7136 S Yale Ave
Suite 501
Tulsa, OK 74133

o 918.664.4581
f 918.664.3066

www.iHeartMedia.com
www.iHeartRadio.com
#iheartradio

July 20, 2021

VIA EMAIL

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

RE: IHM LICENSES, LLC (FRN No. 0014042816)
Application for New License on FCC Form 302-AM
WIMA (AM), 1150 kHz, Lima, OH; Facility ID No. 37498

Dear Ms. Dortch:

On behalf of IHM LICENSES, LLC, the licensee of the above-referenced station, enclosed is copy of an application for New License submitted on FCC Form 302-AM.

Also enclosed is Form 159, Remittance Advice, with credit card payment of the $1905.00 filing fee.

Please contact the undersigned with any communications concerning this application.

Respectfully submitted,
IHM LICENSES, LLC

By: _____
Troy Langham
VP, Technical Regulatory Affairs

cc: Public Inspection File

Online Payment Information

Total Amount	$1,905.00
Payer FRN	0014042816
Payer Name	iHM Licenses, LLC
Remittance ID	3609575
Treasury Tracking ID	26SOOVD4

Thank you for your payment!

Federal Communications Commission
Washington, D. C. 20554

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

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.)

FOR COMMISSION USE ONLY

FILE NO.

SECTION I - APPLICANT FEE INFORMATION

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

IHM Licenses LLC

MAILING ADDRESS (Line 1) (Maximum 35 characters)
7136 S YALE

MAILING ADDRESS (Line 2) (Maximum 35 characters)
SUITE 501

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
TULSA	OK	74136

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
918-664-4611	WIMA	37498

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

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

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

C. If Yes, provide the following information:

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

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
MMR	0001	$ 645.00	

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

(A)	(B)	(C)	FOR FCC USE ONLY
MOR	0001	$ 1260.00	

ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.

TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
$ 1905.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT IHM Licenses LLC		
MAILING ADDRESS 7136 S YALE SUITE 501		
CITY TULSA	STATE OK	ZIP CODE 74136

2. This application is for:

☑ Commercial ☐ Noncommercial

☑ AM Directional ☐ AM Non-Directional

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
WIMA	Lima, Ohio			

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.

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.

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

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

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

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

CERTIFICATION

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

☑ Yes ☐ No

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

Name	Signature	
Troy G Langham	Troy Langham Digitally signed by Troy Langham DN: cn=Troy Langham, o, ou, email=Troylangham@iheartmedia.com, c=US Date: 2021.07.20 12:05:08 -05'00'	
Title	Date	Telephone Number
VP, Technical Regulatory Affairs	7/20/2021	918-664-4581

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

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
IHM Licenses LLC

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☐ Station License ☑ Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
WIMA		1150	UNLIMITED	1.0	1.0

2. Station location

State	City or Town
OHIO	LIMA

3. Transmitter location

State	County	City or Town	Street address (or other identification)
OH	ALLEN	LIMA	2500 McClain Rd

4. Main studio location

State	County	City or Town	Street address (or other identification)
OH	ALLEN	LIMA	667 W Market St

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

State	County	City or Town	Street address (or other identification)
OH	ALLEN	LIMA	667 W Market St

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.

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
4.64	2.88
Measured antenna or common point resistance (in ohms) at operating frequency Night 50.0 Day 120.2	Measured antenna or common point reactance (in ohms) at operating frequency Night -5 Day +178.6

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
Tower #1 (North)	0	N/A	1	N/A	N/A	N/A
Tower #2	167	0	0.568	1	N/A	2.88
Tower #3	-46	N/A	1.093	N/A	N/A	N/A
Tower #4 (South)	130.1	N/A	1.041	N/A	N/A	N/A

Manufacturer and type of antenna monitor: Potomac AM-19

SECTION III - Page 2

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
4 guyed uniform towers	3x 65.22 1x 77.48	3x 66.7 1x 78.8	2x 68 1x 80.2	Exhibit No.

Excitation ☑ Series ☐ Shunt

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

North Latitude	40	o	40	'	47	"	West Longitude	84	o	06	'	34	"

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

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

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

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

see technical narrative

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

Name (Please Print or Type)	Signature (check appropriate box below)
Nicolas Blomstrand	Nicolas Blomstrand
Address (include ZIP Code) 1780 180th St. Centuria, WI 54824	Date 7-12-2021 Telephone No. (Include Area Code) 715-808-2132

☑ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☐ Other (specify)

APPLICATION FOR LICENSE INFORMATION

RADIO STATION WIMA

IHM LICENSES, LLC

LIMA, OHIO

FID 37498

1150 KHZ 1KW NDD 1KW DAN

July 12, 2021

APPLICATION FOR LICENSE INFORMATION
RADIO STATION WIMA
LIMA, OHIO

1150 KHZ 1KW NDD 1KW DAN

Table of Contents

EXECUTIVE SUMMARY

This engineering exhibit has been prepared in support of an application for licensing for radio station WIMA, Lima Ohio, Facility ID #37498. Measurements included comply with the requirements of Rule Section 73.151c. Station WIMA suffered a failed sample line. The sample lines were replaced to all 4 towers of the array. The system was adjusted to operating parameters computed using the Moment Method process as described in Rule Section 73.151c. MiniNEC Broadcast Professional version 14.6 by EM Scientific Inc. was used in the analysis.

The system has been adjusted to produce directional antenna parameters within+/-5% in ratio and +/-3 degrees in phase of the modeled values as prescribed in the Rules.

All measurements contained in this report were made by Mr. Nicolas Blomstrand of the iHeart Media Corporate Engineering Staff or the undersigned.

