Gregory L. Masters
202.719.7370
gmasters@wileyrein.com

ORIGINAL

November 12, 2019

BY HAND VIA COURIER

Accepted / Filed

NOV 12 2019

Federal Communications Commission
Office of the Secretary

Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
12th Street Lobby, TW-A325
Washington, DC 20554

Re: **Salem Communications Holding Corporation – FRN 0003760352**
Station WSDZ(AM), Belleville, IL (Fac. ID 4622)
Application for Station License

Dear Ms. Dortch:

On behalf of Salem Communications Holding Corporation, licensee of AM station WSDZ, Belleville, Illinois, we are submitting herewith an original and two copies of an application on FCC Form 302-AM for license.

The fee due for this application, $1,560.00, has been paid, using the FCC Fee Filer system. A copy of Form 159 confirming the payment is included herewith.

Should there be any questions concerning this application, please contact the undersigned.

Respectfully Submitted,

Gregory L. Masters

Agency Tracking ID:PGC3321803
Authorization Number:671857
Successful Authorization -- Date Paid: 11/11/19
FILE COPY ONLY!!

READ INSTRUCTIONS CAREFULLY BEFORE PROCEEDING (1) LOCKBOX #979089	FEDERAL COMMUNICATIONS COMMISSION **REMITTANCE ADVICE** **FORM 159** PAGE NO 1 OF 1	APPROVED BY OMB 3060-059 SPECIAL USE FCC USE ONLY

SECTION A - Payer Information

(2) PAYER NAME (If paying by credit card, enter name exactly as it appears on your card)	(3) TOTAL AMOUNT PAID (dollars and cents)
Salem Communications Holding Corporation	**$1560.00**

(4) STREET ADDRESS LINE NO. 1
4880 Santa Rosa Road
(5) STREET ADDRESS LINE NO. 2

(6) CITY	(7) STATE	(8) ZIP CODE
Camarillo	**CA**	**93012**

(9) DAYTIME TELEPHONE NUMBER (INCLUDING AREA CODE)	(10) COUNTRY CODE (IF NOT IN U.S.A.)
805-3844502	**US**

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

(11) PAYER (FRN)	(12) FCC USE ONLY
0003760352	

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

(13) APPLICANT NAME
Salem Communications Holding Corporation
(14) STREET ADDRESS LINE NO. 1
4880 Santa Rosa Road
(15) STREET ADDRESS LINE NO. 2

(16) CITY	(17) STATE	(18) ZIP CODE
Camarillo	**CA**	**93012**

(19) DAYTIME TELEPHONE NUMBER (INCLUDING AREA CODE)	(20) COUNTRY CODE (IF NOT IN U.S.A.)
805-3844502	**US**

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

(21) APPLICANT (FRN)	(22) FCC USE ONLY
0003760352	

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

(23A) FCC Call Sign/Other ID	(24A) Payment Type Code(PTC)	(25A) Quantity
WSDZ	**MMR**	**1**
(26A) Fee Due for (PTC)	(27A) Total Fee	FCC Use Only
$725.00	**$725.00**	

(28A) FCC CODE 1	(29A) FCC CODE 2
4622	**Form302-AM**

(23B) FCC Call Sign/Other ID	(24B) Payment Type Code(PTC)	(25B) Quantity
WSDZ	**MOR**	**1**

(26B) Fee Due for (PTC)	(27B) Total Fee	FCC Use Only
$835.00	$835.00	

(28B) FCC CODE 1	(29B) FCC CODE 2
4622	Form302-AM

Accepted / Filed

Federal Communications Commission
Washington, D. C. 20554

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

FOR FCC USE ONLY

NOV 12 2019

Federal Communications Commission
Office of the Secretary

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.

FOR COMMISSION USE ONLY
FILE NO BML-20191112ABL

SECTION I - APPLICANT FEE INFORMATION

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

SALEM COMMUNICATIONS HOLDING CORPORATION

MAILING ADDRESS (Line 1) (Maximum 35 characters)
4880 SANTA ROSA ROAD

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
CAMARILLO	CA	93012

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(805)987-0400	WSDZ	4622

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): Non-feeable application

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	$ 725.00	

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	$ 835.00	

	TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.	$ 1,560.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT SALEM COMMUNICATIONS HOLDING CORPORATION		
MAILING ADDRESS 4880 SANTA ROSA ROAD		
CITY CAMARILLO	STATE CA	ZIP CODE 93012

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
WSDZ	Belleville, IL	N/A	N/A	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. Not applicable - BMML application

Exhibit No.

4. Have all the terms, conditions, and obligations set forth in the above described construction permit been fully met? Not applicable - BMML application

☐ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

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

☐ Yes ☐ No

If Yes, explain in an Exhibit. Not applicable - BMML application

Exhibit No.

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

☐ Yes ☐ No

☑ Does not apply

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☑ No

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

Exhibit No.

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

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

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

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

CERTIFICATION

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

☑ Yes ☐ No

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

Name	Signature	
Christopher J. Henderson		
Title	Date	Telephone Number
Executive Vice President & Secretary	11-8-2019	(805)987-0400

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.

