5321 | 63.8286 | 1.65725 | 43.9 | 1.1942 | 1.14908 |
| 49 | -268.973 | -23.5321 | 71.8071 | 1.44896 | 43.6 | 1.04994 | .998553 |

TABLE 3.10 (cont'd)

| | | | | | | | |
|-----|----------|----------|---------|---------|------|---------|---------|
| 50 | -268.973 | -23.5321 | 79.7857 | 1.21378 | 43.2 | .884321 | .831408 |
| 51 | -268.973 | -23.5321 | 87.7643 | .954729 | 42.9 | .699316 | .649973 |
| 52 | -268.973 | -23.5321 | 95.7429 | .673762 | 42.6 | .496136 | .455856 |
| 53 | -268.973 | -23.5321 | 103.721 | .369519 | 42.2 | .273554 | .24842 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.11

WIOU DAYTIME
DIRECTIONAL ARRAY SYNTHESIS
 Hoosier AM/FM, LLC
 Kokomo, IN

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.35 MHz

| tower | field ratio | |
|-------|-------------|-------------|
| | magnitude | phase (deg) |
| 1 | 1. | 0 |
| 2 | 1.98 | 135. |
| 3 | 1.45 | -90. |
| 4 | .42 | 45. |

VOLTAGES AND CURRENTS - rms

| node | source voltage | | current | |
|------|----------------|-------------|-----------|-------------|
| | magnitude | phase (deg) | magnitude | phase (deg) |
| 1 | 999.846 | 89.6 | 3.78713 | .3 |
| 14 | 1,412.06 | 213.1 | 8.54673 | 139.9 |
| 27 | 779.782 | 348.6 | 7.15177 | 272.9 |
| 40 | 200.471 | 123.9 | 1.95427 | 48.2 |

Sum of square of source currents = 284.712

Total power = 5,000. watts

TOWER ADMITTANCE MATRIX

| admittance | real (mhos) | imaginary (mhos) |
|------------|-------------|------------------|
| Y(1, 1) | .00433426 | -.00539481 |
| Y(1, 2) | .0026846 | .00129728 |
| Y(1, 3) | .000757329 | -.00071764 |
| Y(1, 4) | -.000238164 | -.000263738 |
| Y(2, 1) | .00268461 | .00129726 |
| Y(2, 2) | .00388133 | -.00414474 |
| Y(2, 3) | .00294468 | .0015344 |
| Y(2, 4) | .000628264 | -.00066792 |
| Y(3, 1) | .000757325 | -.000717642 |
| Y(3, 2) | .00294468 | .00153442 |
| Y(3, 3) | .00401187 | -.00455362 |
| Y(3, 4) | .00239585 | .000992654 |
| Y(4, 1) | -.000238164 | -.000263736 |
| Y(4, 2) | .000628263 | -.000667909 |
| Y(4, 3) | .00239585 | .000992716 |
| Y(4, 4) | .00325958 | -.00408649 |

TOWER IMPEDANCE MATRIX

| impedance | real (ohms) | imaginary (ohms) |
|-----------|-------------|------------------|
| Z(1, 1) | 72.4091 | 105.088 |
| Z(1, 2) | 34.1798 | -39.6423 |
| Z(1, 3) | -23.062 | -25.9491 |
| Z(1, 4) | -23.5938 | 24.699 |
| Z(2, 1) | 34.18 | -39.642 |
| Z(2, 2) | 76.3311 | 108.484 |
| Z(2, 3) | 33.5837 | -32.5316 |
| Z(2, 4) | -29.6352 | -28.8698 |
| Z(3, 1) | -23.0619 | -25.949 |
| Z(3, 2) | 33.5832 | -32.5316 |

TABLE 3.11 (cont'd)

| | | |
|---------|----------|----------|
| Z(3, 3) | 68.2608 | 105.948 |
| Z(3, 4) | 36.793 | -43.146 |
| Z(4, 1) | -23.5934 | 24.699 |
| Z(4, 2) | -29.6354 | -28.8691 |
| Z(4, 3) | 36.7914 | -43.1464 |
| Z(4, 4) | 97.0426 | 141.557 |

TABLE 3.12

WIOU DAYTIME
TOWER 1 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 3.01, 263.99 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | 3.37 | 270.04 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1129.417 | 89.68 |
| 2 | 999.846 | 89.60 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-------|-----------|-----------|-------|
| INPUT CURRENT I1 (AMPS): | 3.691 | 0.020 | 3.691 | 0.32 |
| OUTPUT CURRENT I2 (AMPS): | 3.787 | 0.020 | 3.787 | 0.30 |
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | 3.40 | 305.97 | 305.99 | 89.36 |

TABLE 3.13

WIOU DAYTIME
TOWER 2 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00,-100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 47.79, 158.15 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | 49.06 | 160.11 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 1696.440 | 216.02 |
| 2 | 1412.060 | 213.10 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|--------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | -6.462 | 5.391 | 8.416 | 140.16 |
| OUTPUT CURRENT I2 (AMPS): | -6.538 | 5.505 | 8.547 | 139.90 |
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | 49.25 | 195.47 | 201.58 | 75.86 |

TABLE 3.14

WIOU DAYTIME
TOWER 3 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 26.77, 105.70 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 27.42 | 106.55 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 1021.893 | 352.07 |
| 2 | 779.782 | 348.60 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 0.376 | -7.067 | 7.077 | 273.05 |
| OUTPUT CURRENT I2 (AMPS): | 0.362 | -7.143 | 7.152 | 272.90 |
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | 27.50 | 141.75 | 144.39 | 79.02 |

TABLE 3.15

WIOU DAYTIME
TOWER 4 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -5895.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 25.26, 99.42 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 26.21 | 100.99 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 266.099 | 127.54 |
| 2 | 200.471 | 123.90 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-------|-----------|-----------|-------|
| INPUT CURRENT I1 (AMPS): | 1.272 | 1.436 | 1.919 | 48.47 |
| OUTPUT CURRENT I2 (AMPS): | 1.303 | 1.457 | 1.954 | 48.20 |
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | 26.29 | 136.17 | 138.69 | 79.07 |

TABLE 3.16

WIOU DAYTIME
ANTENNA MONITOR PARAMETERS
RESULTING FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

| <u>Tower</u> | Current Transformer Sample Element | | Antenna Monitor | |
|--------------|------------------------------------|--------------------|-----------------|--------------------|
| | Magnitude (amps) | Phase (degrees) | Ratio | Phase (degrees) |
| 1 | 3.691 | 0.32 | 0.439 | -139.8 |
| 2 | 8.416 | 140.16 | 1.000 | 0.0 |
| 3 | 7.077 | 273.05 | 0.841 | 132.9 |
| 4 | 1.919 | 48.47 | 0.228 | -91.7 |