Please refer any questions regarding this report to:

Jacob A Wyatt
jakewyatt@iheartmedia.com
308-289-1872

Analysis of Tower Impedance Measurements to Verify Method of Moments Model

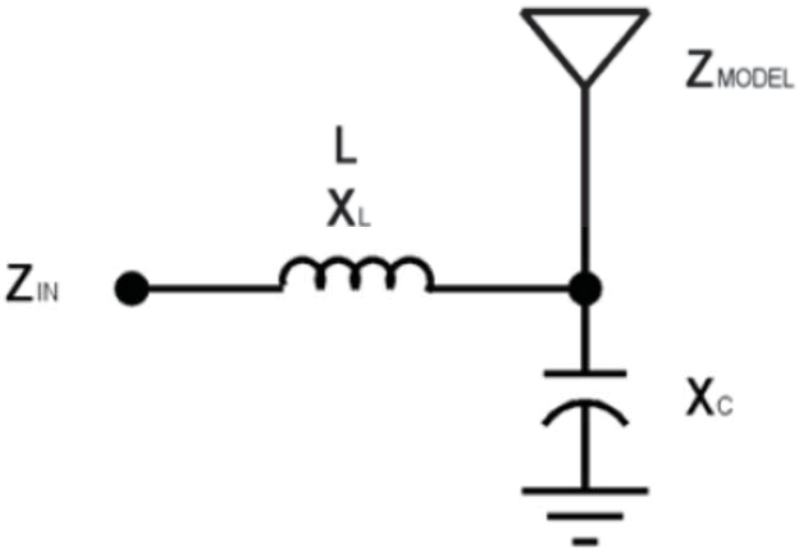
Impedance measurements were made of the individual towers with the other tower bases open. Measurements were made using a Keysight P5020A vector network analyzer and a Tunwall Radio directional coupler in a calibrated measurement system. Measurements were made immediately adjacent to the toroidal antenna sampling transformers, inside the antenna coupling units. An assumption is made regarding the sum of the tower base and base region stray capacitance as it pertains to each tower base calculation. Calculations were then made to relate modeled impedance of each tower to the measured impedance found at the output of each ATU.

The measured and modeled impedances were correlated using the Westberg Consulting WCAP Pro software program. WCAP is based on the SPICE nodal analysis program.

The shunt capacitive reactance of the tower base insulator is represented in the drawing below as Xc. The series inductive reactance of the tower feed conductor is represented as Xl. Z model represents the modeled impedance of the tower and Zin represents the impedance measured at the sampling point. In the following WCAP tabulations, the modeled impedance is represented between nodes 3-0. The measured impedance is represented between nodes 2-0. Node 0 represents ground. The calculated reference point impedances appear under the “TO NODE IMPEDANCE” columns of the WCAP calculations, following the insignificantly short transmission line (TL 1-3) that was included in series with the drive current sources (I 0-1) to provide calculation points for the impedances.

All tower models were calculated using the commissions currently published theoretical parameters.

The modeled and measured tower impedances are tabulated below and are shown to agree within the +/- 2ohms and +/- 4% as required by the rules.



Tower	L (uh)	Xl (+j)	Xc (-j)	Z Modeled	Z in Modeled	Z in Measured
1	5.5	39.74	-5536	62.72 + j76.23	64.49 + j116.31	64.7 +j116.3
2	7.8	56.36	-5536	57.55 + j67.31	58.97 + j123.88	58.41 +j123.8
3	2.5	18.06	-5536	104.93 +j161.9	111.3 + j182.67	110.9 +j182.98
4	7	50.58	-5536	57.92 + j70.85	59.42 + j121.72	59.22 +j121.48

Method of Moments Model Details for Towers Driven Individually

The antenna array was modeled using Expert MININEC Broadcast Professional Version 14.6. Tower geometry was defined based upon values gathered from the Commission's database. A single wire was used to represent each tower in the array. Each tower was then divided up into 15 segments, thus producing a wire segmentation of approximately 6.0 to 7.13 degrees/segment.

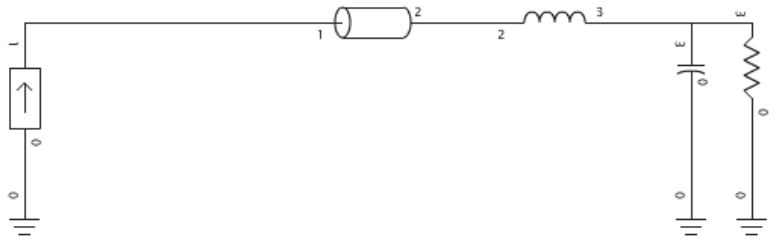
Tower parameters were modified to provide the required impedance match, that when combined with a circuit model containing base capacitance and series hookup inductance, equals the measured impedance of each tower while the other towers were open circuited.

Heights of the towers were adjusted as permitted by Rule Section 73.151(c)(1).
The tower radii were modeled at their actual values. Tabulations below show the parameters that were used for each tower in the Method of Moments model.

Tower	Actual Height Degrees	Model Height Degrees	Model Percent of Height
1	90.0	101.2	112.4
2	90.0	99.0	110.0
3	107.0	114.0	106.5
4	90.0	100.0	111.1

Following pages show the details from the method of moments models for each tower in addition to the WCAP circuit analysis for each tower.

WCAP – **WIMA Tower 1 Driven, others floated**



WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 13298.8404 ∠ 60.9932° V
Node: 2 10010.3696 ∠ 49.8937° V
Node: 3 13298.8083 ∠ 60.9931° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3 50.00000000	100.00 ∠ -0.001° A	100.00 ∠ -0.001° A

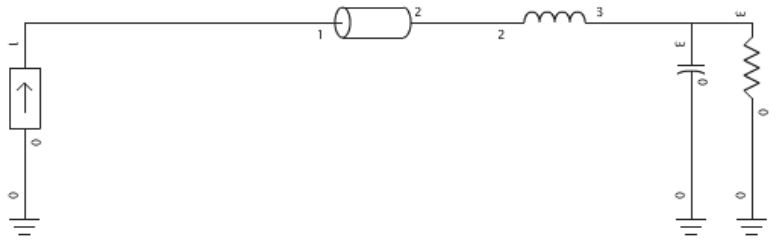
WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0 62.73000000	10010.37 ∠ 49.894° V	101.39 ∠ -0.659° A
C	2→0 0.00002500	10010.37 ∠ 49.894° V	1.81 ∠ 139.894° A
L	3→2 5.50000000	3974.18 ∠ 89.999° V	100.00 ∠ -0.001° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0 62.73000000	62.73 + j 76.240	0.00 + j 0.000
C	2→0 0.00002500	0.00 - j 5535.824	0.00 + j 0.000
L	3→2 5.50000000	64.49 + j 116.305	64.49 + j 76.564
TL	1→3 50.00000000	64.49 + j 116.307	**64.49 + j 116.305**