Consulting Engineers
CTJC
CARL T. JONES CORPORATION

ENGINEERING EXHIBIT
IN SUPPORT OF AN
APPLICATION FOR STATION LICENSE
STATION WSDZ- BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N U, DA-2
FACILITY ID: 4622

Applicant: Salem Communications Holding Corporation

NOVEMBER, 2019

7901 Yarnwood Court
Springfield, VA 22153-2899

tel: (703) 569-7704
fax: (703) 569-6417

email: info@ctjc.com
www.ctjc.com

TABLE OF CONTENTS

SECTION III OF FCC FORM 302-AM

ENGINEERING STATEMENT OF JAMES D. SADLER

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
Salem Communications Holding Corporation

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ Station License ☐ Direct Measurement of Power
Nighttime BMML-

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
WSDZ	N/A	1260	Unlimited	5	20

2. Station location

State	City or Town
Illinois	Belleville

3. Transmitter location

State	County	City or Town	Street address (or other identification)
IL	St. Clair	Belleville	546 Schlueter Germaine Rd

4. Main studio location

State	County	City or Town	Street address (or other identification)
MO	St. Louis	St. Louis	12250 Weber Hill

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

State	County	City or Town	Street address (or other identification)
MO	St. Louis	St. Louis	12250 Weber Hill

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. On File

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
10.39	20.52

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	+j0	+j0

Antenna indications for directional operation

Towers		Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
DAY	NIGHT	Night	Day	Night	Day	Night	Day
3	1	-10.7	0.0	0.409	1.000	------	------
4	2	158.1	67.3	0.531	0.772	------	------
6	3	-156.7	123.6	0.390	0.528	------	------
7	4	0.0	-71.9	1.000	0.311	------	------
8	5	176.0	-145.9	0.524	1.063	------	------

Manufacturer and type of antenna monitor: Potomac Instruments, Model 1901-8, serial number 456

SECTION III - Page 2

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
uniform cross-section, guyed, base insulated	56.2	57.4	57.4	Exhibit No. N/A

Excitation ☑ Series ☐ Shunt

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

North Latitude	38 °	27 '	31 "	West Longitude	89 °	57 '	41 "

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. On File

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.

N/A

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)
James D. Sadler	
Address (include ZIP Code) Carl T. Jones Corporation 7901 Yarnwood Court Springfield, VA 22153	Date November 8, 2019 Telephone No. (Include Area Code) (703) 569-7704

☐ Technical Director

☐ Registered Professional Engineer

☐ Chief Operator

☑ Technical Consultant

☐ Other (specify)

Consulting Engineers
CTJC
CARL T. JONES CORPORATION

ENGINEERING STATEMENT OF JAMES D. SADLER
IN SUPPORT OF AN
APPLICATION FOR STATION LICENSE
STATION WSDZ- BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N U, DA-2
FACILITY ID: 4622

Applicant: Salem Communications Holding Corporation

I am a Technical Consultant, an employee in the firm of Carl T. Jones Corporation, with offices located in Springfield, Virginia. My education and experience are a matter of record with the Federal Communications Commission.

1.0 GENERAL

This office has been authorized by Salem Communications Holding Corporation ("SCH"), licensee of AM Station WSDZ, to prepare this engineering statement, FCC Form 302-AM, Section III, and the associated figures and appendices in support of an Application for License of the nighttime directional antenna system. Station WSDZ is licensed for operation on 1260 kilohertz at a power of 20 kilowatts during daytime hours and 5 kilowatt during nighttime hours. The station operates with a different directional antenna pattern day and night (DA-2). Presently, Station WSDZ is operating under the terms of a special temporary authority (STA), granted November 4, 2019, that authorizes operation with parameters at variance from the licensed values and /or

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reduced power. The measured field strengths on two of the nighttime monitored radials exceeded the maximum value specified on the WSDZ license. Following evaluation of the directional pattern issues it was decided to prepare and application for license of the nighttime directional antenna system under the Commission's moment of methods rules. No changes to the daytime directional antenna system are proposed. The daytime antenna monitor parameters and daytime monitoring points were all verified to be within the licensed tolerances.

Computer modeling and sample system verification techniques, as described in Section 47 CFR 73.151(c) of the Commission's Rules and Regulations, were used to verify the performance of the WSDZ nighttime directional antenna system. The specific measurement and modeling techniques used in performing the proof of performance on the WSDZ nighttime directional pattern are described in detail in this engineering statement. Impedance measurement data, sample system verification measurement data, model derived operating parameters, and reference field strength measurements relative to the nighttime directional antenna pattern are tabulated in the figures attached to this engineering statement. Finally, all pertinent computer model input and output files are contained in the attached Appendices A, B, and C.

2.0 IMPEDANCE MEASUREMENTS, COMPUTER MODELING AND SAMPLE SYSTEM VERIFICATION

The nighttime proof of performance contained herein is based on the computer modeling and sample system verification procedures described in Section 47 CFR

73.151(c) of the FCC's Rules and Regulations. The WSDZ antenna array consists of a total of eight towers, seven of the towers are identical, uniform cross-section, guyed, base insulated, steel, series-fed towers. An eighth uniform cross-section, guyed, base insulated, steel, series-fed tower has an identical height but a smaller tower face width. All eight towers have an electrical height of 85 degrees (56.2 meters). The northern most tower, tower No. 5, has a face width of 12 inches. The other seven towers have face width of 18 inches. The daytime and nighttime directional arrays each employ five towers. Tower numbers 3 and 4 are shared between the two arrays. The directional antenna sampling system employs identical toroidal current transformers located at the output of the antenna matching network at the base of each tower.

A detailed description of the impedance measurements, the computer models employed, and the sample system verification measurements, is contained below.

2.1 INDIVIDUAL TOWER IMPEDANCE MEASUREMENTS

Impedance measurements were performed at the base of each tower by Carl T. Jones, Jr., P.E., at the J-Plug located in the output branch of the antenna matching network. This measurement location is immediately adjacent to the location of the sampling system toroidal current transformer. The impedance measurements were performed using a Hewlett-Packard Model 8753C network analyzer; an ENI, Model 240L, power amplifier; and a Tunwall Radio directional coupler. The impedance of each tower was measured with the other four nighttime towers open-circuited at the same antenna matching network J-Plug location that was used to perform the impedance

measurement. The three unused daytime only towers were in the detuned mode while performing the impedance measurements. The measured impedances are tabulated in Figure 2.