TABLE 3.17

WIOU NIGHTTIME
DIRECTIONAL ARRAY MoM SUMMARY
 Hoosier AM/FM, LLC
 Kokomo, IN

GEOMETRY

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

| wire | caps | Distance | Angle | Z | radius | segs |
|------|------|----------|-------|-------|--------|------|
| 1 | none | 0 | 0 | 0 | .25 | 13 |
| | | 0 | 0 | 105.5 | | |
| 2 | none | 90. | 175. | 0 | .31 | 13 |
| | | 90. | 175. | 106.7 | | |
| 3 | none | 180. | 175. | 0 | .23 | 13 |
| | | 180. | 175. | 105.4 | | |
| 4 | none | 270. | 175. | 0 | .28 | 14 |
| | | 270. | 175. | 111.7 | | |

Number of wires = 4
 current nodes = 53

| | minimum | | maximum | |
|------------------|---------|---------|---------|---------|
| Individual wires | wire | value | wire | value |
| segment length | 4 | 7.97857 | 2 | 8.20769 |
| radius | 3 | .23 | 2 | .31 |

ELECTRICAL DESCRIPTION

Frequencies (MHz)

| frequency | | | no. of steps | segment length (wavelengths) | |
|-----------|--------|------|--------------|------------------------------|----------|
| no. | lowest | step | | minimum | maximum |
| 1 | 1.35 | 0 | 1 | .0221627 | .0227991 |

Sources

| source | node | sector | magnitude | phase | type |
|--------|------|--------|-----------|-------|---------|
| 1 | 1 | 1 | 746.912 | 103. | voltage |
| 2 | 14 | 1 | 1,749.93 | 260.3 | voltage |
| 3 | 27 | 1 | 1,253.36 | 59. | voltage |
| 4 | 40 | 1 | 592.045 | 215.8 | voltage |

IMPEDANCE

normalization = 50.

| freq (MHz) | resist (ohms) | react (ohms) | imped (ohms) | phase (deg) | VSWR | S11 dB | S12 dB |
|-------------------------------|---------------|--------------|--------------|-------------|--------|---------|---------|
| source = 1; node 1, sector 1 | | | | | | | |
| 1.35 | -36.209 | 120.28 | 125.61 | 106.8 | **** | **** | **** |
| source = 2; node 14, sector 1 | | | | | | | |
| 1.35 | 20.449 | 174.14 | 175.33 | 83.3 | 32.482 | -.53498 | -9.3592 |
| source = 3; node 27, sector 1 | | | | | | | |
| 1.35 | 5.5295 | 124.42 | 124.54 | 87.5 | 65.128 | -.26675 | -12.249 |
| source = 4; node 40, sector 1 | | | | | | | |
| 1.35 | 30.76 | 121.79 | 125.62 | 75.8 | 11.801 | -1.4756 | -5.405 |

TABLE 3.17 (cont'd)

CURRENT rms

Frequency = 1.35 MHz

Input power = 1,000. watts

Efficiency = 100. %

coordinates in degrees

current

| no. | X | Y | Z | mag (amps) | phase (deg) | real (amps) | imaginary (amps) |
|-----|----------|----------|---------|---------------|----------------|----------------|---------------------|
| GND | 0 | 0 | 0 | 4.20458 | 356.2 | 4.19539 | -.277829 |
| 2 | 0 | 0 | 8.11539 | 4.59468 | 357.8 | 4.59125 | -.177684 |
| 3 | 0 | 0 | 16.2308 | 4.76254 | 358.7 | 4.76123 | -.111675 |
| 4 | 0 | 0 | 24.3462 | 4.80542 | 359.3 | 4.80508 | -.0572754 |
| 5 | 0 | 0 | 32.4615 | 4.73607 | 359.9 | 4.73606 | -.012163 |
| 6 | 0 | 0 | 40.5769 | 4.56148 | .3 | 4.56141 | .024329 |
| 7 | 0 | 0 | 48.6923 | 4.28755 | .7 | 4.28723 | .0523359 |
| 8 | 0 | 0 | 56.8077 | 3.92047 | 1. | 3.91981 | .0718304 |
| 9 | 0 | 0 | 64.9231 | 3.46707 | 1.4 | 3.46609 | .0827517 |
| 10 | 0 | 0 | 73.0385 | 2.93462 | 1.7 | 2.93338 | .0850534 |
| 11 | 0 | 0 | 81.1539 | 2.32998 | 1.9 | 2.32865 | .0786922 |
| 12 | 0 | 0 | 89.2692 | 1.65774 | 2.2 | 1.65652 | .0635453 |
| 13 | 0 | 0 | 97.3846 | .914296 | 2.5 | .91346 | .0391074 |
| END | 0 | 0 | 105.5 | 0 | 0 | 0 | 0 |
| GND | -89.6575 | -7.84403 | 0 | 7.05738 | 177. | -7.04797 | .364327 |
| 15 | -89.6575 | -7.84403 | 8.20769 | 8.12099 | 176.1 | -8.10235 | .549783 |
| 16 | -89.6575 | -7.84403 | 16.4154 | 8.63109 | 175.7 | -8.60631 | .653586 |
| 17 | -89.6575 | -7.84403 | 24.6231 | 8.86868 | 175.3 | -8.83916 | .722957 |
| 18 | -89.6575 | -7.84403 | 32.8308 | 8.86625 | 175.1 | -8.83337 | .76288 |
| 19 | -89.6575 | -7.84403 | 41.0385 | 8.64019 | 174.9 | -8.60532 | .775467 |
| 20 | -89.6575 | -7.84403 | 49.2462 | 8.20273 | 174.7 | -8.16727 | .761947 |
| 21 | -89.6575 | -7.84403 | 57.4538 | 7.56638 | 174.5 | -7.53172 | .723445 |
| 22 | -89.6575 | -7.84403 | 65.6615 | 6.7443 | 174.4 | -6.71182 | .661118 |
| 23 | -89.6575 | -7.84403 | 73.8692 | 5.75068 | 174.2 | -5.72173 | .576246 |
| 24 | -89.6575 | -7.84403 | 82.0769 | 4.59886 | 174.1 | -4.57478 | .470039 |
| 25 | -89.6575 | -7.84403 | 90.2846 | 3.29735 | 174. | -3.27944 | .343204 |
| 26 | -89.6575 | -7.84403 | 98.4923 | 1.83839 | 173.9 | -1.82806 | .19468 |
| END | -89.6575 | -7.84403 | 106.7 | 0 | 0 | 0 | 0 |
| GND | -179.315 | -15.6881 | 0 | 7.11619 | 331.6 | 6.25896 | -3.38609 |
| 28 | -179.315 | -15.6881 | 8.10769 | 7.7754 | 331.4 | 6.82362 | -3.7276 |
| 29 | -179.315 | -15.6881 | 16.2154 | 8.06052 | 331.2 | 7.06488 | -3.88064 |
| 30 | -179.315 | -15.6881 | 24.3231 | 8.13279 | 331.1 | 7.12124 | -3.92813 |
| 31 | -179.315 | -15.6881 | 32.4308 | 8.0143 | 331. | 7.01176 | -3.88127 |
| 32 | -179.315 | -15.6881 | 40.5385 | 7.71721 | 331. | 6.74704 | -3.74604 |
| 33 | -179.315 | -15.6881 | 48.6462 | 7.25175 | 330.9 | 6.33606 | -3.52736 |
| 34 | -179.315 | -15.6881 | 56.7539 | 6.62864 | 330.8 | 5.78823 | -3.23037 |
| 35 | -179.315 | -15.6881 | 64.8615 | 5.85959 | 330.8 | 5.11387 | -2.86063 |
| 36 | -179.315 | -15.6881 | 72.9692 | 4.95703 | 330.7 | 4.3239 | -2.42407 |
| 37 | -179.315 | -15.6881 | 81.0769 | 3.93282 | 330.7 | 3.42876 | -1.92632 |
| 38 | -179.315 | -15.6881 | 89.1846 | 2.79497 | 330.6 | 2.43553 | -1.37115 |
| 39 | -179.315 | -15.6881 | 97.2923 | 1.53781 | 330.6 | 1.33938 | -.75559 |
| END | -179.315 | -15.6881 | 105.4 | 0 | 0 | 0 | 0 |
| GND | -268.973 | -23.5321 | 0 | 3.33268 | 139.9 | -2.55049 | 2.14516 |
| 41 | -268.973 | -23.5321 | 7.97857 | 3.66068 | 138.6 | -2.74403 | 2.423 |
| 42 | -268.973 | -23.5321 | 15.9571 | 3.81021 | 137.8 | -2.82268 | 2.55933 |
| 43 | -268.973 | -23.5321 | 23.9357 | 3.86633 | 137.2 | -2.83816 | 2.62552 |
| 44 | -268.973 | -23.5321 | 31.9143 | 3.83949 | 136.8 | -2.79716 | 2.63013 |
| 45 | -268.973 | -23.5321 | 39.8929 | 3.73519 | 136.4 | -2.70347 | 2.57739 |
| 46 | -268.973 | -23.5321 | 47.8714 | 3.55782 | 136. | -2.56027 | 2.47045 |
| 47 | -268.973 | -23.5321 | 55.85 | 3.31191 | 135.7 | -2.37093 | 2.31244 |
| 48 | -268.973 | -23.5321 | 63.8286 | 3.00244 | 135.4 | -2.13917 | 2.10681 |
| 49 | -268.973 | -23.5321 | 71.8071 | 2.63493 | 135.2 | -1.86901 | 1.85733 |
| 50 | -268.973 | -23.5321 | 79.7857 | 2.21507 | 134.9 | -1.56464 | 1.56794 |