WCAP PART		VSWR
TL	1→3 50.00000000	6.0963

WCAP INPUT DATA:
1.1500 0.00000000 0
R 62.73000000 2 0 76.24000000
C 0.00002500 2 0
L 5.50000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 100.00000000 0 1 0.00000000

WCAP – **WIMA Tower 2 driven, others floated**



WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 13720.0177 ∠ 64.5440° V
Node: 2 8964.5377 ∠ 48.8661° V
Node: 3 13719.9846 ∠ 64.5439° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3 50.00000000	100.00 ∠ 0.001° A	100.00 ∠ -0.000° A

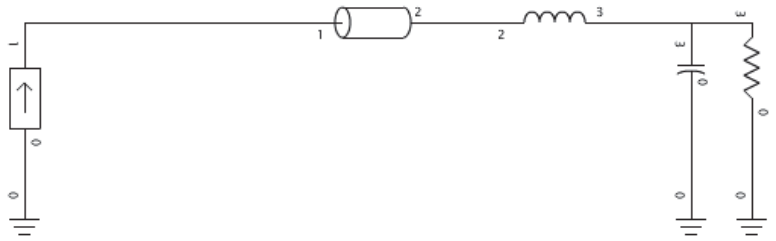
WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0 57.55000000	8964.54 ∠ 48.866° V	101.23 ∠ -0.603° A
C	2→0 0.00002500	8964.54 ∠ 48.866° V	1.62 ∠ 138.866° A
L	3→2 7.80000000	5636.12 ∠ 90.000° V	100.00 ∠ -0.000° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0 57.55000000	57.55 + j 67.310	0.00 + j 0.000
C	2→0 0.00002500	0.00 - j 5535.824	0.00 + j 0.000
L	3→2 7.80000000	58.97 + j 123.878	58.97 + j 67.518
TL	1→3 50.00000000	58.97 + j 123.880	**58.97 + j 123.878**

WCAP PART		VSWR
TL	1→3 50.00000000	7.0910

WCAP INPUT DATA:
1.1500 0.00000000 0
R 57.55000000 2 0 67.31000000
C 0.00002500 2 0
L 7.80000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 100.00000000 0 1 0.00000000

WCAP – **WIMA Tower 3 driven, others floated**



WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 21391.3975 ∠ 58.6439° V
Node: 2 19870.9663 ∠ 55.9325° V
Node: 3 21391.3661 ∠ 58.6439° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3 50.00000000	100.00 ∠ 0.000° A	100.00 ∠ -0.001° A

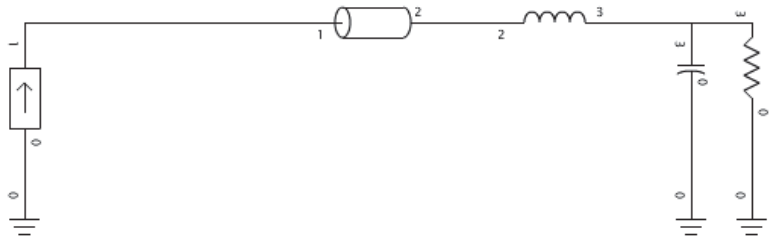
WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0 104.93000000	19870.97 ∠ 55.933° V	103.00 ∠ -1.120° A
C	2→0 0.00002500	19870.97 ∠ 55.933° V	3.59 ∠ 145.933° A
L	3→2 2.50000000	1806.46 ∠ 89.999° V	100.00 ∠ -0.001° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0 104.93000000	104.93 + j 161.900	0.00 + j 0.000
C	2→0 0.00002500	-0.00 - j 5535.824	0.00 + j 0.000
L	3→2 2.50000000	111.31 + j 182.668	111.31 + j 164.604
TL	1→3 50.00000000	111.31 + j 182.672	**111.31 + j 182.668**

WCAP PART		VSWR
TL	1→3 50.00000000	8.5541

WCAP INPUT DATA:
1.1500 0.00000000 0
R 104.93000000 2 0 161.90000000
C 0.00002500 2 0
L 2.50000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 100.00000000 0 1 0.00000000

WCAP – **WIMA Tower 4 driven, others floated**



WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 13545.2640 ∠ 63.9772° V
Node: 2 9269.4863 ∠ 50.1262° V
Node: 3 13545.2310 ∠ 63.9771° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3 50.00000000	100.00 ∠ -0.000° A	100.00 ∠ -0.001° A

WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0 57.92000000	9269.49 ∠ 50.126° V	101.29 ∠ -0.608° A
C	2→0 0.00002500	9269.49 ∠ 50.126° V	1.67 ∠ 140.126° A
L	3→2 7.00000000	5058.05 ∠ 89.999° V	100.00 ∠ -0.001° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0 57.92000000	57.92 + j 70.850	0.00 + j 0.000
C	2→0 0.00002500	0.00 - j 5535.824	0.00 + j 0.000
L	3→2 7.00000000	59.42 + j 121.718	59.42 + j 71.139
TL	1→3 50.00000000	59.43 + j 121.720	**59.42 + j 121.718**

WCAP PART		VSWR
TL	1→3 50.00000000	6.8706

WCAP INPUT DATA:
1.1500 0.00000000 0
R 57.92000000 2 0 70.85000000
C 0.00002500 2 0
L 7.00000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 100.00000000 0 1 0.00000000

Tower 1 driven, others floated

```
IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(MHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 1, sector 1
1.15     62.729   76.241   98.73    50.6     3.6294  -4.9133  -1.6916

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0           0            .388         15
           0            0           101.2
 2    none 90.          0           0            .388         15
           90.          0           99.
 3    none 234.4        0           0            .291         15
           234.4        0           114.
 4    none 324.4        0           0            .388         15
           324.4        0           100.

Number of wires          =  4
          current nodes  =  60

                        minimum                  maximum
Individual wires      wire    value             wire  value
segment length         2      6.6               3    7.6
radius                 3      .291              1    .388


ELECTRICAL DESCRIPTION
Frequencies (MHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   1.15         0             1      .0183333       .0211482

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

Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     16    0             -5,536.       0           0            0
 2     31    0             -5,536.       0           0            0
 3     46    0             -5,536.       0           0            0
```