2.2 INDIVIDUAL TOWER COMPUTER MODELS

A Method of Moments ("MoM") computer model was developed to model each element in the array using Expert MiniNEC Broadcast Professional (Version 23.0). A wire model was developed for each tower in the array that is comprised of 14 segments. To replicate the individual measured base impedances to within FCC specified tolerances, each of the nighttime towers physical height was adjusted in the MiniNEC model and shunt capacitances and lumped series inductances were employed in a separate circuit model. The actual equivalent physical radius was used in all computer models contained in this application. Details of the modeled individual nighttime tower adjusted heights are contained in Figure 1.

The values of the shunt capacitances and lumped series inductances used in the circuit model are contained in the table of Figure 2. A comparison of the measured individual tower impedances, the modeled individual tower impedances, and the adjusted modeled (circuit model) individual tower impedances is also contained in the table of Figure 2. The percentage difference between the adjusted modeled tower height and the actual physical tower height and the magnitude of the lumped series inductances that were used in the circuit models are all within the tolerances set forth in the Rules.

As demonstrated by the data contained in Figure 2, the adjusted modeled individual tower resistance and reactance for each tower is well within ± 2 ohms and ± 4 percent tolerance of the corresponding measured individual tower resistance and reactance. The text files containing all pertinent input and output data associated with the individual tower models are contained in Appendix A.

2.3 DIRECTIONAL ANTENNA COMPUTER MODEL AND ANTENNA MONITOR PARAMETERS

The theoretical nighttime directional field parameters and the licensed tower spacings and orientations were used in combination with the adjusted individual tower models to produce the nighttime directional antenna computer model. From the directional computer model, tower currents were derived for each wire segment of each antenna. Each segment current was multiplied by the segment length and numerically integrated and normalized to the appropriate reference tower to verify that the modeled current moments are essentially identical to the authorized relative theoretical directional field parameters.

The nighttime antenna system uses five of the eight towers in the WSDZ directional antenna array. Towers 6, 7, and 8 were included in the nighttime directional model in a detuned condition. In order to determine the lumped inductance that was required to detune the unused 85 degree towers, a separate detuning model was created in the MiniNEC program. In the detuning model, a plane wave excitation was employed and a lumped inductive load was used to terminate the tower at the ground

interface. While monitoring the far field horizontal electric field, the value of the terminating inductor was changed in the model until the field was minimized. The lumped inductance required to detune the towers was used to terminate towers 6, 7, and 8 in the nighttime directional model. All of the pertinent input and output files for the detuned tower model are contained in Appendix C.

The new nighttime directional array operating parameters were determined from the MiniNEC modeled base currents as modified by the shunt capacitance and series inductance for each tower and are tabulated in Figure 3. The text files containing all pertinent input and output data associated with the nighttime directional antenna computer model are contained in Appendix B.

2.4 SAMPLE SYSTEM DESCRIPTION AND VERIFICATION MEASUREMENTS

The WSDZ antenna sampling system utilizes identical Phasetek, Inc., Type P600-202, 0.5V/A, toroidal current transformers mounted in an identical manner in the output branch of each tower's impedance matching network. The transformers are connected to a Potomac Instruments, Model 1901-8, antenna monitor with equal lengths of Andrew, Type LDF2-50, phase stabilized, foam dielectric, 3/8 inch coaxial cable. There are various short jumper cables located between the end of the Type LDF2-50 coaxial cable and the antenna monitor. The sample cables, including excess lengths of cable, are buried such that each cable is subjected to the same environmental conditions.

The sample lines, including the jumper cables, were verified to be equal in length by measuring the open-circuit series resonate frequency closest to the carrier frequency. The characteristic impedance was verified by measuring the impedance at frequencies corresponding to odd multiples of 1/8 wavelength immediately above and below the open circuit series resonant frequency closest to the carrier frequency, while the line was open-circuited at the sample element end of the line. The characteristic impedance was calculated by the following formula:

$$Z = \sqrt{\sqrt{R_1^2 + X_1^2} \times \sqrt{R_2^2 + X_2^2}}$$

where:

Z = *Characteristic impedance and*

$R_1 + jX_1$ *and* $R_2 + jX_2$ *are the measured impedances at* $\pm$ *45 degrees offset frequencies.*

A tabulation of the measured nighttime sample line lengths and the characteristic impedance of each line is contained in Figure 4. All sample line verification measurements were performed by Mr. Jones using a Hewlett-Packard, Model 8753C, network analyzer; an ENI, Model 240L, power amplifier; and a Tunwall Radio directional coupler. As demonstrated by the measured values in Figure 4, the measured nighttime sample line lengths are within 1 electrical degree with respect to each other and the measured characteristic impedances are well within 2 ohms of each other, as required by Section 47 CFR 73.151(c)(2)(i) of the FCC Rules and Regulations.

An impedance measurement was performed at the input to each nighttime sample line, at the antenna monitor end of the line, with the toroidal current transformer connected. The measurement was performed at the WSDZ operating frequency of 1260 kilohertz. The measured nighttime sample line impedances with the current transformers connected are tabulated in Figure 4 under the heading "Reference Impedance Sample Transformer Connected." The performance of the nighttime toroidal current transformers was verified by driving a common reference current through all five nighttime transformers and comparing the relative outputs as observed on the network analyzer. The test confirmed that the performance of all five of the WSDZ nighttime current transformers is well within the manufacturer's stated accuracy. A tabulation of the nighttime toroidal current transformer measurement data and the serial number of each toroidal current transformer is contained in Figure 5.