TABLE 3.17 (cont'd)

| | | | | | | | |
|-----|----------|----------|---------|---------|-------|----------|---------|
| 51 | -268.973 | -23.5321 | 87.7643 | 1.74819 | 134.7 | -1.22995 | 1.24233 |
| 52 | -268.973 | -23.5321 | 95.7429 | 1.23771 | 134.5 | -.867476 | .882849 |
| 53 | -268.973 | -23.5321 | 103.721 | .680968 | 134.3 | -.475482 | .487478 |
| END | -268.973 | -23.5321 | 111.7 | 0 | 0 | 0 | 0 |

TABLE 3.18

WIOU NIGHTTIME
DIRECTIONAL ARRAY SYNTHESIS
 Hoosier AM/FM, LLC
 Kokomo, IN

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.35 MHz

| tower | field ratio magnitude | phase (deg) |
|-------|--------------------------|-------------|
| 1 | 1. | 0 |
| 2 | 1.9 | 175. |
| 3 | 1.69 | -29. |
| 4 | .85 | 136.5 |

VOLTAGES AND CURRENTS - rms

| source | voltage node | magnitude | phase (deg) | current magnitude | phase (deg) |
|--------|-----------------|-----------|-------------|----------------------|-------------|
| 1 | 528.147 | 103. | 4.20456 | 356.2 | |
| 14 | 1,237.39 | 260.3 | 7.05734 | 177. | |
| 27 | 886.259 | 59. | 7.11615 | 331.6 | |
| 40 | 418.639 | 215.8 | 3.33266 | 139.9 | |

Sum of square of source currents = 258.461

Total power = 1,000. watts

TOWER ADMITTANCE MATRIX

| admittance | real (mhos) | imaginary (mhos) |
|------------|-------------|------------------|
| Y(1, 1) | .00433426 | -.00539481 |
| Y(1, 2) | .00268461 | .00129729 |
| Y(1, 3) | .000757325 | -.000717637 |
| Y(1, 4) | -.000238164 | -.000263737 |
| Y(2, 1) | .00268461 | .00129727 |
| Y(2, 2) | .00388136 | -.00414475 |
| Y(2, 3) | .00294469 | .00153441 |
| Y(2, 4) | .000628268 | -.000667921 |
| Y(3, 1) | .000757321 | -.000717639 |
| Y(3, 2) | .00294468 | .00153442 |
| Y(3, 3) | .00401187 | -.00455362 |
| Y(3, 4) | .00239585 | .000992656 |
| Y(4, 1) | -.000238163 | -.000263735 |
| Y(4, 2) | .000628267 | -.000667909 |
| Y(4, 3) | .00239585 | .000992717 |
| Y(4, 4) | .00325959 | -.0040865 |

TOWER IMPEDANCE MATRIX

| impedance | real (ohms) | imaginary (ohms) |
|-----------|-------------|------------------|
| Z(1, 1) | 72.4091 | 105.088 |
| Z(1, 2) | 34.1797 | -39.6421 |
| Z(1, 3) | -23.062 | -25.949 |
| Z(1, 4) | -23.5936 | 24.6988 |
| Z(2, 1) | 34.18 | -39.642 |
| Z(2, 2) | 76.331 | 108.484 |
| Z(2, 3) | 33.5834 | -32.5315 |
| Z(2, 4) | -29.635 | -28.8696 |
| Z(3, 1) | -23.062 | -25.949 |
| Z(3, 2) | 33.5831 | -32.5317 |

TABLE 3.18 (cont'd)

| | | |
|---------|----------|----------|
| Z(3, 3) | 68.2608 | 105.948 |
| Z(3, 4) | 36.7928 | -43.1459 |
| Z(4, 1) | -23.5934 | 24.699 |
| Z(4, 2) | -29.6354 | -28.869 |
| Z(4, 3) | 36.7914 | -43.1463 |
| Z(4, 4) | 97.0424 | 141.557 |

