LAW OFFICES

ORIGINAL

2019 APR 15 PM 2:5

JEROLD L. JACOBS
1629 K STREET, N.W. SUITE 300
WASHINGTON, D.C. 20006
TELEPHONE: 202-508-3383
FACSIMILE: 202-331-3759
E-MAIL: **jerold.jacobs.esq@verizon.net**

IRVING JACOBS (1910-1986)

April 15, 2019

Accepted / Filed

APR 15 2019

Federal Communications Commission
Office of the Secretary

VIA HAND DELIVERY

Marlene H. Dortch, Secretary
Federal Communications Commission
Portals II, Filing Center, TW-A325
Washington, D.C. 20554

Re: Radio Vision Cristiana Management (FRN 0005-0749-68)
Station WWRV(AM), New York NY (Fac. ID #54874)
File No. BP-20131104AQW
Form 302-AM License Application

Dear Ms. Dortch:

Enclosed for filing, on behalf of our client, Radio Vision Cristiana Management ("Radio Vision"), licensee of Station WWRV(AM), New York, New York, are an original and two (2) copies of a Form 302-AM license application to cover construction of File No. BP-20131104AQW.

No filing fee is included herewith because Radio Vision is a nonprofit educational organization, operating WWRV as a noncommercial educational AM station.

Please direct any communications or inquiries concerning this matter to the undersigned.

Sincerely

Jerold L. Jacobs

Enclosure

cc: Jerome Manarchuck (FCC via e-mail)
<Jerome.Manarchuck@fcc.gov>

Federal Communications Commission
Washington, D. C. 20554

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

ORIGINAL Accepted / Filed

APR 15 2019

Federal Communications Commission
Office of the Secretary

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.

FOR COMMISSION USE ONLY
FILE NO. BMML-20190415ABH

SECTION I - APPLICANT FEE INFORMATION

1. PAYOR NAME (Last, First, Middle Initial)
RADIO VISION CRISTIANA MANAGEMENT

MAILING ADDRESS (Line 1) (Maximum 35 characters)
P.O. BOX 2908

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
PATERSON	NEW JERSEY	07509

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
973-881-8700	WWRV	FAC ID 54874

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
	0001	$	

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
	0001	$	

	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.	$	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT RADIO VISION CRISTIANA MANAGEMENT		
MAILING ADDRESS P.O. BOX 2908		
CITY PATERSON	STATE NEW JERSEY	ZIP CODE 07509

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
WWRV	NEW YORK, NY	BP-20131104AQW		05/19/2019

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.

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

☐ Yes ☑ No

If Yes, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☐ No

☐ Does not apply

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☑ No

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

Exhibit No.

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

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

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

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

CERTIFICATION

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

☑ Yes ☐ No

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

Name	Signature	
DR. JOSE MARTINEZ		
Title	Date	Telephone Number
PRESIDENT	04/12/2019	973-818-8700

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
RADIO VISION CRISTIANA MANAGEMENT

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
WWRV	BP-20131104AQW	1330	UNLIMITED	3.8	10.0

2. Station location

State	City or Town
NEW YORK	NEW YORK

3. Transmitter location

State	County	City or Town	Street address (or other identification)
NJ	BERGEN	RIDGEFIELD PARK	END OF BIRCH STREET

4. Main studio location

State	County	City or Town	Street address (or other identification)
NJ	PASSAIC	Paterson	419 Broadway

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

State	County	City or Town	Street address (or other identification)
NJ	PASSAIC	Paterson	419 Broadway

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

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

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

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
9	14.5

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	-J 8	-J 8

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1 SE	+75.5	-88.0	0.436	0.661		
2 SC	-152.4	0.0	1.092	1.000		
3 NC	0.0	+115.2	1.000	0.928		
4 NW	+150.2	-116.9	0.362	0.835		

Manufacturer and type of antenna monitor: Gorman Redlich CMR

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.
Guyed Towers	87.8	89.0	89.9	Exhibit No. See Eng.

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 °	50 '	42 "	West Longitude	74 °	01 '	12 "

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

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

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

N/A

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

No Changes

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 I
Clarence M. Beverage	
Address (include ZIP Code)	Date
Communications Technologies, Inc. P.O. Box 1130 Marlton, NJ 08053	04/12/2019
	Telephone No. (Include Area Code) 609-451-5296

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☑ Other (specify) Broadcast Engineering Consultant

ENGINEERING STATEMENT

APPLICATION FOR MOMENT METHOD MODELING LICENSED OPERATION

WWRV, 1330 kHz

10 kW DAY, 3.8 kW NIGHT

NEW YORK, NEW YORK

TABLE OF CONTENTS

APRIL 2019

ENGINEERING STATEMENT

APPLICATION FOR MOMENT METHOD MODELING LICENSED OPERATION

WWRV, 1330 kHz

10 kW DAY, 3.8 kW NIGHT

NEW YORK, NEW YORK

APRIL 2019

SUMMARY

The following engineering statement has been prepared on behalf of **Radio Vision Cristiana Management Corp** ("RVC") licensee of standard broadcast station WWRV. The construction of the WWRV facilities described herein were permitted under FCC File Number BP-20131104AQW. This document includes MOM based performance verification for the DA-2 directional antenna system operation.

The applicant requests authorization to operate the WWRV antenna system using computer modeling and sample system verification as provided for in the Second Report and Order in MM Docket No. 93-177 released September 26, 2008 pending grant of the license application submitted herein. The rules specify that the directional antenna parameters be set to the operating parameters determined by the moment method without deviation. That operation has been completed and this statement is being submitted, along with Section III of FCC Form 302-AM, specifying the calculated MoM parameters for licensed operation.