The antenna monitor that is employed by WSDZ is a Potomac Instruments, Model 1901-8, Serial Number 456. The antenna monitor has been recently calibrated by the manufacturer on August 5, 2019.

3.0 COMMON POINT IMPEDANCE AND COMMON POINT CURRENT

The networks associated with the daytime and nighttime directional antenna system were adjusted for proper impedance transformation and the common point impedance matching network was set for Z = 50 +j 0 Ohms. The transmitter output power level was adjusted for a daytime common point current of 20.52 amperes and a

nighttime common point current of 10.39 amperes, corresponding to daytime and nighttime input powers of 20,060 Watts and 5,400 Watts, respectively.

4.0 REFERENCE FIELD STRENGTH MEASUREMENTS

Reference field strength measurements were performed on the nighttime antenna pattern on the 160° and the 340° radial bearings, corresponding to the major lobes of the pattern. In addition, reference field strength measurements were performed on the 57°, 70°, 83°, 237°, 250° and 263° radial bearings, corresponding to the nighttime directional pattern minima. Three reference field strength measurements were performed on each of the selected radial bearings.

The measurements were performed by Mr. Scott Horner, Vice President of Engineering for the station parent company, accompanied by Mr. Jones using a Potomac Instruments, Model FIM-41, Serial Number 2185, last calibrated by the manufacturer in August, 2019. The measured field strength value for each established reference point location is tabulated in Figure 6, Sheets 1 through 4. The tabulations contained in Figure 6 also include for each reference location; GPS coordinates (NAD83), distance from the WSDZ array center, and a description of measurement location.

SUMMARY

It is submitted that the performance of the WSDZ nighttime directional antenna pattern has been verified using computer modeling and sample system verification

procedures in accordance with Section 47 CFR 73.151(c) of the Commission's Rules and Regulations. The daytime monitoring points and antenna monitor parameters are within the licensed tolerances. It is believed that the daytime and nighttime directional antenna systems, as adjusted, fully comply with the terms of the station's FCC Authorization and all applicable FCC Rules and Regulations. It is requested that a superseding license be issued to SHC reflecting the new MoM model derived nighttime operating parameters as contained herein.

This engineering statement, FCC Form 302-AM, Section III, and the attached figures and appendices were prepared by the undersigned or under the direct supervision of the undersigned and are believed to be true and correct.

Dated: November 8, 2019

James D. Sadler

Figure 1

TOWER MODEL HEIGHT AND RADIUS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

Tower	Physical Height (degrees)	Modeled Height (degrees)	Percent of Physical Height	Modeled Radius (degrees)	Percent of Equivalent Radius
1	85.0	88.2	103.8	0.2183	100.0
2	85.0	88.7	104.4	0.2183	100.0
3	85.0	87.3	102.7	0.2183	100.0
4	85.0	86.7	102.0	0.2183	100.0
5	85.0	86.6	101.9	0.1455	100.0

MEASURED AND MODELED IMPEDANCES

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

Tower	Measured Tower Base Impedance[1]	Modeled Tower Base Impedance	Shunt Capacitance (pF)	Modeled plus Shunt Reactance	Lumped Series Inductance (uH)	Total Adjusted Tower Base Impedance
1	40.3 +j 56.6	40.3 +j 11.7	15.0	40.4 +j 11.5	5.7	40.4 +j 56.7
2	41.6 +j 54.6	41.6 +j 14.8	15.0	41.7 +j 14.6	5.0	41.7 +j 54.2
3	39.9 +j 54.2	39.9 +j 7.6	15.0	39.9 +j 7.4	5.9	39.9 +j 54.1
4	38.7 +j 53.4	38.6 +j 4.2	15.0	38.7 +j 4.0	6.2	38.7 +j 53.1
5	37.5 +j 38.3	37.4 +j 1.8	15.0	37.4 +j 1.6	4.6	37.4 +j 38.1

[1] Measured at output of matching network with other towers open-circuited

Figure 2

ANTENNA MONITOR PARAMETERS AND COMMON POINT DATA

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

DAYTIME		
	Licensed Parameters	
Tower	**Ratio**	**Phase (deg)**
3	1.000	0.0
4	0.772	67.3
6	0.528	123.6
7	0.311	-71.9
8	1.063	-145.4
Common Point Impedance = 50 +j 0 ohms Common Point Current = 20.52 amperes Antenna Input Power = 21,060 Watts		

NIGHTTIME		
	Modeled Parameters	
Tower	**Ratio**	**Phase (deg)**
1	0.409	-10.7
2	0.531	158.1
3	0.390	-156.7
4	1.000	0.0
5	0.524	176.0
Common Point Impedance = 50 +j 0 ohms Common Point Current = 10.39 amperes Antenna Input Power = 5,400 Watts		

SAMPLE LINE VERIFICATION MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

Tower	Open Circuit Series Resonant Frequency[1] (kHz)	Open Circuit Measured Line Length[2] (degrees)	Resonant Frequency -45 degree Offset Frequency (kHz)	Resonant Frequency -45 degree Offset Impedance (Ohms)	Resonant Frequency +45 degree Offset Frequency (kHz)	Resonant Frequency +45 degree Offset Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)	Reference Impedance Sample Toroid Connected[2] (Ohms)
1	1062.4	533.7	956.2	10.94 -j 48.14	1168.6	13.76 +j 48.23	49.76	50.31 + j1.20
2	1062.6	533.6	956.3	10.33 -j 47.69	1168.9	13.52 +j 48.31	49.48	49.59 - j0.78
3	1064.0	532.9	957.6	10.43 -j 46.53	1170.4	13.54 +j 47.23	48.40	49.73 + j0.54
4	1064.2	532.8	957.8	11.01 -j 48.17	1170.6	13.35 +j 47.08	49.17	49.63 + j1.48
5	1063.1	533.3	956.8	11.10 -j 48.64	1169.4	13.68 +j 48.44	50.11	51.55 - j0.68

[1] At this frequency, the sample line electrical length is equal to 450°.
[2] Measurements performed at 1260 kHz.