TABLE 3.19

WIOU NIGHTTIME
TOWER 1 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS

Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00,-100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): -36.21, 120.28 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | -37.06 | 121.38 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 668.812 | 99.35 |
| 2 | 528.147 | 103.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---------------------------|-------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 4.145 | -0.290 | 4.155 | 356.00 |
| OUTPUT CURRENT I2 (AMPS): | 4.195 | -0.279 | 4.205 | 356.20 |

| | | | | |
|-------------------------|--------|--------|--------|--------|
| MODELED ATU OUTPUT | | | | |
| IMPEDANCE V1/I1 (OHMS): | -37.17 | 156.61 | 160.96 | 103.35 |

TABLE 3.22

WIOU NIGHTTIME
TOWER 4 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -5895.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 30.76, 121.79 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 31.91 | 124.23 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 530.045 | 218.87 |
| 2 | 418.639 | 215.80 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---|--------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | -2.504 | 2.085 | 3.259 | 140.22 |
| OUTPUT CURRENT I2 (AMPS): | -2.549 | 2.147 | 3.333 | 139.90 |
| MODELED ATU OUTPUT IMPEDANCE V1/I1 (OHMS): | 32.01 | 159.48 | 162.66 | 78.65 |

TABLE 3.23

WIOU NIGHTTIME
 ANTENNA MONITOR PARAMETERS
RESULTING FROM ARRAY SYNTHESIS
 Hoosier AM/FM, LLC
 Kokomo, IN

| <u>Tower</u> | Current Transformer Sample Element | | Antenna Monitor | |
|--------------|------------------------------------|--------------------|-----------------|--------------------|
| | Magnitude (amps) | Phase (degrees) | Ratio | Phase (degrees) |
| 1 | 4.155 | 356.00 | 0.599 | 178.9 |
| 2 | 6.938 | 177.11 | 1.000 | 0.0 |
| 3 | 7.030 | 331.63 | 1.013 | 154.5 |
| 4 | 3.259 | 140.22 | 0.470 | -36.9 |

4.0 REFERENCE FIELD STRENGTH MEASUREMENTS

Reference field strength measurements, measured on the pattern minima radial bearings and center of pattern maxima bearing, were made on the WIOU daytime and nighttime directional patterns. Three measurement values, along with GPS coordinates and point descriptions, are listed in Table 4.0 for the daytime directional pattern, and Table 4.1 for the nighttime directional pattern. All field strength measurements were made by Derek Gorman using a Potomac Instruments 4100, S/N 250. This meter was last calibrated by Potomac Instruments on September 23, 2014.

TABLE 4.0

WIOU DAYTIME REFERENCE
FIELD STRENGTH MEASUREMENTS

Hoosier AM/FM, LLC
Kokomo, IN

| Azimuth (Degrees) | Point | Distance (km) | Field Strength (mV/m) | Date | Time (EDT) | GPS | | Description |
|----------------------|-------|------------------|-----------------------------|---------|---------------|----------------------------|--|--|
| | | | | | | Coordinates (NAD 27) | | |
| 115 | 1 | 3.19 | 17.2 | 7/20/17 | 1735 | N40-24-17.6 W86-04-46.1 | | Center of County Road E 500 S 0.75 km E of County Road S 200 E |
| 115 | 2 | 4.08 | 12.0 | 7/20/17 | 1751 | N40-24-05.2 W86-04-11.9 | | East edge of County Road N 300 W 0.4 km S of County Road E 500 S |
| 115 | 3 | 5.86 | 22.9 | 7/20/17 | 1801 | N40-23-41.7 W86-03-02.9 | | East edge of County Road N 200 W at the driveway to 6629 County Road N 200 W |
| 235 | 1 | 3.39 | 12.3 | 7/20/17 | 1820 | N40-23-57.2 W86-08-46.0 | | East edge of County Road N 700 W opposite the driveway to 6692 County Road N 700 W |
| 235 | 2 | 5.32 | 3.85 | 7/20/17 | 1828 | N40-23-21.5 W86-09-53.1 | | North edge of County Road W 600 N 37 m E of the intersection of County Road W 600 N and County Road N 800 W |
| 235 | 3 | 6.70 | 3.22 | 7/20/17 | 1843 | N40-22-55.6 W86-10-40.8 | | North edge of County Road W 550 N at the driveway to 8732 County Road W 550 N |
| 355 | 1 | 3.05 | 315 | 7/20/17 | 1905 | N40-26-39.6 W86-07-00.2 | | Center of Southway Boulevard at the driveway to 3313 Orleans Drive |
| 355 | 2 | 4.46 | 178 | 7/20/17 | 1912 | N40-27-25.4 W86-07-05.2 | | East edge of Home Avenue 0.2 km N of E Lincoln Road at the 2 nd employee entrance to the Chrysler Kokomo Transmission Plant |

TABLE 4.0 (cont'd)

| <u>Azimuth</u> (Degrees) | <u>Point</u> | <u>Distance</u> (km) | <u>Field</u> <u>Strength</u> (mV/m) | <u>Date</u> | <u>Time</u> (EDT) | <u>GPS</u> <u>Coordinates</u> (NAD 27) | <u>Description</u> |
|-----------------------------|--------------|-------------------------|---|-------------|----------------------|--|---|
| 355 | 3 | 5.48 | 164 | 7/20/17 | 1916 | N40-27-57.9 W86-07-08.0 | South edge of E Hoffer Street at the E entrance to 929 E Hoffer Street (United Auto Workers) |