This facility is diplexed with WZRC(AM) which filed its MoM license application under BMML-20180417AAZ and that application was granted on October 9, 2018. All of the measurements and adjustments were done for the WWRV array in combination with the WZRC measurements. WWRV elected to not file its license application until some finishing touches were made to its phasing system out of an abundance of caution in not wanting to have to modify the license at a later date. At this time it is hoped that the FCC will implement allocation changes in the AM Improvement Proceeding that will allow the station to implement 10 kW nighttime using the current authorized operating parameters.

METHOD OF MOMENTS MODEL – SELF IMPEDANCE ANALYSIS

In an effort to model the antenna system as accurately as possible, detailed mechanical data was obtained from the licensee and FCC tower registration data and is summarized below:

Four identical uniform triangular cross-section towers, each 87.78 M of steel with a .610 M face width, and each top loaded with 35° (21.9 M) of the top level of guy wires. The tower registration numbers are 1054298, 1058315, 1054299, and 1058316. These towers are also used by WZRC, 1480 kHz, New York.

MoM calculated values were undertaken by Kurt Gorman of Phasetek using Expert Mininec Broadcast Professional Version 23. The circuit analysis software employed to check circuit models is WCAP Professional Version 1.1.10.

The wire model data are compiled in Table 1. The values there comply with the 73.151 requirement that the radius of the wire model cylinder be within 80 and 150 percent of the radius of a circle with a circumference equal to the sum of the faces, that the height be between 75 and 125 percent of the physical length and that no segment be greater than 10 electrical degrees.

Table 2 is a summary of measured and calculated self-impedance, circuit model data and calculated tolerances. The tower measured base self-impedances, with all other towers floating, as measured at the connection point of the voltage sample devices, are listed in Table 2. All tower base impedance measurements were taken with a Delta Electronics OIB-3 calibrated with known loads. The Mininec tower models for self-impedance determination, with all other towers floating, may be found in *Exhibit I*. A circuit model has been constructed for each tower to account for shunt and series reactance across the tower base. All calculations have been made employing WCAP Professional version 1.1.10 as seen in *Figures 1&2* for self-impedance. The measured and calculated self-impedance values are well within the tolerance specified in 73.151(c)(2)(ii) as seen in Table 2.

METHOD OF MOMENTS MODEL – BASE OPERATING PARAMETERS

The modeled tower array was employed, as constructed for the derivation of self-impedance, for the determination of DA-1 directional operating parameters. The FCC theoretical values were converted to base excitation values. The base driving point parameters for the DA-1 directional array are on *Exhibit II page 4*. Table(s) 5 Day and Night summarizes the Mininec voltage source values for each tower base.

The calculated base operating parameters and the phase monitor parameters as adjusted and reflected on

Form 302-AM, attached, are found on Tables 3 and 4, Day and Night. Due to the tower height base voltage sampling is employed. The calculated MoM base operating parameters are found on *Exhibit II* for the DA-1 directional operation.

DIRECT MEASUREMENT OF POWER

Common point impedance as measured, and common point currents, are listed in Table 5. This data is found on Section III FCC Form 302-AM attached.

SAMPLING SYSTEM

The sampling system equipment is summarized in Table 6. Phasetek voltage sampling devices, model P600-206-3, serial numbers 1330-1 through 1330-4, were tested for accuracy at the factory using a Hewlett Packard 8753ES vector network analyzer. The factory calibration accuracy is 2% in amplitude and 2 degrees in phase. The sample devices were then measured when connected to the phase monitor with coax jumpers having exact equal electrical length.

The sampling device accuracy is well within the manufacturer tolerance of ±2% in magnitude and ±2 degrees in phase. Phase monitor accuracy was confirmed by feeding the tower inputs through a "T" and two equal length jumpers to confirm equal magnitude and phase on each tower. There were no observable errors.

Impedance and electrical length for each of the sample lines were measured. The lines are equal length RFS LCF12-50J foam coaxial cable. The measurement was made at the transmitter building with the sample lines unterminated on the tuning unit end. The results are in Table 7.

It may be seen that the sample lines are essentially equal in length at the specified frequencies. The sample system meets the rule requirement that the sample lines be equal to within one degree.

The impedance of the sample lines was determined by measuring the open circuit impedance 45 degrees above and below the resonant length of the sample lines. The impedance is determined using the formula:

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

The results are tabulated in Table 8. The characteristic impedance of the transmission lines is within the allowable tolerance of 2 ohms.

Sampling system impedance was measured with each of the sampling lines terminated in its respective voltage sampling device. Impedance was measured by connecting each sample line directly to the measurement device. Measurement of sample system impedance was made with a HP 8753ES VNA and a Tunwall directional coupler.

GROUND SYSTEM

The ground system consists of 120 equally-spaced, buried, copper wire radials, around the base of each tower, each 32 to 91 meters in length except where foreshortened where intersecting radials are shortened and bonded to a transverse copper strap midway between adjacent towers. A 18.3 meter square ground screen is centered on each tower base.

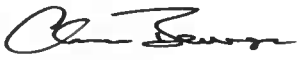
REFERENCE FIELD STRENGTH MEASUREMENTS

Reference field strength measurements were taken by Broadcast Engineer Charles A. Hecht using a Potomac Instruments FIM-41, serial number 2065, last calibrated by the factory 2/25/2010, and recently checked against a meter of recent calibration. The measurement data appears in *Appendix 1*.