Figure 4

Figure 5

SAMPLE DEVICE VERIFICATION MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

Reference Sample Toroid Number	Measured Sample Toroid Number	Measured	
		Field Ratio	Phase (degrees)
4	1	0.9995	-0.35
4	2	0.9981	-0.62
4	3	1.0016	-0.15
4	5	1.0025	-0.53

Sample Toroid Number	Type	Serial Number
1	Phasetek, Inc.	None
2	Phasetek, Inc.	None
3	Phasetek, Inc.	None
4	Phasetek, Inc.	None
5	Phasetek, Inc.	None

REFERENCE FIELD STRENGTH MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

57 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.43	7.0	38° 28' 29.5"	89° 55' 40.6"	The point is located on the north side of Highway 13, 30 ft southeast of intersection with Turkeyhill Ln.
2	6.45	5.8	38° 29' 24.0"	89° 53' 58.3"	The point is located on the south side of Hickory Hill Rd at telephone pole with guy and yellow cover.
3	9.13	6.2	38° 30' 10.7"	89° 52' 23.9"	The point is located on the west side of road opposite drive to #2409 Rentchler Rd.

70 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.78	21	38° 28' 08.4"	89° 55' 12.8"	The point is located on the grass median on Highway 13 opposite Jefferson Rd turn sign on east side of road.
2	6.93	7.5	38° 28' 46.4"	89° 53' 10.8"	The point is located on the south side of the road at mailbox #2963 Rentchler Rd.
3	8.17	3.7	38° 29' 00.7"	89° 52' 23.2"	The point is located on the west side of the road opposite mailbox #2749 Rentchler Rd.

Figure 6
Sheet 1 of 4

REFERENCE FIELD STRENGTH MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

83 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.77	11.3	38° 27' 41.6"	89° 55' 07.1"	The point is located on the east side of Highway 13 at small culvert with galvanized grate cover.
2	6.20	8.5	38° 27' 54.8"	89° 53' 26.4"	The point is located on the south side of the road at the drive to #8058 Jefferson Rd.
3	8.16	1.7	38° 28' 00.1"	89° 52' 06.1"	The point is located on the west side of the road at mailbox #6737 Reinneck Rd.

160 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.37	138	38° 25' 47.3"	89° 56' 53.9"	The point is located on the east side of Countryside Ln opposite corn silo at #5712 Countryside Ln.
2	5.33	82	38° 24' 46.8"	89° 56' 28.2"	The point is located on the west side of Holcomb School Rd opposite drive at #6940 Holcomb School Rd.
3	8.82	47	38° 23' 01.8"	89° 55' 36.6"	The point is located 20 ft into field on east side of Carr Rd, 0.2 mile north of Blacksmith Shop Rd.

REFERENCE FIELD STRENGTH MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

237 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.69	17	38° 26' 25.0"	89° 59' 48.5"	The point is located on the east side of Lunch Rd, 20 ft into field, opposite telephone pole with yellow guy, 0,4 mile south of Schmidt Ln.
2	5.13	11.5	38° 25' 59.7"	90° 00' 38.0"	The point is located on the west side of road opposite drive to #3636 N High Prairie School Rd.
3	6.79	5.7	38° 25' 29.8"	90° 01' 35.6"	The point is located on the north side of Douglas Rd opposite drive and white mailbox at #5028 Douglas Rd.

250 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.94	9.0	38° 26' 46.2"	90° 00' 14.0"	The point is located on the south side of Schmidt Ln, 0.3 mile west of Lunch Rd at culvert/creek south side of road.
2	7.39	5.3	38° 26' 08.0"	90° 02' 27.4"	The point is located on the west side of Roachtown Rd, 0.8 mile south of Schmidt Ln, 100 ft north of Black mailbox and telephone pedestal.
3	8.67	4.5	38° 27' 02.3"	90° 02' 27.1"	The point is located on the west side of road at mailbox #6264 Roachtown Rd.

REFERENCE FIELD STRENGTH MEASUREMENTS

STATION WSDZ - BELLEVILLE, ILLINOIS
1260 kHz - 20 kW-D, 5 kW-N, U, DA-2
NOVEMBER, 2019

263 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	3.93	24.5	38° 27' 13.9"	90° 00' 21.8"	The point is located at the drive to #3131 Mulligan Ln.
2	5.16	10.5	38° 27' 09.0"	90° 01' 11.2"	The point is located on the east side of Park Rd at the south end of creek guard rail.
3	6.99	11.2	38° 27' 02.3"	90° 02' 27.1"	The point is located on the west side of road at mailbox #6264 Roachtown Rd.

340 Degree Radial

Point Number	Distance (km)	Nighttime Field (mV/m)	Geographic Coordinates (NAD83)		Description
			Latitude	Longitude	
1	5.26	68	38° 30' 09.0"	89° 58' 55.1"	The point is located in the western most parking space at McDonald's north of Highway 13.
2	7.90	22.6	38° 31' 29.8"	89° 59' 32.3"	The point is located on the north side of Gilbert St at Narrow Bridge sign in front of #419 Gilbert St.
3	9.68	25	38° 32' 24.2"	89° 59' 57.7"	The point is located on the south side of W Belle St at drive to #1510 W Belle St.