TABLE 4.1

WIOU NIGHTTIME REFERENCE
FIELD STRENGTH MEASUREMENTS

Hoosier AM/FM, LLC
Kokomo, IN

| <u>Azimuth (Degrees)</u> | <u>Point</u> | <u>Distance (km)</u> | <u>Field Strength (mV/m)</u> | <u>Date</u> | <u>Time (EDT)</u> | <u>GPS</u> | | <u>Description</u> |
|------------------------------|--------------|--------------------------|--------------------------------------|-------------|-----------------------|---------------------------------|---------------------------------|--|
| | | | | | | <u>Coordinates (NAD 27)</u> | <u>Coordinates (NAD 27)</u> | |
| 62 | 1 | 3.25 | 2.35 | 7/20/17 | 1500 | N40-25-49.8 W86-04-46.9 | | West edge of County Road S 250 E 1.25 km N of County Road E 400 S (State Highway 26) opposite power pole HW13978 |
| 62 | 2 | 4.97 | 2.00 | 7/20/17 | 1450 | N40-26-16.4 W86-03-42.3 | | Center of the intersection of Quincy Lane and County Road S 344 E |
| 62 | 3 | 6.01 | 1.40 | 7/20/17 | 1439 | N40-26-32.4 W86-03-03.5 | | West edge of County Road S 400 E at the driveway to 2449 County Road S 400 E |
| 81.5 | 1 | 2.90 | 15.3 | 7/20/17 | 1515 | N40-25-14.6 W86-04-46.7 | | East edge of County Road S 250 E in front of 3924 County Road S 250 E |
| 81.5 | 2 | 4.55 | 7.85 | 7/20/17 | 1523 | N40-25-24.0 W86-03-37.9 | | East edge of County Road S 350 E at the driveway to 3738 County Road S 350 E |
| 81.5 | 3 | 5.37 | 1.50 | 7/20/17 | 1531 | N40-25-27.6 W86-03-04.0 | | West edge of County Road S 400 E 0.45 km N of County Road E 400 S (State Highway 26) opposite power pole 10-291 |
| 152.5 | 1 | 3.35 | 20.7 | 7/20/17 | 1544 | N40-23-25.0 W86-05-42.8 | | Center of County Road W 600 N 0.55 km W of County Road N 400 W at Kelly Ditch |
| 152.5 | 2 | 4.64 | 11.9 | 7/20/17 | 1559 | N40-22-48.0 W86-05-18.0 | | Center of parking lot on N side of Sharpville Untied Methodist Church at the intersection of N Church Street and E Meridian Street |

Carl E. Smith Consulting Engineers

TABLE 3.20

WIOU NIGHTTIME
TOWER 2 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS

Hoosier AM/FM, LLC

Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -100000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 20.45, 174.14 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|------------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -100000.00 |
| 2 | | GROUND | 21.07 | 176.71 |
| 1 | | .2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|--------|
| | MAGNITUDE | PHASE |
| 1 | 1479.316 | 261.42 |
| 2 | 1237.390 | 260.30 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---|--------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | -6.930 | 0.349 | 6.938 | 177.11 |
| OUTPUT CURRENT I2 (AMPS): | -7.048 | 0.369 | 7.057 | 177.00 |
| MODELED ATU OUTPUT IMPEDANCE V1/I1 (OHMS): | 21.16 | 212.16 | 213.21 | 84.30 |

TABLE 3.21

WIOU NIGHTTIME
TOWER 3 BASE CIRCUIT ANALYSIS
DRIVEN FROM ARRAY SYNTHESIS
Hoosier AM/FM, LLC
Kokomo, IN

FREQUENCY: 1350 kHz

STATIC DRAIN CHOKE IMPEDANCE (R,X): 0.00, -98000.00 OHMS
TOWER FEED IMPEDANCE (R,X): 0.00, 35.00 OHMS
TOWER BASE REGION IMPEDANCE (R,X): 0.00, -11789.00 OHMS
MoM MODELED TOWER IMPEDANCE (R,X): 5.53, 124.42 OHMS

| NODE | TO | NODE | IMPEDANCE (OHMS) | |
|------|----|--------|------------------|-----------|
| | | | R | X |
| 1 | | GROUND | 0.00 | -98000.00 |
| 2 | | GROUND | 5.77 | 125.74 |
| 1 | | 2 | 0.00 | 35.00 |

| NODE | VOLTAGE (VOLTS) | |
|------|-----------------|-------|
| | MAGNITUDE | PHASE |
| 1 | 1132.493 | 59.57 |
| 2 | 886.259 | 59.00 |

| | REAL | IMAGINARY | MAGNITUDE | PHASE |
|---|-------|-----------|-----------|--------|
| INPUT CURRENT I1 (AMPS): | 6.185 | -3.340 | 7.030 | 331.63 |
| OUTPUT CURRENT I2 (AMPS): | 6.260 | -3.385 | 7.116 | 331.60 |
| MODELED ATU OUTPUT IMPEDANCE V1/I1 (OHMS): | 5.79 | 161.00 | 161.11 | 87.94 |

TABLE 4.1 (cont'd)

| Azimuth (Degrees) | Point | Distance (km) | Field Strength (mV/m) | Date | Time (EDT) | GPS | | Description |
|----------------------|-------|------------------|-----------------------------|---------|---------------|----------------------------|--|---|
| | | | | | | Coordinates (NAD 27) | | |
| 152.5 | 3 | 6.94 | 7.55 | 7/20/17 | 1614 | N40-21-41.4 W86-04-33.1 | | North edge of County Road W 400 N 1.1 km E of County Road N 400 W |
| 197.5 | 1 | 3.18 | 23.0 | 7/20/17 | 1655 | N40-23-23.3 W86-07-31.2 | | Center of the intersection of County Road W 600 N and Commerce Drive |
| 197.5 | 2 | 3.98 | 16.4 | 7/20/17 | 1642 | N40-22-58.4 W86-07-41.3 | | North edge of County Road W 550 N 0.1 km W of State Highway 31 in the parking area of Kelley Agricultural Historical Museum |
| 197.5 | 3 | 5.67 | 12.9 | 7/20/17 | 1632 | N40-22-05.8 W86-08-01.4 | | North edge of County Road W 450 N 0.55 km W of State Highway 31 opposite power pole 9-677 |
| 268.5 | 1 | 2.76 | 20.3 | 7/20/17 | 1151 | N40-24-58.6 W86-08-45.8 | | East edge of County Road S 100 W at the driveway to 4158 County Road S 100 W |
| 268.5 | 2 | 4.08 | 10.3 | 7/20/17 | 1203 | N40-24-57.4 W86-09-42.1 | | Center of Lake Windemere Lane at the driveway to 4164 Lake Windemere Lane |
| 268.5 | 3 | 5.99 | 5.55 | 7/20/17 | 1216 | N40-24-57.7 W86-11-02.9 | | East edge of County Road S 300 W at the driveway to 4130 County Road S 300 W |
| 288 | 1 | 3.21 | 9.45 | 7/20/17 | 1230 | N40-25-32.8 W86-08-58.8 | | Center of Crooked Stick Drive at the driveway to 3162 Crooked Stick Drive |
| 288 | 2 | 4.19 | 6.30 | 7/20/17 | 1241 | N40-25-43.7 W86-09-37.7 | | Center of Timber Valley Drive at the driveway to 3140 Timber Valley Drive |
| 288 | 3 | 5.37 | 6.55 | 7/20/17 | 1251 | N40-25-54.6 W86-10-25.5 | | Center of Emerald Boulevard at the driveway to 3050 Emerald Boulevard |