CONCLUSION

All adjustments, measurements and field work were undertaken under the direction of the affiant.

The foregoing was prepared on behalf of **Radio Vision Cristiana Management Corp** by Clarence M. Beverage of *Communications Technologies, Inc.*, Marlton, New Jersey, whose qualifications are a matter of record with the Federal Communications Commission. The statements herein are true and correct of his own knowledge, except such statements made on information and belief, and as to these statements he believes them to be true and correct.



/s/ Clarence M. Beverage
for Communications Technologies, Inc.
Marlton, New Jersey

April 12, 2019

EXHIBIT I

WWRV TOWER 1 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0157705	.0178357

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	43	0	-15,659.	0	0	0
2	85	0	-15,662.5	0	0	0
3	127	0	-15,683.2	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.33	318.03	-525.8	614.5	301.2	23.862	-.72842	-8.1131

WWRV TOWER 2 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0157705	.0178357

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-15,697.	0	0	0
2	85	0	-15,662.5	0	0	0
3	127	0	-15,683.2	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 43, sector 1							
1.33	207.5	-589.46	624.91	289.4	37.855	-.45901	-9.9871

WWRV TOWER 3 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0157705	.0178357

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-15,697.	0	0	0
2	43	0	-15,659.	0	0	0
3	127	0	-15,683.2	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 85, sector 1							
1.33	197.66	-567.01	600.48	289.2	36.709	-.47335	-9.8606

WWRV TOWER 4 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0157705	.0178357

Sources

source	node	sector	magnitude	phase	type
1	127	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-15,697.	0	0	0
2	43	0	-15,659.	0	0	0
3	85	0	-15,662.5	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 127, sector 1							
1.33	286.69	-518.23	592.24	299.	24.603	-.70647	-8.2353

EXHIBIT II

WWRV DAY DA-D

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.33 MHz

tower	field ratio magnitude	phase (deg)
1	.419	32.3
2	.956	114.6
3	.974	-132.5
4	1.	0

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	1,637.86	107.2	4.37193	183.8
43	2,490.71	194.6	3.52444	263.1
85	2,283.17	310.1	2.67811	19.2
127	2,011.69	77.8	2.27884	128.

Sum of square of source currents = 87.8015
Total power = 10,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00102847	.00117516
Y(1, 2)	.000656009	-3.0406E-05
Y(1, 3)	7.4797E-05	-.00033565
Y(1, 4)	-.000173006	-6.389E-05
Y(2, 1)	.000656028	-3.0393E-05
Y(2, 2)	.001062	.00105634
Y(2, 3)	.000747882	-1.7213E-05
Y(2, 4)	7.2736E-05	-.000327178
Y(3, 1)	7.4807E-05	-.000335657
Y(3, 2)	.00074788	-1.721E-05
Y(3, 3)	.00106249	.00111568
Y(3, 4)	.000639573	-3.6426E-05
Y(4, 1)	-.000173009	-6.3894E-05
Y(4, 2)	7.2734E-05	-.000327176
Y(4, 3)	.00063958	-3.6417E-05
Y(4, 4)	.000978344	.00127053

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	314.616	-530.304
Z(1, 2)	98.9218	282.611
Z(1, 3)	6.85863	-68.5711
Z(1, 4)	-12.8068	.554019
Z(2, 1)	98.9246	282.6
Z(2, 2)	198.67	-599.912
Z(2, 3)	127.654	340.176
Z(2, 4)	8.79723	-61.5852
Z(3, 1)	6.85721	-68.5688
Z(3, 2)	127.654	340.176
Z(3, 3)	188.995	-576.397

Z(3, 4)	106.554	251.193
Z(4, 1)	-12.8066	.553436
Z(4, 2)	8.79909	-61.5822
Z(4, 3)	106.555	251.189
Z(4, 4)	283.443	-521.558

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.33	0	1	.0157705	.0178357

Sources

source	node	sector	magnitude	phase	type
1	1	1	2,316.28	107.2	voltage
2	43	1	3,522.4	194.6	voltage
3	85	1	3,228.89	310.1	voltage
4	127	1	2,844.96	77.8	voltage

C:\Users\kurtg\Desktop\ENGINEER\WWRVMOM\WWRVDAY 12-22-2017 13:56:36

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.33	86.985	-364.39	374.63	283.4	32.814	-.52957	-9.4007
source = 2; node 43, sector 1							
1.33	259.03	-657.51	706.7	291.5	38.728	-.44866	-10.081
source = 3; node 85, sector 1							
1.33	304.4	-796.33	852.53	290.9	47.897	-.36274	-10.962
source = 4; node 127, sector 1							
1.33	565.48	-677.88	882.77	309.8	27.614	-.62936	-8.6997