APPENDIX A

INDIVIDUAL TOWER MODELING

IMPEDANCE - TOWER #1
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.26	40.281	11.724	41.952	16.2	1.4018	-15.531	-.12326

GEOMETRY - TOWER #1
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum wire	minimum value	maximum wire	maximum value
Individual wires				
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - TOWER #1
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	0	0
2	15	1.	0	0	1.5E-05	0
3	29	1.	0	0	1.5E-05	0
4	43	1.	0	0	1.5E-05	0
5	57	1.	0	0	1.5E-05	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

IMPEDANCE - TOWER #2
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 15, sector 1							
1.26	41.55	14.767	44.096	19.6	1.4494	-14.728	-.14871

GEOMETRY - TOWER #2
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - TOWER #2
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

source	node	sector	magnitude	phase	type
1	15	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	1.5E-05	0
2	15	1.	0	0	0	0
3	29	1.	0	0	1.5E-05	0
4	43	1.	0	0	1.5E-05	0
5	57	1.	0	0	1.5E-05	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

IMPEDANCE - TOWER #3
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 29, sector 1							
1.26	39.862	7.5609	40.573	10.7	1.3262	-17.063	-8.6E-02

GEOMETRY - TOWER #3
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum wire	minimum value	maximum wire	maximum value
Individual wires				
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - TOWER #3
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

source	node	sector	magnitude	phase	type
1	29	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	1.5E-05	0
2	15	1.	0	0	1.5E-05	0
3	29	1.	0	0	0	0
4	43	1.	0	0	1.5E-05	0
5	57	1.	0	0	1.5E-05	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

IMPEDANCE - TOWER #4
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 43, sector 1							
1.26	38.644	4.2158	38.873	6.2	1.3162	-17.297	-8.2E-02

GEOMETRY - TOWER #4
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - TOWER #4
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	1.5E-05	0
2	15	1.	0	0	1.5E-05	0
3	29	1.	0	0	1.5E-05	0
4	43	1.	0	0	0	0
5	57	1.	0	0	1.5E-05	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

IMPEDANCE - TOWER #5
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 57, sector 1							
1.26	37.431	1.8143	37.475	2.8	1.3398	-16.76	-9.3E-02

GEOMETRY - TOWER #5
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum wire	minimum value	maximum wire	maximum value
Individual wires				
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - TOWER #5
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

source	node	sector	magnitude	phase	type
1	57	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	1.5E-05	0
2	15	1.	0	0	1.5E-05	0
3	29	1.	0	0	1.5E-05	0
4	43	1.	0	0	1.5E-05	0
5	57	1.	0	0	0	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

APPENDIX B

NIGHTTIME DIRECTIONAL ARRAY MODEL

IMPEDANCE - NIGHTTIME OPERATION
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.26	68.637	-.37591	68.638	359.7	1.3728	-16.075	-.10857
source = 2; node 15, sector 1							
1.26	59.658	-9.6047	60.426	350.9	1.2824	-18.15	-6.7E-02
source = 3; node 29, sector 1							
1.26	48.401	33.785	59.026	34.9	1.9634	-9.7598	-.4851
source = 4; node 43, sector 1							
1.26	39.547	11.179	41.097	15.8	1.4085	-15.412	-.12675
source = 5; node 57, sector 1							
1.26	43.662	28.858	52.337	33.5	1.8631	-10.415	-.41379

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	88.2		
2	none	170.	340.	0	.2183	14
		170.	340.	88.7		
3	none	340.	340.	0	.2183	14
		340.	340.	87.3		
4	none	510.	340.	0	.2183	14
		510.	340.	86.7		
5	none	680.	340.	0	.1455	14
		680.	340.	86.6		
6	none	277.96	341.26	0	.2183	14
		277.96	341.26	85.		
7	none	391.46	345.32	0	.2183	14
		391.46	345.32	85.		
8	none	450.58	338.97	0	.2183	14
		450.58	338.97	85.		

Number of wires = 8
current nodes = 112

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	6	6.07143	2	6.33571
radius	5	.1455	1	.2183

ELECTRICAL DESCRIPTION - NIGHTTIME OPERATION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.26	0	1	.0168651	.0175992

Sources

source	node	sector	magnitude	phase	type
1	1	1	300.393	353.	voltage
2	15	1	343.727	152.9	voltage

3	29	1	246.473	242.2	voltage
4	43	1	440.144	19.8	voltage
5	57	1	293.691	213.4	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	0	0	0
2	15	1.	0	0	0	0
3	29	1.	0	0	0	0
4	43	1.	0	0	0	0
5	57	1.	0	0	0	0
6	71	1.	0	.067	0	0
7	85	1.	0	.067	0	0
8	99	1.	0	.067	0	0