TABLE 4.1 (cont'd)

| <u>Azimuth (Degrees)</u> | <u>Point</u> | <u>Distance (km)</u> | <u>Field Strength (mV/m)</u> | <u>Date</u> | <u>Time (EDT)</u> | <u>GPS Coordinates (NAD 27)</u> | <u>Description</u> |
|------------------------------|--------------|--------------------------|--------------------------------------|-------------|-----------------------|---|--|
| 355 | 1 | 3.05 | 140 | 7/20/17 | 1337 | N40-26-39.6 W86-07-00.2 | Center of Southway Boulevard at the driveway to 3313 Orleans Drive |
| 355 | 2 | 4.46 | 75.4 | 7/20/17 | 1353 | N40-27-25.4 W86-07-05.2 | East edge of Home Avenue 0.2 km N of E Lincoln Road at the 2 nd employee entrance to the Chrysler Kokomo Transmission Plant |
| 355 | 3 | 5.48 | 70.1 | 7/20/17 | 1407 | N40-27-57.9 W86-07-08.0 | South edge of E Hoffer Street at the E entrance to 929 E Hoffer Street (United Auto Workers) |

5.0 ANTENNA SYSTEM IMPEDANCE MEASUREMENTS

All impedance measurements were conducted on July 19, 2017 by Derek Gorman using the equipment shown in Figure 5.0. This equipment consists of an Agilent Technologies model 8753ES Vector Network Analyzer (VNA), an Electronic Navigation Industries (ENI) model 310L linear amplifier, and a Tunwall Radio directional coupler, as a calibrated measurement system. The system was calibrated with precision standards prior to conducting these measurements.

The WIOU daytime directional common point impedance measurements are tabulated in Table 5.1 and plotted in Figure 5.1. The WIOU nighttime directional common point impedance measurements are tabulated in Table 5.2 and plotted in Figure 5.2. Figure 5.3 is a diagram of the feeder system for the WIOU directional antenna system showing the point at which these impedance measurements were made.