Tower 2 driven, others floated

```
IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(MHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 16, sector 1
1.15     57.545   67.305   88.552   49.5     3.2903  -5.452   -1.4568

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0            0            .388         15
           0            0            101.2
 2    none 90.          0            0            .388         15
           90.          0            99.
 3    none 234.4        0            0            .291         15
           234.4        0            114.
 4    none 324.4        0            0            .388         15
           324.4        0            100.

Number of wires          =  4
          current nodes  =  60

                        minimum                  maximum
Individual wires      wire    value             wire  value
segment length         2      6.6               3    7.6
radius                 3      .291              1    .388

ELECTRICAL DESCRIPTION
Frequencies (MHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   1.15         0             1      .0183333       .0211111

Sources
source node    sector  magnitude      phase          type
 1      16      1       1.             0              voltage


Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1     0             -5,536.       0           0            0
 2     31    0             -5,536.       0           0            0
 3     46    0             -5,536.       0           0
```

Tower 3 driven, others floated

```
IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(MHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 31, sector 1
1.15     104.93   161.9    192.93   57.1     7.4369  -2.3501  -3.7891

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0            0            .388         15
           0            0            101.2
 2    none 90.          0            0            .388         15
           90.          0            99.
 3    none 234.4        0            0            .291         15
           234.4        0            114.
 4    none 324.4        0            0            .388         15
           324.4        0            100.

Number of wires          =  4
          current nodes  =  60

                        minimum                  maximum
Individual wires      wire    value             wire  value
segment length         2      6.6               3    7.6
radius                 3      .291              1    .388


ELECTRICAL DESCRIPTION
Frequencies (MHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   1.15         0             1      .0183333       .0211111

Sources
source node    sector  magnitude      phase          type
 1      31      1       1.             0              voltage


Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1     0             -5,536.       0           0            0
 2     16    0             -5,536.       0           0            0
 3     46    0             -5,536.       0           0            0
```

Tower 4 driven, others floated

```
IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(MHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 46, sector 1
1.15     57.922   70.852   91.514   50.7     3.4665  -5.1576  -1.5799

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0           0            .388         15
           0            0           101.2
 2    none 90.          0           0            .388         15
           90.          0           99.
 3    none 234.4        0           0            .291         15
           234.4        0           114.
 4    none 324.4        0           0            .388         15
           324.4        0           100.

Number of wires          =  4
          current nodes  =  60

                        minimum                  maximum
Individual wires      wire    value             wire  value
segment length         2      6.6               3    7.6
radius                 3      .291              1    .388


ELECTRICAL DESCRIPTION
Frequencies (MHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   1.15         0             1      .0183333       .0211111

Sources
source node    sector  magnitude      phase          type
 1      46      1       1.             0              voltage



Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1     0             -5,536.       0           0            0
 2     16    0             -5,536.       0           0            0
 3     31    0             -5,536.       0           0            0
```

CURRENT NODES

wire	coordinates (degrees) X	Y	Z	connections end1	end2	node no.
1	0	0	0	GND	1	1
1	0	0	6.74667	1	1	2
1	0	0	13.4933	1	1	3
1	0	0	20.24	1	1	4
1	0	0	26.9867	1	1	5
1	0	0	33.7333	1	1	6
1	0	0	40.48	1	1	7
1	0	0	47.2267	1	1	8
1	0	0	53.9733	1	1	9
1	0	0	60.72	1	1	10
1	0	0	67.4667	1	1	11
1	0	0	74.2133	1	1	12
1	0	0	80.96	1	1	13
1	0	0	87.7067	1	1	14
1	0	0	94.4533	1	END	15
2	90.	0	0	GND	2	16
2	90.	0	6.6	2	2	17
2	90.	0	13.2	2	2	18
2	90.	0	19.8	2	2	19
2	90.	0	26.4	2	2	20
2	90.	0	33.	2	2	21
2	90.	0	39.6	2	2	22
2	90.	0	46.2	2	2	23
2	90.	0	52.8	2	2	24
2	90.	0	59.4	2	2	25
2	90.	0	66.	2	2	26
2	90.	0	72.6	2	2	27
2	90.	0	79.2	2	2	28
2	90.	0	85.8	2	2	29
2	90.	0	92.4	2	END	30
3	234.4	0	0	GND	3	31
3	234.4	0	7.6	3	3	32
3	234.4	0	15.2	3	3	33
3	234.4	0	22.8	3	3	34
3	234.4	0	30.4	3	3	35
3	234.4	0	38.	3	3	36
3	234.4	0	45.6	3	3	37
3	234.4	0	53.2	3	3	38
3	234.4	0	60.8	3	3	39
3	234.4	0	68.4	3	3	40
3	234.4	0	76.	3	3	41
3	234.4	0	83.6	3	3	42
3	234.4	0	91.2	3	3	43
3	234.4	0	98.8	3	3	44
3	234.4	0	106.4	3	END	45
4	324.4	0	0	GND	4	46
4	324.4	0	6.66667	4	4	47
4	324.4	0	13.3333	4	4	48
4	324.4	0	20.	4	4	49

4	324.4	0	26.6667	4	4	50
4	324.4	0	33.3333	4	4	51
4	324.4	0	40.	4	4	52
4	324.4	0	46.6667	4	4	53
4	324.4	0	53.3333	4	4	54
4	324.4	0	60.	4	4	55
4	324.4	0	66.6667	4	4	56
4	324.4	0	73.3333	4	4	57
4	324.4	0	80.	4	4	58
4	324.4	0	86.6667	4	4	59
4	324.4	0	93.3333	4	END	60

Derivation of Operating Parameters, Nighttime

Directional Array

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

In so much as the sample lines are equal in length and the sample toroids responses are identical, the antenna monitor amplitudes and phases have been calculated directly from the reference point currents and phases.