PEAK CURRENT - NIGHTTIME OPERATION
Frequency = 1.26 MHz
Input power = 5,000. watts
Efficiency = 97.84 %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.37647	353.3	4.34677	-.508959
2	0	0	6.3	4.35448	350.8	4.29811	-.69835
3	0	0	12.6	4.28544	349.1	4.20882	-.806759
4	0	0	18.9	4.16807	347.8	4.07403	-.880384
5	0	0	25.2	4.00265	346.6	3.89434	-.924835
6	0	0	31.5	3.79026	345.6	3.67122	-.942459
7	0	0	37.8	3.53258	344.7	3.40672	-.934528
8	0	0	44.1	3.23171	343.8	3.10329	-.901958
9	0	0	50.4	2.89012	343.	2.76366	-.845558
10	0	0	56.7	2.51041	342.2	2.39066	-.766094
11	0	0	63.	2.09508	341.5	1.98699	-.664255
12	0	0	69.3	1.64592	340.8	1.55465	-.540482
13	0	0	75.6	1.16271	340.2	1.09375	-.394467
14	0	0	81.9	.639141	339.5	.598729	-.223663
END	0	0	88.2	0	0	0	0
GND	159.748	58.1434	0	5.68836	162.1	-5.41186	1.75192
16	159.748	58.1434	6.33571	5.62397	159.8	-5.27905	1.93923
17	159.748	58.1434	12.6714	5.5111	158.4	-5.1239	2.02925
18	159.748	58.1434	19.0071	5.34037	157.2	-4.92307	2.06952
19	159.748	58.1434	25.3429	5.11148	156.2	-4.67526	2.06619
20	159.748	58.1434	31.6786	4.82562	155.2	-4.38148	2.02218
21	159.748	58.1434	38.0143	4.48492	154.4	-4.04389	1.93945
22	159.748	58.1434	44.35	4.09213	153.6	-3.66527	1.81971
23	159.748	58.1434	50.6857	3.65045	152.9	-3.24881	1.66464
24	159.748	58.1434	57.0214	3.16328	152.2	-2.79785	1.47592
25	159.748	58.1434	63.3571	2.63383	151.5	-2.31556	1.25509
26	159.748	58.1434	69.6929	2.06451	150.9	-1.80433	1.0033
27	159.748	58.1434	76.0286	1.45514	150.3	-1.26434	.720338
28	159.748	58.1434	82.3643	.798034	149.7	-.689325	.402106
END	159.748	58.1434	88.7	0	0	0	0
GND	319.496	116.287	0	4.1757	207.3	-3.71121	-1.914
30	319.496	116.287	6.23571	4.24553	205.5	-3.83052	-1.83075
31	319.496	116.287	12.4714	4.23307	204.5	-3.85251	-1.75415
32	319.496	116.287	18.7071	4.1603	203.6	-3.81168	-1.66708
33	319.496	116.287	24.9429	4.03059	202.9	-3.7131	-1.56798
34	319.496	116.287	31.1786	3.84631	202.3	-3.55978	-1.45673
35	319.496	116.287	37.4143	3.60971	201.7	-3.35424	-1.33381

36	319.496	116.287	43.65	3.32324	201.2	-3.09901	-1.20003
37	319.496	116.287	49.8857	2.98952	200.7	-2.79667	-1.05634
38	319.496	116.287	56.1214	2.61123	200.2	-2.44984	-.90378
39	319.496	116.287	62.3571	2.19088	199.8	-2.06092	-.743339
40	319.496	116.287	68.5929	1.73016	199.4	-1.63154	-.575775
41	319.496	116.287	74.8286	1.22853	199.1	-1.16119	-.401149
42	319.496	116.287	81.0643	.678951	198.7	-.643164	-.21752
END	319.496	116.287	87.3	0	0	0	0
GND	479.243	174.43	0	10.7099	4.	10.6836	.750214
44	479.243	174.43	6.19286	10.7299	2.6	10.7189	.484851
45	479.243	174.43	12.3857	10.6002	1.7	10.5955	.313789
46	479.243	174.43	18.5786	10.3398	1.	10.3383	.173977
47	479.243	174.43	24.7714	9.95324	.3	9.95307	.0580758
48	479.243	174.43	30.9643	9.44484	359.8	9.44477	-.0366716
49	479.243	174.43	37.1571	8.81953	359.3	8.81882	-.111419
50	479.243	174.43	43.35	8.08295	358.8	8.08123	-.166705
51	479.243	174.43	49.5429	7.24134	358.4	7.2385	-.202811
52	479.243	174.43	55.7357	6.30113	358.	6.29729	-.219902
53	479.243	174.43	61.9286	5.26825	357.6	5.26373	-.218065
54	479.243	174.43	68.1214	4.14681	357.3	4.14212	-.197252
55	479.243	174.43	74.3143	2.93555	356.9	2.93135	-.157049
56	479.243	174.43	80.5071	1.61778	356.6	1.61493	-.0959466
END	479.243	174.43	86.7	0	0	0	0
GND	638.991	232.574	0	5.61156	180.	-5.61156	2.9E-03
58	638.991	232.574	6.18571	5.67175	178.6	-5.67009	.137226
59	638.991	232.574	12.3714	5.636	177.7	-5.63159	.222865
60	638.991	232.574	18.5571	5.52341	177.	-5.51591	.287784
61	638.991	232.574	24.7429	5.33771	176.4	-5.32714	.335709
62	638.991	232.574	30.9286	5.08172	175.8	-5.06837	.368039
63	638.991	232.574	37.1143	4.75837	175.4	-4.74273	.385422
64	638.991	232.574	43.3	4.37087	174.9	-4.35359	.388243
65	638.991	232.574	49.4857	3.92273	174.5	-3.90459	.376793
66	638.991	232.574	55.6714	3.41759	174.1	-3.39948	.351328
67	638.991	232.574	61.8571	2.85889	173.7	-2.84181	.312065
68	638.991	232.574	68.0429	2.24919	173.4	-2.23421	.259105
69	638.991	232.574	74.2286	1.58835	173.1	-1.57668	.192195
70	638.991	232.574	80.4143	.868099	172.7	-.861106	.109962
END	638.991	232.574	86.6	0	0	0	0
GND	263.224	89.3013	0	.709598	261.4	-.105839	-.70166
72	263.224	89.3013	6.07143	.465024	261.5	-.0691041	-.459861
73	263.224	89.3013	12.1429	.307719	261.4	-.0459392	-.30427
74	263.224	89.3013	18.2143	.179064	261.2	-.0274605	-.176946
75	263.224	89.3013	24.2857	.0722848	260.	-.012587	-.0711805
76	263.224	89.3013	30.3571	.0155803	93.1	-8.5E-04	.0155571
77	263.224	89.3013	36.4286	.0847072	84.6	8.02E-03	.0843263
78	263.224	89.3013	42.5	.136374	84.	.0142505	.135627
79	263.224	89.3013	48.5714	.170685	83.9	.0180402	.169729
80	263.224	89.3013	54.6429	.187829	84.	.0196103	.186802
81	263.224	89.3013	60.7143	.187934	84.1	.0191859	.186952
82	263.224	89.3013	66.7857	.171015	84.3	.0169844	.170169
83	263.224	89.3013	72.8571	.136756	84.5	.0131828	.136119
84	263.224	89.3013	78.9286	.0838638	84.6	7.84E-03	.0834962
END	263.224	89.3013	85.	0	0	0	0
GND	378.681	99.2039	0	.50602	27.8	.447636	.235962
86	378.681	99.2039	6.07143	.331316	27.9	.292928	.154801
87	378.681	99.2039	12.1429	.218263	28.	.192797	.102314
88	378.681	99.2039	18.2143	.125113	28.2	.110272	.0591034
89	378.681	99.2039	24.2857	.0471079	29.2	.0411344	.0229589
90	378.681	99.2039	30.3571	.0175528	203.2	-.0161326	-6.92E-03
91	378.681	99.2039	36.4286	.0692987	206.4	-.0620709	-.0308142