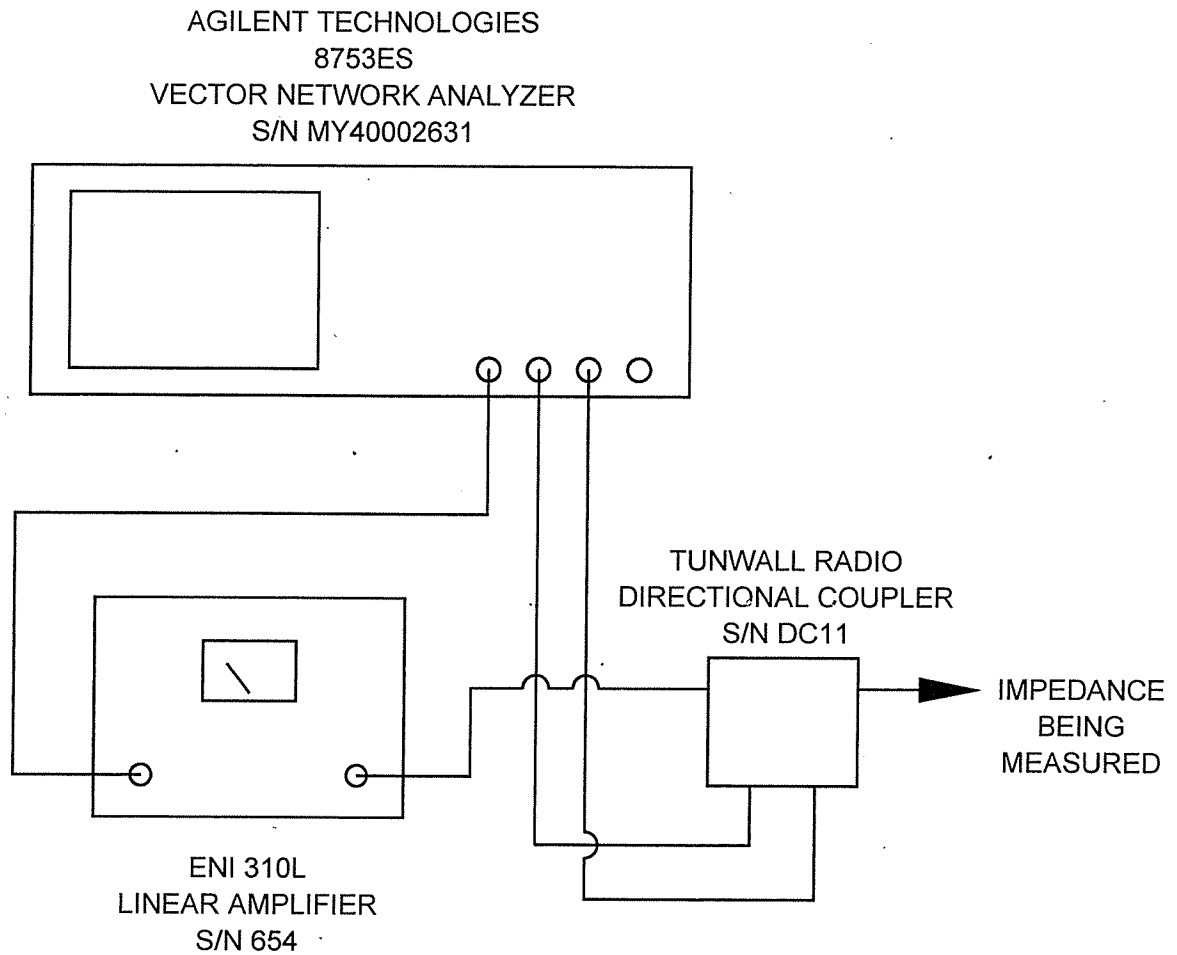


FIG. 5.0

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(330) 659-4440

BLOCK DIAGRAM OF
IMPEDANCE MEASURING EQUIPMENT

HOOSIER AM/FM, LLC
KOKOMO, IN

TABLE 5.1

WIOU DAYTIME DIRECTIONAL COMMON
POINT IMPEDANCE MEASUREMENTS

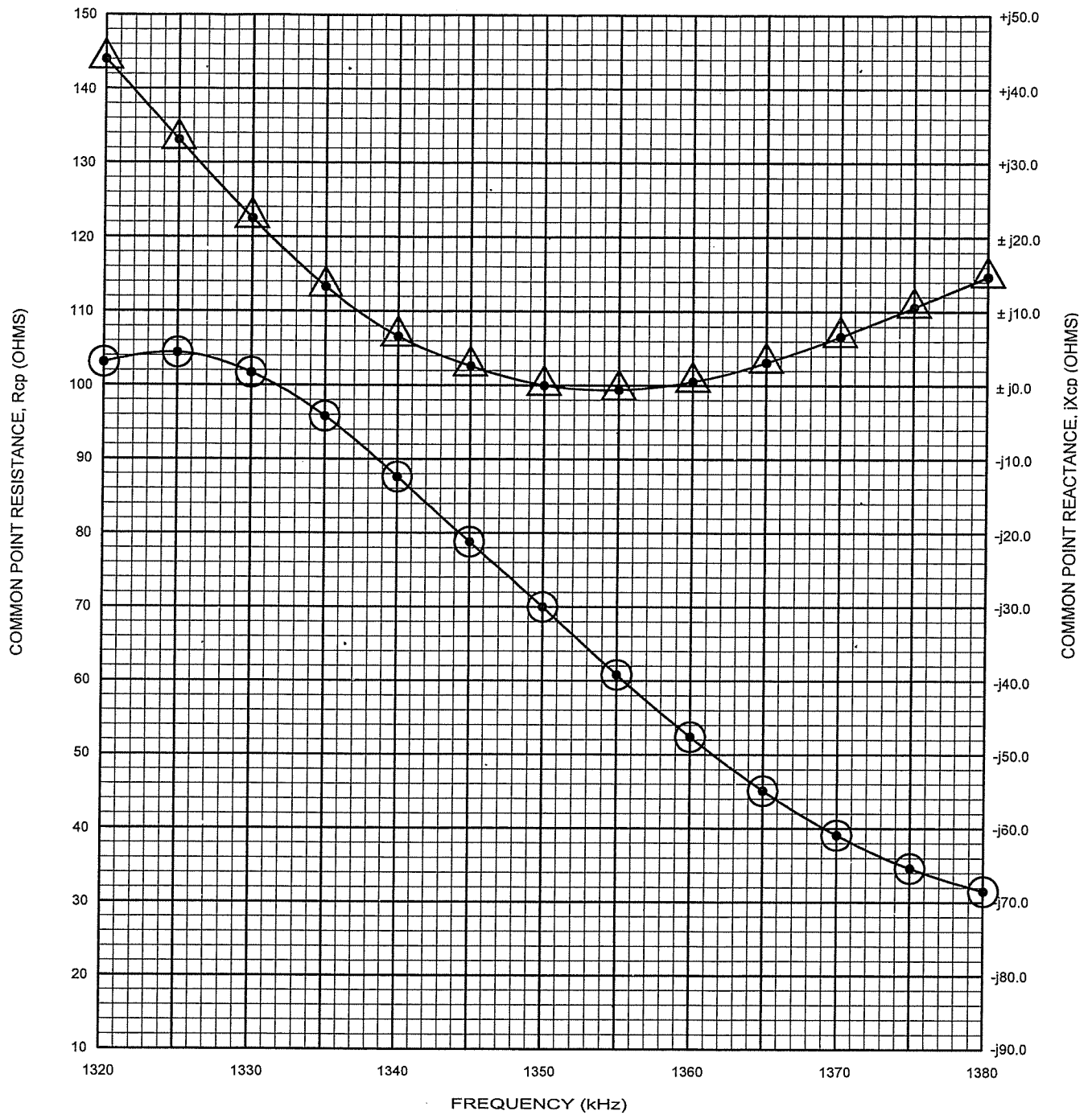
Hoosier AM/FM, LLC
Kokomo, IN

| Frequency (kHz) | Resistance (ohms) | Reactance (ohms) |
|--------------------|----------------------|---------------------|
| 1320 | 103.1 | +j44.2 |
| 1325 | 104.4 | +j33.1 |
| 1330 | 101.7 | +j22.5 |
| 1335 | 95.8 | +j13.3 |
| 1340 | 87.6 | +j6.6 |
| 1345 | 78.8 | +j2.6 |
| *1350 | 70.0 | +j0.0 |
| 1355 | 60.8 | -j0.6 |
| 1360 | 52.4 | +j0.5 |
| 1365 | 45.1 | +j3.1 |
| 1370 | 39.1 | +j6.6 |
| 1375 | 34.6 | +j10.6 |
| 1380 | 31.5 | +j14.7 |