We would like to make note to the commission that all modeling herein follows the commission's currently published theoretical parameters. We want to make it abundantly clear that the onsite antenna monitor and schematics reflect the tower numbers inverted from what the commission has on file.

The commission has on file that the South most tower is tower number 1, and the towers go up sequentially on a bearing of 0 degrees. Thus, tower number 4 is the most North tower in the array.

The onsite antenna monitor, onsite schematics, and phasing documentation have the inverse numbering scheme so that tower number 1 is the most North tower and counts sequentially on a bearing of 180 degrees. Thus, tower number 4 is the most South tower in the array. We ask that the commission consider changing the theoretical pattern numbering scheme to match the current onsite antenna monitor numbers so as to reduce confusion in the future.

Calculated Night Parameters

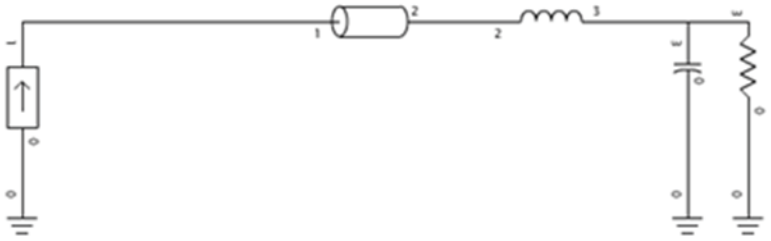
Tower	Model Pulse	Model Current Magnitude At Toroid, Amps	Model Current Phase at Toroid, Degrees	Modeled Antenna Monitor Ratio	Modeled Antenna Monitor Phase, Degrees
1	1	4.252	131.1	1.041	130.1
2	16	4.468	315.0	1.093	-46.0
3	31	2.32	168.0	0.568	167.0
4	46	4.086	1.0	1	0

Antenna Monitor Night Parameters

Tower	Model Pulse	Model Current Magnitude At Toroid, Amps	Model Current Phase at Toroid, Degrees	Modeled Antenna Monitor Ratio	Modeled Antenna Monitor Phase, Degrees
1 (North)**	46	4.086	1.0	1	0
2	31	2.32	168.0	0.568	167.0
3	16	4.468	315.0	1.093	-46
4 (South)	1	4.252	131.1	1.041	130.1

**Proposed antenna parameters utilizing onsite antenna monitor numbering.

WCAP Circuit Diagram



WCAP - WIMA T1 DAN-U

WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 542.7157 ∠ -152.3256° V
Node: 2 380.3784 ∠ -158.2460° V
Node: 3 542.7142 ∠ -152.3257° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3	50.00000000	4.25 ∠ 131.100° A	4.25 ∠ 131.100° A

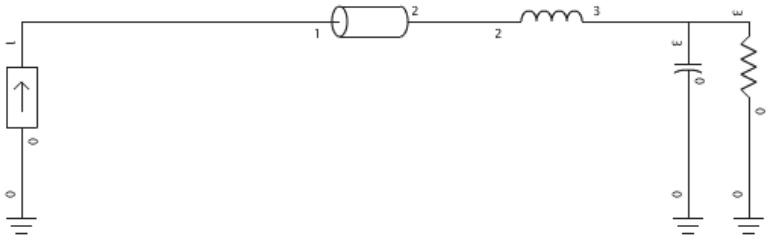
WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	28.75000000	380.38 ∠ -158.246° V	**4.32 ∠ 130.798° A**
C	2→0	0.00002500	380.38 ∠ -158.246° V	0.07 ∠ -68.246° A
L	3→2	5.50000000	168.98 ∠ -138.900° V	4.25 ∠ 131.100° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	28.75000000	28.75 + j 83.290	0.00 + j 0.000
C	2→0	0.00002500	0.00 - j 5535.824	0.00 + j 0.000
L	3→2	5.50000000	29.63 + j 124.147	29.63 + j 84.406
TL	1→3	50.00000000	29.64 + j 124.150	29.63 + j 124.147

WCAP PART			VSWR
TL	1→3	50.00000000	12.6024

WCAP INPUT DATA:
1.1500 0.00000000 0
R 28.75000000 2 0 83.29000000
C 0.00002500 2 0
L 5.50000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 4.25200000 0 1 131.10000000

WCAP Circuit Diagram



WCAP - WIMA T2 DAN-U

WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 717.9405 ∠ 42.5712° V
Node: 2 466.4640 ∠ 41.2603° V
Node: 3 717.9389 ∠ 42.5712° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3 50.00000000	4.47 ∠ -45.000° A	4.47 ∠ -45.000° A

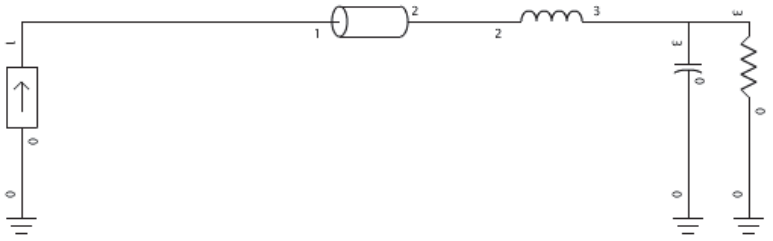
WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0 6.56000000	466.46 ∠ 41.260° V	**4.55 ∠ -45.069° A**
C	2→0 0.00002500	466.46 ∠ 41.260° V	0.08 ∠ 131.260° A
L	3→2 7.80000000	251.82 ∠ 45.000° V	4.47 ∠ -45.000° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0 6.56000000	6.56 + j 102.260	0.00 + j 0.000
C	2→0 0.00002500	0.00 - j 5535.824	0.00 + j 0.000
L	3→2 7.80000000	6.81 + j 160.536	6.81 + j 104.176
TL	1→3 50.00000000	6.81 + j 160.541	6.81 + j 160.536

WCAP PART		VSWR
TL	1→3 50.00000000	83.1642

WCAP INPUT DATA:
1.1500 0.00000000 0
R 6.56000000 2 0 102.26000000
C 0.00002500 2 0
L 7.80000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 4.46800000 0 1 315.00000000