C:\Users\kurtg\Desktop\ENGINEER\WWRVMOM\WWRVDAY 12-22-2017 13:56:36

CURRENT rms
Frequency = 1.33 MHz
Input power = 10,000. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.37191	183.8	-4.36226	-.290296
2	0	0	6.42083	2.93854	177.1	-2.93482	.147699
3	0	0	12.8417	2.08242	168.6	-2.04155	.410568
4	0	0	19.2625	1.39851	153.	-1.24661	.633862
5	0	0	25.6833	.976389	121.9	-.516567	.82855
6	0	0	32.1042	1.01242	80.8	.161591	.999443
7	0	0	38.525	1.39465	55.4	.791158	1.14852
8	0	0	44.9458	1.87385	42.9	1.37162	1.2767
9	0	0	51.3667	2.3515	36.1	1.90074	1.38446
10	0	0	57.7875	2.79475	31.8	2.37561	1.47211
11	0	0	64.2083	3.18953	28.9	2.79315	1.53995
12	0	0	70.6292	3.5282	26.8	3.15048	1.58829
13	0	0	77.05	3.80597	25.2	3.44513	1.61755
14	0	0	83.4708	4.01978	23.9	3.67524	1.62826
15	0	0	89.8917	4.16791	22.9	3.83973	1.62111
16	0	0	96.3125	4.25001	22.1	3.93854	1.59703
17	0	0	102.733	4.26732	21.4	3.97301	1.55732

18	0	0	109.154	4.22347	20.9	3.94663	1.50394
19	0	0	115.575	4.12609	20.4	3.8666	1.44015
20	0	0	121.996	3.98851	20.1	3.74544	1.3711
21	0	0	128.417	3.82341	19.9	3.59516	1.30126
22	0	0	134.838	3.63139	19.8	3.41673	1.23003
23	0	0	141.258	3.4071	19.8	3.20555	1.15446
24	0	0	147.679	3.14603	19.9	2.9577	1.07216
J1	0	0	154.1	2.79305	20.2	2.62058	.966276
2J1	0	0	154.1	.934659	17.8	.890153	.284982
26	2.13562	-.45394	148.683	.837435	17.9	.797091	.256795
27	4.27125	-.90788	143.267	.699903	18.	.66565	.216273
28	6.40687	-1.36182	137.85	.544173	18.2	.517054	.169644
29	8.54249	-1.81576	132.433	.376267	18.3	.357138	.118444
30	10.6781	-2.2697	127.017	.197762	18.5	.187491	.0629046
END	12.8137	-2.72364	121.6	0	0	0	0
2J1	0	0	154.1	.927062	23.6	.849374	.371493
32	-1.47036	-1.5226	148.683	.832705	24.2	.759572	.341245
33	-2.94072	-3.04521	143.267	.697969	24.9	.632846	.294392
34	-4.41108	-4.56781	137.85	.544519	25.8	.490308	.236853
35	-5.88144	-6.09041	132.433	.378041	26.7	.337778	.169769
36	-7.3518	-7.61301	127.017	.19967	27.7	.176861	.0926732
END	-8.82216	-9.13562	121.6	0	0	0	0
2J1	0	0	154.1	.933933	19.4	.881053	.309801
38	-.601808	2.09876	148.683	.837031	19.6	.788464	.280971
39	-1.20362	4.19751	143.267	.699828	19.9	.657876	.238661
40	-1.80542	6.29626	137.85	.544371	20.3	.51052	.188969
41	-2.40723	8.39502	132.433	.376619	20.7	.352251	.133269
42	-3.00904	10.4938	127.017	.19808	21.2	.184708	.0715463
END	-3.61085	12.5925	121.6	0	0	0	0
GND	75.3965	48.9631	0	3.52442	263.1	-.425879	-3.4986
44	75.3965	48.9631	6.04167	1.68508	234.7	-.974801	-1.3745
45	75.3965	48.9631	12.0833	1.30377	183.8	-1.30092	-.0862145
46	75.3965	48.9631	18.125	1.89121	146.6	-1.57941	1.04025
47	75.3965	48.9631	24.1667	2.74803	131.6	-1.82365	2.05571
48	75.3965	48.9631	30.2083	3.61266	124.4	-2.03952	2.98189
49	75.3965	48.9631	36.25	4.42795	120.2	-2.22914	3.82592
50	75.3965	48.9631	42.2917	5.1758	117.5	-2.39325	4.58925
51	75.3965	48.9631	48.3333	5.84736	115.7	-2.53192	5.27077
52	75.3965	48.9631	54.375	6.43683	114.3	-2.64502	5.86828
53	75.3965	48.9631	60.4167	6.93981	113.2	-2.73238	6.37927
54	75.3965	48.9631	66.4583	7.35295	112.3	-2.7939	6.80147
55	75.3965	48.9631	72.5	7.67388	111.6	-2.82964	7.13313
56	75.3965	48.9631	78.5417	7.90122	111.1	-2.83994	7.37319
57	75.3965	48.9631	84.5833	8.03505	110.6	-2.82543	7.5219
58	75.3965	48.9631	90.625	8.07674	110.2	-2.78718	7.58059
59	75.3965	48.9631	96.6667	8.02999	109.9	-2.72689	7.5528
60	75.3965	48.9631	102.708	7.90122	109.6	-2.64708	7.44461
61	75.3965	48.9631	108.75	7.7005	109.4	-2.5515	7.2655
62	75.3965	48.9631	114.792	7.44163	109.2	-2.44496	7.02852
63	75.3965	48.9631	120.833	7.13751	109.1	-2.3317	6.7459
64	75.3965	48.9631	126.875	6.79427	109.	-2.2134	6.42362
65	75.3965	48.9631	132.917	6.41186	109.	-2.0894	6.06188
66	75.3965	48.9631	138.958	5.98671	109.1	-1.95786	5.65751
J5	75.3965	48.9631	145.	5.48409	109.3	-1.80825	5.1774
2J1	75.3965	48.9631	145.	1.83506	107.8	-.562317	1.74678
68	78.1087	47.7492	139.967	1.65045	107.9	-.508241	1.57025