*Operating Frequency

CES-116

WIOUIM1 7/27/2017



○ - Rcp

△ - jXcp

$Z_{cp} = 70.0 + j0.0$ OHMS

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FIG. 5.1

WIOU DAYTIME DIRECTIONAL COMMON
POINT IMPEDANCE MEASUREMENTS

HOOSIER AM/FM, LLC
KOKOMO, IN

TABLE 5.2

WIOU NIGHTTIME DIRECTIONAL COMMON
POINT IMPEDANCE MEASUREMENTS

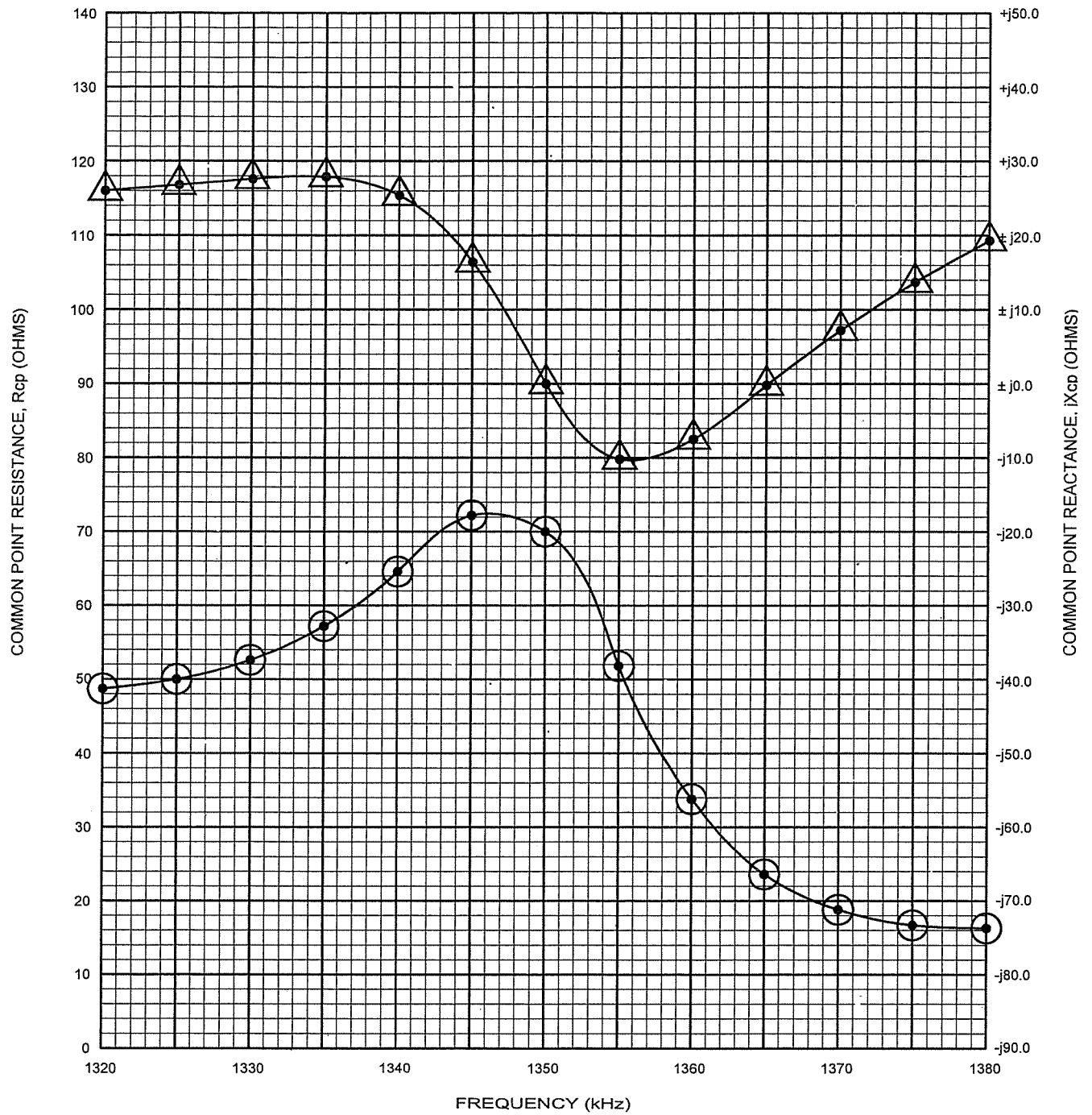
Hoosier AM/FM, LLC
Kokomo, IN

| Frequency (kHz) | Resistance (ohms) | Reactance (ohms) |
|--------------------|----------------------|---------------------|
| 1320 | 48.7 | +j26.1 |
| 1325 | 50.0 | +j26.8 |
| 1330 | 52.6 | +j27.6 |
| 1335 | 57.2 | +j27.9 |
| 1340 | 64.6 | +j25.4 |
| 1345 | 72.2 | +j16.4 |
| *1350 | 70.0 | +j0.0 |
| 1355 | 51.8 | -j10.2 |
| 1360 | 33.8 | -j7.5 |
| 1365 | 23.6 | -j0.2 |
| 1370 | 18.8 | +j7.2 |
| 1375 | 16.7 | +j13.7 |
| 1380 | 16.3 | +j19.3 |

*Operating Frequency

CES-116

WIOUIM2 7/27/2017



○ - R_{cp}

△ - X_{cp}

$Z_{cp} = 70.0 + j0.0$ OHMS

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FIG. 5.2

WIOU NIGHTTIME DIRECTIONAL COMMON
POINT IMPEDANCE MEASUREMENTS

HOOSIER AM/FM, LLC
KOKOMO, IN

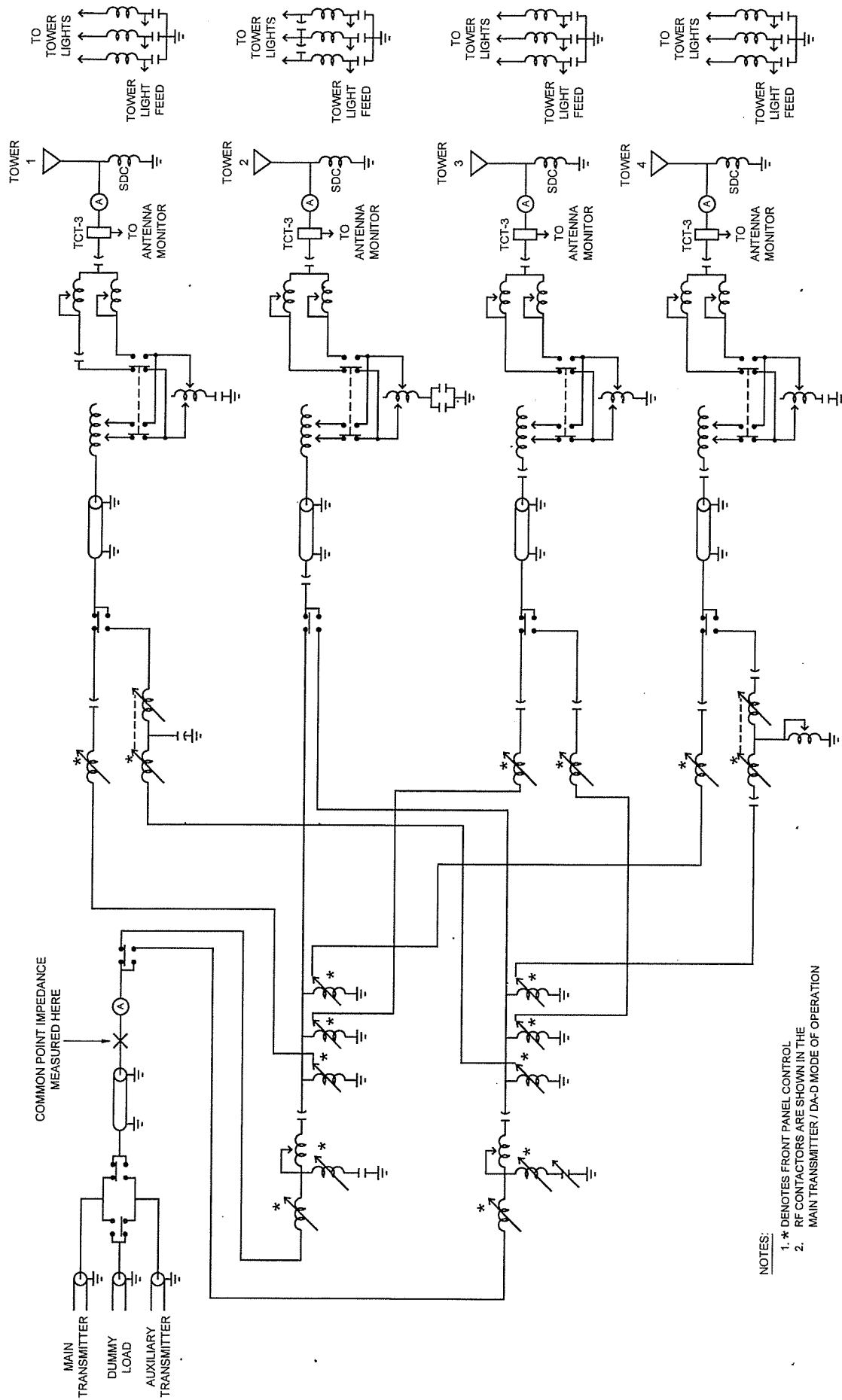


FIG. 5.3

WIU FEEDER SYSTEM
HOOSIER AMFM, LLC
KOKOMO, IN

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