WCAP Circuit Diagram



WCAP - WIMA T3 DAN-U

WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 813.0498 ∡ -107.6103° V
Node: 2 771.3526 ∡ -107.9168° V
Node: 3 813.0490 ∡ -107.6103° V

WCAP PART		CURRENT IN	CURRENT OUT
TL	1→3	50.00000000 2.32 ∡ 168.040° A	2.32 ∡ 168.040° A

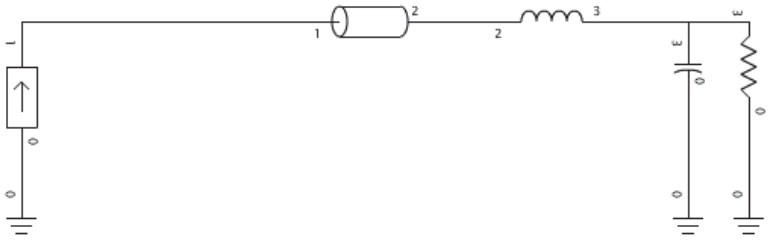
WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	30.72000000 771.35 ∡ -107.917° V	**2.46 ∡ 167.703° A**
C	2→0	0.00002500 771.35 ∡ -107.917° V	0.14 ∡ -17.917° A
L	3→2	2.50000000 41.91 ∡ -101.960° V	2.32 ∡ 168.040° A

WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0	30.72000000 30.72 + j 312.210	0.00 + j 0.000
C	2→0	0.00002500 0.00 - j 5535.824	0.00 + j 0.000
L	3→2	2.50000000 34.50 + j 348.732	34.50 + j 330.668
TL	1→3	50.00000000 34.50 + j 348.750	34.50 + j 348.732

WCAP PART		VSWR
TL	1→3	50.00000000 72.6247

WCAP INPUT DATA:
1.1500 0.00000000 0
R 30.72000000 2 0 312.21000000
C 0.00002500 2 0
L 2.50000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 2.32000000 0 1 168.04000000

WCAP Circuit Diagram



WCAP - WIMA T4 DAN-U

WCAP OUTPUT AT FREQUENCY: 1.150 MHz

NODE VOLTAGES
Node: 1 652.7044 ∠ 87.9366° V
Node: 2 446.4616 ∠ 86.5191° V
Node: 3 652.7029 ∠ 87.9366° V

WCAP PART		CURRENT IN		CURRENT OUT	
TL	1→3	50.00000000	4.09 ∠ 1.000° A	4.09 ∠	1.000° A

WCAP PART			BRANCH VOLTAGE		BRANCH CURRENT	
R	2→0	8.21000000	446.46 ∠	86.519° V	**4.17 ∠**	**0.913° A**
C	2→0	0.00002500	446.46 ∠	86.519° V	0.08 ∠	176.519° A
L	3→2	7.00000000	206.67 ∠	91.000° V	4.09 ∠	1.000° A

WCAP PART			FROM IMPEDANCE		TO IMPEDANCE	
R	2→0	8.21000000	8.21 + j	106.840	0.00 + j	0.000
C	2→0	0.00002500	0.00 - j	5535.824	0.00 + j	0.000
L	3→2	7.00000000	8.54 + j	159.509	8.54 + j	108.930
TL	1→3	50.00000000	8.54 + j	159.513	8.54 + j	159.509

WCAP PART			VSWR
TL	1→3	50.00000000	65.6247

WCAP INPUT DATA:
1.1500 0.00000000 0
R 8.21000000 2 0 106.84000000
C 0.00002500 2 0
L 7.00000000 3 2 0.00000000
TL 50.00000000 1 3 100.00000000 0.00100000 0.00000000
I 4.08600000 0 1 1.00000000

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.15 MHz

tower	field ratio magnitude	phase (deg)
1	1.	127.4
2	1.07	-45.8
3	.932	165.1
4	1.	0

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	380.371	201.7	4.31675	130.8
16	466.462	41.3	4.55203	314.9
31	771.558	252.1	2.45939	167.7
46	446.366	86.5	4.16572	.9

Sum of square of source currents = 125.514
Total power = 1,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00552994	-.00621434
Y(1, 2)	.00338201	.00218285
Y(1, 3)	-.000122328	-.000746846
Y(1, 4)	-.000491825	-6.3407E-05
Y(2, 1)	.003382	.00218294
Y(2, 2)	.00740295	-.00668039
Y(2, 3)	.00299063	-.000858646
Y(2, 4)	.000291373	-.00175952
Y(3, 1)	-.000122368	-.000746836
Y(3, 2)	.00299047	-.000858944
Y(3, 3)	.00326558	-.00342994
Y(3, 4)	.00265047	.000971613
Y(4, 1)	-.000491797	-6.3371E-05
Y(4, 2)	.000291318	-.00175947
Y(4, 3)	.00265045	.000972023
Y(4, 4)	.00643432	-.0069521

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	63.0973	76.3168
Z(1, 2)	29.7956	-31.8542
Z(1, 3)	-31.8985	2.79176
Z(1, 4)	1.70456	21.555
Z(2, 1)	29.7947	-31.8547
Z(2, 2)	57.857	67.1227
Z(2, 3)	-3.15167	-37.6207
Z(2, 4)	-23.7719	.928855

Z(3, 1)	-31.8986	2.79011
Z(3, 2)	-3.14794	-37.6217
Z(3, 3)	105.483	161.717
Z(3, 4)	35.6812	-43.2561
Z(4, 1)	1.70463	21.5547
Z(4, 2)	-23.7717	.928758
Z(4, 3)	35.6736	-43.2589
Z(4, 4)	58.4877	70.7463

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.15	28.752	83.292	88.115	71.	6.997	-2.4999	-3.5888
source = 2; node 16, sector 1							
1.15	6.564	102.26	102.47	86.3	39.587	-.43891	-10.172
source = 3; node 31, sector 1							
1.15	30.716	312.21	313.72	84.4	65.696	-.26445	-12.286
source = 4; node 46, sector 1							
1.15	8.2069	106.84	107.15	85.6	34.043	-.51043	-9.5512