69	80.8208	46.5353	134.933	1.39103	108.1	-.431098	1.32254
70	83.533	45.3214	129.9	1.09217	108.2	-.340858	1.03761
71	86.2452	44.1075	124.867	.762862	108.3	-.239854	.724174
72	88.9573	42.8936	119.833	.405233	108.5	-.128402	.384352
END	91.6695	41.6797	114.8	0	0	0	0
2J1	75.3965	48.9631	145.	1.83223	111.8	-.680238	1.70127
74	72.978	47.2077	139.967	1.64786	112.2	-.622408	1.5258
75	70.5596	45.4523	134.933	1.38929	112.7	-.535846	1.28179
76	68.1411	43.697	129.9	1.09152	113.2	-.430252	1.00314
77	65.7226	41.9416	124.867	.763158	113.8	-.307539	.698448
78	63.3042	40.1862	119.833	.405929	114.3	-.167287	.369856
END	60.8857	38.4309	114.8	0	0	0	0
2J1	75.3965	48.9631	145.	1.81952	108.1	-.565699	1.72935
80	75.0738	51.8886	139.967	1.63671	108.2	-.511911	1.55459
81	74.7511	54.8141	134.933	1.37942	108.4	-.434777	1.30911
82	74.4283	57.7397	129.9	1.08301	108.5	-.344233	1.02684
83	74.1056	60.6652	124.867	.756437	108.7	-.242573	.716488
84	73.7829	63.5907	119.833	.40181	108.9	-.130051	.380181
END	73.4602	66.5163	114.8	0	0	0	0
GND	150.709	97.8716	0	2.6781	19.2	2.52975	.878967
86	150.709	97.8716	6.12083	1.06691	336.6	.979376	-.423235
87	150.709	97.8716	12.2417	1.21251	271.6	.0334772	-1.21205
88	150.709	97.8716	18.3625	2.05825	247.3	-.795931	-1.89812
89	150.709	97.8716	24.4833	2.94997	238.4	-1.54576	-2.51256
90	150.709	97.8716	30.6042	3.79398	234.	-2.23141	-3.0684
91	150.709	97.8716	36.725	4.5727	231.3	-2.85767	-3.56978
92	150.709	97.8716	42.8458	5.27926	229.5	-3.42515	-4.01734
93	150.709	97.8716	48.9667	5.90892	228.3	-3.93258	-4.41023
94	150.709	97.8716	55.0875	6.45757	227.3	-4.37795	-4.74696
95	150.709	97.8716	61.2083	6.92161	226.6	-4.75902	-5.02597
96	150.709	97.8716	67.3292	7.29808	226.	-5.07373	-5.24588
97	150.709	97.8716	73.45	7.58479	225.5	-5.32044	-5.40574
98	150.709	97.8716	79.5708	7.78054	225.	-5.49816	-5.50519
99	150.709	97.8716	85.6917	7.88534	224.7	-5.60669	-5.5447
100	150.709	97.8716	91.8125	7.90074	224.4	-5.64695	-5.52573
101	150.709	97.8716	97.9333	7.83032	224.1	-5.62132	-5.45112
102	150.709	97.8716	104.054	7.68061	223.9	-5.53428	-5.32575
103	150.709	97.8716	110.175	7.46221	223.7	-5.39325	-5.15727
104	150.709	97.8716	116.296	7.18998	223.6	-5.20878	-4.95625
105	150.709	97.8716	122.417	6.87833	223.5	-4.99118	-4.73282
106	150.709	97.8716	128.538	6.53363	223.4	-4.7452	-4.49125
107	150.709	97.8716	134.658	6.15468	223.4	-4.47029	-4.23045
108	150.709	97.8716	140.779	5.73695	223.5	-4.16347	-3.94691
J9	150.709	97.8716	146.9	5.24128	223.6	-3.7958	-3.61427
2J1	150.709	97.8716	146.9	1.80702	224.9	-1.27987	-1.27565
110	150.709	94.9206	141.867	1.62787	225.2	-1.14795	-1.15419
111	150.708	91.9695	136.833	1.37562	225.5	-.964852	-.980507
112	150.707	89.0184	131.8	1.08338	225.8	-.755556	-.776436
113	150.707	86.0673	126.767	.759293	226.1	-.526421	-.547181
114	150.706	83.1162	121.733	.404822	226.4	-.278965	-.293359
END	150.705	80.1651	116.7	0	0	0	0
2J1	150.709	97.8716	146.9	1.65682	224.7	-1.1784	-1.16465
116	148.433	99.1823	141.867	1.49627	224.9	-1.06007	-1.05598
117	146.157	100.493	136.833	1.26545	225.2	-.892126	-.897479
118	143.881	101.804	131.8	.997001	225.5	-.699185	-.710739
119	141.605	103.114	126.767	.698986	225.8	-.48752	-.500904