92	378.681	99.2039	42.5	.108441	206.8	-.0968273	-.048826
93	378.681	99.2039	48.5714	.134919	206.9	-.120363	-.0609571
94	378.681	99.2039	54.6429	.14859	206.9	-.13254	-.0671717
95	378.681	99.2039	60.7143	.149234	206.9	-.133143	-.0674073
96	378.681	99.2039	66.7857	.136519	206.8	-.121851	-.0615601
97	378.681	99.2039	72.8571	.109838	206.7	-.098095	-.0494148
98	378.681	99.2039	78.9286	.0677995	206.7	-.0605946	-.0304149
END	378.681	99.2039	85.	0	0	0	0
GND	420.568	161.694	0	.699191	81.8	.0994493	.692082
100	420.568	161.694	6.07143	.458303	81.8	.065405	.453612
101	420.568	161.694	12.1429	.303593	81.5	.0450729	.300228
102	420.568	161.694	18.2143	.177313	80.3	.0300003	.174757
103	420.568	161.694	24.2857	.0730587	74.9	.0190064	.0705431
104	420.568	161.694	30.3571	.0188108	307.4	.0114244	-.0149442
105	420.568	161.694	36.4286	.083052	274.6	6.72E-03	-.0827801
106	420.568	161.694	42.5	.133544	271.9	4.34E-03	-.133473
107	420.568	161.694	48.5714	.167328	271.3	3.72E-03	-.167286
108	420.568	161.694	54.6429	.184411	271.3	4.25E-03	-.184362
109	420.568	161.694	60.7143	.184835	271.6	5.25E-03	-.18476
110	420.568	161.694	66.7857	.168518	272.1	6.07E-03	-.168409
111	420.568	161.694	72.8571	.135036	272.6	6.02E-03	-.134902
112	420.568	161.694	78.9286	.0829863	273.1	4.44E-03	-.0828673
END	420.568	161.694	85.	0	0	0	0

APPENDIX C

DETUNED TOWER MODEL

ELECTRICAL DESCRIPTION - UNMODIFIED 85 DEGREE TOWER STRUCTURE
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.26	0	1	.0168651	.0168651

Plane wave source

zenith angle (deg)	= 90
increment (deg)	= 0
number of angles	= 1
azimuth angle (deg)	= 0
increment (deg)	= 0
number of angles	= 1
polarization angle (deg)	= 0
magnitude (v/m)	= 1

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	1.	0	.067	0	0

GEOMETRY - UNMODIFIED TOWER STRUCTURE
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	14
		0	0	85.		

Number of wires = 1
current nodes = 14

Individual wires	minimum wire	minimum value	maximum wire	maximum value
segment length	1	6.07143	1	6.07143
radius	1	.2183	1	.2183

PEAK CURRENTS - UNMODIFIED 85 DEGREE TOWER STRUCTURE
Frequency = 1.26 MHz
Plane wave zenith (deg) = 90
Plane wave azimuth (deg) = 0
Polarization angle (deg) = 0
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	.139432	270.2	5.08E-04	-.139431
2	0	0	6.07143	.0912884	270.3	4.22E-04	-.0912874
3	0	0	12.1429	.0601257	270.3	3.63E-04	-.0601246
4	0	0	18.2143	.034443	270.5	3.12E-04	-.0344416
5	0	0	24.2857	.0129334	271.2	2.66E-04	-.0129307
6	0	0	30.3571	4.88E-03	87.4	2.23E-04	4.88E-03
7	0	0	36.4286	.019144	89.4	1.84E-04	.0191431

8	0	0	42.5	.0299196	89.7	1.49E-04	.0299192
9	0	0	48.5714	.0371977	89.8	1.17E-04	.0371975
10	0	0	54.6429	.040945	89.9	8.9E-05	.0409449
11	0	0	60.7143	.0411081	89.9	6.45E-05	.041108
12	0	0	66.7857	.0376013	89.9	4.35E-05	.0376013
13	0	0	72.8571	.03026	90.	2.6E-05	.03026
14	0	0	78.9286	.0186922	90.	1.18E-05	.0186922
END	0	0	85.	0	0	0	0