CURRENT rms
Frequency = 1.15 MHz
Input power = 999.994 watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.31675	130.8	-2.81893	3.26924
2	0	0	6.74667	4.59554	129.5	-2.92165	3.54724
3	0	0	13.4933	4.70301	128.8	-2.94518	3.66663
4	0	0	20.24	4.72467	128.2	-2.92336	3.71167
5	0	0	26.9867	4.66977	127.8	-2.86025	3.6913
6	0	0	33.7333	4.54335	127.4	-2.75833	3.61021
7	0	0	40.48	4.34917	127.	-2.61973	3.47164
8	0	0	47.2267	4.09077	126.7	-2.44656	3.27853
9	0	0	53.9733	3.77189	126.5	-2.24111	3.03391
10	0	0	60.72	3.39648	126.2	-2.0058	2.74095
11	0	0	67.4667	2.96859	126.	-1.74312	2.40293
12	0	0	74.2133	2.49208	125.7	-1.45542	2.02293
13	0	0	80.96	1.96992	125.5	-1.14452	1.60332
14	0	0	87.7067	1.40235	125.3	-.810698	1.14427
15	0	0	94.4533	.782582	125.1	-.450177	.640137
END	0	0	101.2	0	0	0	0
GND	90.	0	0	4.55203	314.9	3.21493	-3.2226
17	90.	0	6.6	4.91263	314.6	3.4521	-3.49527
18	90.	0	13.2	5.0633	314.5	3.54836	-3.61194
19	90.	0	19.8	5.1149	314.4	3.57703	-3.6561
20	90.	0	26.4	5.07914	314.3	3.54592	-3.63649
21	90.	0	33.	4.96213	314.2	3.45915	-3.55767
22	90.	0	39.6	4.76813	314.1	3.31965	-3.42272
23	90.	0	46.2	4.50097	314.1	3.13007	-3.23441
24	90.	0	52.8	4.16452	314.	2.89312	-2.99552
25	90.	0	59.4	3.76286	314.	2.61162	-2.70898
26	90.	0	66.	3.30008	313.9	2.28844	-2.37772
27	90.	0	72.6	2.78003	313.9	1.92625	-2.00452
28	90.	0	79.2	2.20549	313.8	1.52699	-1.59137
29	90.	0	85.8	1.57611	313.8	1.09045	-1.138
30	90.	0	92.4	.883583	313.7	.610883	-.638389
END	90.	0	99.	0	0	0	0
GND	234.4	0	0	2.45939	167.7	-2.40298	.523721
32	234.4	0	7.6	3.05838	166.6	-2.97477	.710218
33	234.4	0	15.2	3.39888	166.	-3.29853	.819813
34	234.4	0	22.8	3.62549	165.7	-3.51272	.897177
35	234.4	0	30.4	3.75491	165.4	-3.63344	.947346
36	234.4	0	38.	3.79413	165.2	-3.66745	.972265
37	234.4	0	45.6	3.7473	165.	-3.61878	.972958
38	234.4	0	53.2	3.61797	164.8	-3.49096	.95021
39	234.4	0	60.8	3.40996	164.6	-3.28771	.904849
40	234.4	0	68.4	3.12753	164.5	-3.01323	.83778
41	234.4	0	76.	2.77538	164.3	-2.67211	.750056
42	234.4	0	83.6	2.3584	164.2	-2.26913	.64275
43	234.4	0	91.2	1.88102	164.1	-1.80862	.516824
44	234.4	0	98.8	1.34551	163.9	-1.29288	.37264
45	234.4	0	106.4	.747289	163.8	-.717579	.208616
END	234.4	0	114.	0	0	0	0
GND	324.4	0	0	4.16571	.9	4.1652	.0654867
47	324.4	0	6.66667	4.51366	.5	4.51346	.0425795

48	324.4	0	13.3333	4.66266	.4	4.66258	.0285306
49	324.4	0	20.	4.71871	.2	4.71868	.0169226
50	324.4	0	26.6667	4.69288	.1	4.69288	7.17E-03
51	324.4	0	33.3333	4.59093	360.	4.59093	-9.49E-04
52	324.4	0	40.	4.41671	359.9	4.4167	-7.52E-03
53	324.4	0	46.6667	4.17372	359.8	4.1737	-.0125683
54	324.4	0	53.3333	3.86548	359.8	3.86545	-.0161205
55	324.4	0	60.	3.49571	359.7	3.49566	-.0181949
56	324.4	0	66.6667	3.06817	359.6	3.06812	-.0188204
57	324.4	0	73.3333	2.58643	359.6	2.58636	-.0180344
58	324.4	0	80.	2.05306	359.6	2.053	-.0158765
59	324.4	0	86.6667	1.46782	359.5	1.46776	-.0123682
60	324.4	0	93.3333	.822965	359.5	.822931	-7.46E-03
END	324.4	0	100.	0	0	0	0

Sampling System Measurements

The following calculations confirm that the sample system as installed complies with Rule Section 73.151(c)(2)(1) in all respects. The sample toroids are Delta model TCT3 and their outputs are in agreement within the manufacturer's specification of +/-2% and +/-2º. The antenna monitor is a Potomac Instruments model AM19 serial number 204. The antenna monitor was compared with the Keysight P5020A network analyzer and was found to agree within manufacturer's specification. The sample lines are equal in length and constructed of 1/4" Andrew FSJ2-50 coaxial cable that has a solid outer conductor and foam dielectric. The cables are equal in length within 1º as required. The cables are all laid in a concrete raceway so as to be exposed to the same environmental conditions. The length of the cables was confirmed by measuring the impedance, looking into the line with the far end opened. The lines were found to be 5/4 wavelength long at the frequencies listed. These frequencies were used to calculate the electrical lengths of the lines at the operating frequency of 1150 kHz. Frequencies were calculated at which the lines were +/- 45º the length of the resonate frequency. The impedance was then calculated using the following formula:

$$Zo = ((R1^2+X1^2)^{1/2} * (R2^2+X2^2)^{1/2})^{1/2}$$

Sample Line Length Calculation

Tower	Resonate Frequency At 450º, kHz	Electrical Length at 1150 kHz, Degrees
1 (North)	1191.50	434.33
2	1192.50	433.96
3	1091.00	434.51
4 (South)	1192.50	433.96