120	139.329	104.425	121.733	.372823	226.1	-.258566	-.26859
END	137.053	105.736	116.7	0	0	0	0
2J1	150.709	97.8716	146.9	1.77966	221.3	-1.33753	-1.17397
122	153.267	99.3481	141.867	1.60103	221.2	-1.20373	-1.05562
123	155.826	100.825	136.833	1.35064	221.2	-1.01587	-.890082
124	158.384	102.301	131.8	1.06174	221.2	-.798852	-.699369
125	160.942	103.778	126.767	.742623	221.2	-.558949	-.488942
126	163.5	105.254	121.733	.395056	221.2	-.297457	-.259978
END	166.058	106.73	116.7	0	0	0	0
GND	226.106	146.835	0	2.27883	128.	-1.40161	1.79682
128	226.106	146.835	6.29583	1.45926	75.4	.367025	1.41235
129	226.106	146.835	12.5917	1.86527	38.9	1.45065	1.17253
130	226.106	146.835	18.8875	2.58224	21.8	2.39771	.958608
131	226.106	146.835	25.1833	3.33824	13.2	3.25026	.761375
132	226.106	146.835	31.4792	4.06645	8.2	4.02531	.576983
133	226.106	146.835	37.775	4.74512	4.9	4.72787	.404192
134	226.106	146.835	44.0708	5.3638	2.6	5.3583	.242772
135	226.106	146.835	50.3667	5.91561	.9	5.91488	.0929631
136	226.106	146.835	56.6625	6.3953	359.6	6.39514	-.0447805
137	226.106	146.835	62.9583	6.79861	358.6	6.79649	-.169914
138	226.106	146.835	69.2542	7.12224	357.7	7.11666	-.281881
139	226.106	146.835	75.55	7.36378	357.	7.35396	-.380155
140	226.106	146.835	81.8458	7.52196	356.5	7.50761	-.464279
141	226.106	146.835	88.1417	7.59661	356.	7.57783	-.533886
142	226.106	146.835	94.4375	7.58932	355.6	7.56645	-.588741
143	226.106	146.835	100.733	7.50339	355.2	7.477	-.62878
144	226.106	146.835	107.029	7.34483	354.9	7.31564	-.65418
145	226.106	146.835	113.325	7.12355	354.6	7.0924	-.665463
146	226.106	146.835	119.621	6.8534	354.4	6.8212	-.663572
147	226.106	146.835	125.917	6.5488	354.3	6.51649	-.649671
148	226.106	146.835	132.213	6.21721	354.2	6.18575	-.624666
149	226.106	146.835	138.508	5.85833	354.2	5.82864	-.589072
150	226.106	146.835	144.804	5.46804	354.3	5.441	-.543125
J13	226.106	146.835	151.1	5.01406	354.5	4.99077	-.482801
2J1	226.106	146.835	151.1	1.65861	354.3	1.65055	-.163316
152	228.035	144.61	146.067	1.49876	354.5	1.49198	-.142373
153	229.964	142.386	141.033	1.27068	354.8	1.26544	-.11529
154	231.893	140.162	136.	1.00406	355.1	1.00031	-.0866076
155	233.822	137.937	130.967	.706032	355.3	.703672	-.0576784
156	235.751	135.713	125.933	.377692	355.6	.376569	-.0291008
END	237.68	133.489	120.9	0	0	0	0
2J1	226.106	146.835	151.1	1.69893	355.	1.69244	-.148341
158	223.191	146.366	146.067	1.53777	355.2	1.53245	-.12774
159	220.275	145.897	141.033	1.30653	355.5	1.30257	-.101692
160	217.36	145.428	136.	1.03478	355.9	1.03207	-.0748485
161	214.445	144.959	130.967	.729441	356.2	.727816	-.0486656
162	211.53	144.49	125.933	.391228	356.5	.390499	-.0238736
END	208.615	144.021	120.9	0	0	0	0
2J1	226.106	146.835	151.1	1.65664	354.1	1.64778	-.171143
164	227.123	149.643	146.067	1.49572	354.3	1.48821	-.149729
165	228.14	152.451	141.033	1.2671	354.5	1.26124	-.121777
166	229.157	155.259	136.	1.00047	354.7	.99624	-.0918805
167	230.174	158.067	130.967	.702985	355.	.700294	-.0614468
168	231.191	160.875	125.933	.37577	355.2	.374478	-.0311248
END	232.208	163.683	120.9	0	0	0	0

WWRV NIGHT DA-N

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.33 MHz

tower	field ratio magnitude	phase (deg)
1	.346	54.5
2	.995	-153.4
3	1.	0
4	.448	149.3

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	1,286.86	162.1	2.7186	271.3
43	3,255.07	292.8	3.70998	11.8
85	2,942.57	85.1	2.6906	157.2
127	1,035.98	235.6	.357459	290.5

Sum of square of source currents = 57.0437
Total power = 3,800. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00102847	.00117516
Y(1, 2)	.000656009	-3.0406E-05
Y(1, 3)	7.4797E-05	-.00033565
Y(1, 4)	-.000173006	-6.389E-05
Y(2, 1)	.000656028	-3.0393E-05
Y(2, 2)	.001062	.00105634
Y(2, 3)	.000747882	-1.7213E-05
Y(2, 4)	7.2736E-05	-.000327178
Y(3, 1)	7.4807E-05	-.000335657
Y(3, 2)	.00074788	-1.721E-05
Y(3, 3)	.00106249	.00111568
Y(3, 4)	.000639573	-3.6426E-05
Y(4, 1)	-.000173009	-6.3894E-05
Y(4, 2)	7.2734E-05	-.000327176
Y(4, 3)	.00063958	-3.6417E-05
Y(4, 4)	.000978344	.00127053

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	314.616	-530.304
Z(1, 2)	98.9218	282.611
Z(1, 3)	6.85863	-68.5711
Z(1, 4)	-12.8068	.554019
Z(2, 1)	98.9246	282.6
Z(2, 2)	198.67	-599.912
Z(2, 3)	127.654	340.176
Z(2, 4)	8.79723	-61.5852
Z(3, 1)	6.85721	-68.5688
Z(3, 2)	127.654	340.176
Z(3, 3)	188.995	-576.397
Z(3, 4)	106.554	251.193

Z(4, 1)	-12.8066	.553436
Z(4, 2)	8.79909	-61.5822
Z(4, 3)	106.555	251.189
Z(4, 4)	283.443	-521.558

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.4	24
		0	0	154.1		
2	none	0	0	154.1	.01	6
		13.1	12.	121.6		
3	none	0	0	154.1	.01	6
		12.7	134.	121.6		
4	none	0	0	154.1	.01	6
		13.1	254.	121.6		
5	none	89.9	327.	0	.4	24
		89.9	327.	145.		
6	none	89.9	327.	145.	.01	6
		100.7	335.55	114.8		
7	none	89.9	327.	145.	.01	6
		72.	327.74	114.8		
8	none	89.9	327.	145.	.01	6
		99.1	317.84	114.8		
9	none	179.7	327.	0	.4	24
		179.7	327.	146.9		
10	none	179.7	327.	146.9	.01	6
		170.7	331.99	116.7		
11	none	179.7	327.	146.9	.01	6
		173.1	322.35	116.7		
12	none	179.7	327.	146.9	.01	6
		197.4	327.27	116.7		
13	none	269.6	327.	0	.4	24
		269.6	327.	151.1		
14	none	269.6	327.	151.1	.01	6
		272.6	330.68	120.9		
15	none	269.6	327.	151.1	.01	6
		253.5	325.38	120.9		
16	none	269.6	327.	151.1	.01	6
		284.1	324.82	120.9		

Number of wires = 16
current nodes = 168

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	11	5.67737	1	6.42083
radius	2	.01	1	.4

ELECTRICAL DESCRIPTION
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum

1	1.33	0	1	.0157705	.0178357

Sources

source	node	sector	magnitude	phase	type
1	1	1	1,819.9	162.1	voltage
2	43	1	4,603.36	292.8	voltage
3	85	1	4,161.42	85.1	voltage
4	127	1	1,465.1	235.6	voltage

C:\Users\kurtg\Desktop\ENGINEER\WWRVMOM\WWRVNIGHT 12-22-2017 14:06:40

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.33	-155.56	-447.06	473.35	250.8	****	****	****
source = 2; node 43, sector 1							
1.33	167.06	-861.33	877.38	281.	92.448	-.18792	-13.732
source = 3; node 85, sector 1							
1.33	336.75	-1,040.5	1,093.7	287.9	71.171	-.2441	-12.624
source = 4; node 127, sector 1							
1.33	1,664.	-2,372.9	2,898.2	305.	100.98	-.17204	-14.107

C:\Users\kurtg\Desktop\ENGINEER\WWRVMOM\WWRVNIGHT 12-22-2017 14:06:40

CURRENT rms
Frequency = 1.33 MHz
Input power = 3,800. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	2.71857	271.3	.0601057	-2.71791
2	0	0	6.42083	1.65596	284.7	.420927	-1.60157
3	0	0	12.8417	1.11184	305.5	.645558	-.905227
4	0	0	19.2625	.891807	341.2	.844098	-.287783
5	0	0	25.6833	1.06144	15.1	1.02469	.276895
6	0	0	32.1042	1.43348	33.9	1.19021	.798922
7	0	0	38.525	1.85439	43.7	1.341	1.28082
8	0	0	44.9458	2.26836	49.4	1.47641	1.72211
9	0	0	51.3667	2.65405	53.1	1.5954	2.12102
10	0	0	57.7875	3.00096	55.6	1.69674	2.47525
11	0	0	64.2083	3.30265	57.4	1.77926	2.78239
12	0	0	70.6292	3.55472	58.8	1.84196	3.04026
13	0	0	77.05	3.75401	59.9	1.88403	3.247
14	0	0	83.4708	3.89847	60.7	1.90501	3.40132
15	0	0	89.8917	3.98705	61.5	1.90482	3.5026
16	0	0	96.3125	4.01984	62.1	1.88383	3.5511
17	0	0	102.733	3.99843	62.6	1.84312	3.54829
18	0	0	109.154	3.92662	63.	1.78478	3.49756
19	0	0	115.575	3.81195	63.3	1.71261	3.40557