Sample Line Impedance Calculation

Tower	450º Resonant Frequency kHz	45º Above Resonant Frequency kHz	Resistance Ohms	Reactance Ohms	45º Below Resonant Frequency kHz	Resistance Ohms	Reactance Ohms	Characteristic Impedance Ohms
1 (N)	1191.50	1310.65	23.97	47.62	1072.35	13.81	-44.45	49.81
2	1192.50	1311.75	23.95	48.03	1073.25	13.85	-45.06	50.30
3	1191.00	1310.10	23.99	48.06	1071.90	13.75	-44.55	50.04
4 (S)	1192.50	1311.75	23.33	46.26	1073.25	13.59	-43.6	48.64

The sample toroid calibration was confirmed by passing a common conductor through the toroids. The common conductor was driven by a Keysight P5020A vector network analyzer that was properly calibrated for response measurement. The output from the tower #1 toroid was fed to the reference receiver of the analyzer and the remaining toroids outputs were alternately fed to the B input, and the results noted in the chart below.

Sample Toroid Calibration Verification

Tower	Serial Number	Indicated Ratio	Indicated Phase
1 (N)	244	1.0	0
2	242	1.006	0.286
3	243	1.004	0.12
4 (S)	241	1.002	0.169

Sample Lines Terminated By Toroids

Tower	Serial Number	Impedance at Input to Sample Line with Toroid Connected
1 (N)	244	51.17 –j6.56
2	242	51.87 –j6.66
3	243	51.34 –j6.59
4 (S)	241	49.37 –j6.87

Direct Measurement of Power

The common point network in the nighttime phasor was adjusted to provide the proper operating resistance of 50 ohms and a reactance of 0 (zero) ohms to the transmitter output. In order to compensate for hookup inductance between the power measurement point and the transmitter the common point reactance was set for a value of –j5.0 at the measurement point. The antenna operating powers were calculated to the nominal operating power of 1kW. The common point current was then calculated as indicated below.

Daytime non directional mode power measurements are made at the tower base via a base current meter. Daytime operating impedance is 120.2 +j178.6.

Pattern	Nominal Power Watts	Operating Power Watts	Operating Common Point Current, Amps
Night	1000	1080	4.65
Day	1000	1000	2.88

Reference Field Strength Measurements

Reference field strength measurements were made on radials having existing monitor point limits on the current license as well as on radials in the main lobes as follows:

WIMA DAN-U

Reference Field Strength Measurements

Point #	Distance /km	Field Strength mv/m	Location Description	GPS Coordinates NAD27
0-1	2.37	140mv	Fort Shawnee Industrial Drive	N40° 42' 4.09" W84° 6' 34.09"
0-2	5.16	69mv	325 Vine St	N40° 43' 34.53" W84° 6' 34.15"
0-3	7.41	54mv	W McKibben St West end of church	N40° 44' 47.21" W84° 6' 33.68"
55-1	5.94	3mv	2138 Bowman Rd	N40° 42' 37.58" W84° 3' 6.30"
55-2	9.95	0.7mv	SE Intersection of 309 & S Thayer Rd	N40° 43' 51.43" W84° 0' 47.08"
55-3	12.8	0.43mv	NE Intersection Reservoir Rd and McClure Rd	N40° 44' 45.66" W83° 59' 5.24"
77-1	5	9.6mv	240 Yds North of Bowman and Breese Rd	N40° 41' 23.58" W84° 3' 6.02"
77-2	7.54	2.1mv	4417 McPheron Rd	N40° 41' 41.96" W84° 1' 21.09"
77-3	10.94	5.2mv	2739 Brentlinger Rd	N40° 42' 6.68" W83° 58' 59.68"
96-1	6.53	3.6mv	Schooler Rd	N40° 40' 24.79" W84° 1' 56.23"
96-2	8.97	2.2mv	100 Ft North 4850 Kerr Rd	N40° 40' 16.29" W84° 0' 13.52"
96-3	11.34	1.7mv	Waynesfield Rd 100 yds West of 5070	N40° 40' 6.72" W83° 58' 32.95"
180-1	2.78	35mv	17951 Amherst Rd	N40° 39' 17.77" W84° 6' 32.71"

180-2	4.87	13mv	Power Pole 994-358 on Freymuth Rd	N40° 38’ 10.06” W84° 6’ 34.48”
180-3	8.09	8.1mv	Hengstler Rd Between poles	N40° 36’ 25.48” W84° 6’ 33.21”
197-1	5.06	8.2mv	Telco Riser A93	N40° 38’ 9.69” W84° 7’ 32.93”
197-2	6.8	6.0mv	Under power lines	N40° 37’ 16.77” W84° 7’ 58.08”
197-3	8.5	1.8mv	16412 Hengstler Rd	N40° 36’ 24.09” W84° 8’ 19.1”
235-1	5.2	25mv	SW Corner Meadow Brook Blvd & Rue Dr	N40° 39’ 9.94” W84° 9’ 35.05”
235-2	7.72	3.2mv	CR 151	N40° 38’ 24.06” W84° 11’ 3.32”
235-3	10.05	7.8mv	CR 190	N40° 37’ 40.95” W84° 12’ 24.94”

All measurements were taken May 19, 2021 with Potomac Instruments FIM-41 field strength meter with serial number 2111. The meter was calibrated by its manufacturer on March 15, 2021.

Item 7

RFR Compliance

Operation of WIMA at 1 kW nighttime will not result in exposure of workers or the general public to RF radiation in excess of levels specified in 47CFR 1.1310. Fences have been installed around all tower bases to comply with the minimum distance which exceeds the distances specified in OET Bulletin 65 for this frequency, calculated power levels in the towers and tower height to prevent electric and magnetic exposure greater than permissible levels. These fences limit access by the general public. If it becomes necessary for workers to enter the tower base areas for maintenance, the station will either reduce power or cease operation to provide RFR safety for the workers.

Item 8

Ground System Description

No changes were made to the ground system at WIMA and remains as previously licensed: Ground System consists of 120 equally space, buried, copper wire radials 65.2m in length about the base of each tower, except where intersecting radials are shortened and bonded to transverse copper straps midway between towers.