20	0	0	121.996	3.66722	63.6	1.63281	3.28366
21	0	0	128.417	3.50436	63.7	1.55093	3.14248
22	0	0	134.838	3.32345	63.8	1.46666	2.98233
23	0	0	141.258	3.11881	63.8	1.37683	2.79845
24	0	0	147.679	2.88568	63.7	1.27886	2.58682
J1	0	0	154.1	2.57533	63.4	1.15278	2.30292
2J1	0	0	154.1	.895901	61.6	.425439	.788442
26	2.13562	-.45394	148.683	.809466	61.3	.389296	.709707
27	4.27125	-.90788	143.267	.684077	60.7	.334362	.596795
28	6.40687	-1.36182	137.85	.538453	60.2	.267752	.467163
29	8.54249	-1.81576	132.433	.377266	59.6	.190945	.325375
30	10.6781	-2.2697	127.017	.201114	59.	.103646	.172349
END	12.8137	-2.72364	121.6	0	0	0	0
2J1	0	0	154.1	.807296	66.1	.327271	.737984
32	-1.47036	-1.5226	148.683	.725088	66.	.294792	.662458
33	-2.94072	-3.04521	143.267	.607629	65.9	.247947	.554739
34	-4.41108	-4.56781	137.85	.473848	65.8	.194134	.432255
35	-5.88144	-6.09041	132.433	.328744	65.7	.135239	.299638
36	-7.3518	-7.61301	127.017	.173428	65.6	.0716276	.157945
END	-8.82216	-9.13562	121.6	0	0	0	0
2J1	0	0	154.1	.873495	62.7	.400065	.776492
38	-.601808	2.09876	148.683	.787775	62.4	.364708	.698268
39	-1.20362	4.19751	143.267	.664077	62.	.311695	.586383
40	-1.80542	6.29626	137.85	.521248	61.6	.248269	.458325
41	-2.40723	8.39502	132.433	.364102	61.1	.176061	.318705
42	-3.00904	10.4938	127.017	.193456	60.6	.0950064	.16852
END	-3.61085	12.5925	121.6	0	0	0	0
GND	75.3965	48.9631	0	3.70994	11.8	3.63162	.75827
44	75.3965	48.9631	6.04167	1.04732	340.5	.98713	-.349931
45	75.3965	48.9631	12.0833	1.18991	238.8	-.61661	-1.01768
46	75.3965	48.9631	18.125	2.57408	218.4	-2.01861	-1.59721
47	75.3965	48.9631	24.1667	3.90447	212.8	-3.28194	-2.11513
48	75.3965	48.9631	30.2083	5.13089	210.2	-4.43338	-2.58286
49	75.3965	48.9631	36.25	6.25077	208.7	-5.48151	-3.0042
50	75.3965	48.9631	42.2917	7.2623	207.7	-6.42779	-3.38001
51	75.3965	48.9631	48.3333	8.16232	207.	-7.27052	-3.70986
52	75.3965	48.9631	54.375	8.94695	206.5	-8.00661	-3.99276
53	75.3965	48.9631	60.4167	9.61227	206.1	-8.63267	-4.22762
54	75.3965	48.9631	66.4583	10.1549	205.8	-9.14567	-4.41349
55	75.3965	48.9631	72.5	10.5722	205.5	-9.54313	-4.54973
56	75.3965	48.9631	78.5417	10.8629	205.3	-9.82385	-4.63618
57	75.3965	48.9631	84.5833	11.0271	205.1	-9.9879	-4.67331
58	75.3965	48.9631	90.625	11.0674	204.9	-10.0374	-4.6624
59	75.3965	48.9631	96.6667	10.9887	204.8	-9.97687	-4.60584
60	75.3965	48.9631	102.708	10.8	204.7	-9.81438	-4.50762
61	75.3965	48.9631	108.75	10.5156	204.6	-9.56279	-4.37383
62	75.3965	48.9631	114.792	10.1544	204.5	-9.23936	-4.21252
63	75.3965	48.9631	120.833	9.73412	204.5	-8.86022	-4.03109
64	75.3965	48.9631	126.875	9.26342	204.4	-8.43327	-3.83286
65	75.3965	48.9631	132.917	8.74202	204.4	-7.95846	-3.61745
66	75.3965	48.9631	138.958	8.16502	204.5	-7.43146	-3.38247
J5	75.3965	48.9631	145.	7.48558	204.5	-6.80943	-3.10895
2J1	75.3965	48.9631	145.	2.5121	203.9	-2.29666	-1.01783
68	78.1087	47.7492	139.967	2.26228	203.9	-2.06775	-.917792
69	80.8208	46.5353	134.933	1.90972	204.	-1.74493	-.776054
70	83.533	45.3214	129.9	1.50193	204.	-1.37182	-.611469

71	86.2452	44.1075	124.867	1.05088	204.1	-.959475	-.428673
72	88.9573	42.8936	119.833	.559215	204.1	-.510365	-.22858
END	91.6695	41.6797	114.8	0	0	0	0
2J1	75.3965	48.9631	145.	2.48545	205.7	-2.23944	-1.07813
74	72.978	47.2077	139.967	2.23605	205.9	-2.01179	-.976021
75	70.5596	45.4523	134.933	1.88571	206.1	-1.69349	-.829454
76	68.1411	43.697	129.9	1.4818	206.3	-1.32814	-.657102
77	65.7226	41.9416	124.867	1.03608	206.6	-.926715	-.463311
78	63.3042	40.1862	119.833	.55103	206.8	-.491791	-.248546
END	60.8857	38.4309	114.8	0	0	0	0
2J1	75.3965	48.9631	145.	2.48881	204.	-2.27333	-1.01298
80	75.0738	51.8886	139.967	2.24145	204.1	-2.04672	-.913797
81	74.7511	54.8141	134.933	1.8919	204.1	-1.7268	-.772929
82	74.4283	57.7397	129.9	1.48766	204.2	-1.35721	-.60919
83	74.1056	60.6652	124.867	1.0407	204.2	-.948975	-.427212
84	73.7829	63.5907	119.833	.553691	204.3	-.504623	-.227881
END	73.4602	66.5163	114.8	0	0	0	0
GND	150.709	97.8716	0	2.69055	157.2	-2.48057	1.04204
86	150.709	97.8716	6.12083	.828672	81.8	.118399	.82017
87	150.709	97.8716	12.2417	1.82887	21.9	1.69675	.682496
88	150.709	97.8716	18.3625	3.124	10.3	3.07349	.559476
89	150.709	97.8716	24.4833	4.33356	5.9	4.31057	.445813
90	150.709	97.8716	30.6042	5.44447	3.6	5.43388	.339274
91	150.709	97.8716	36.725	6.45596	2.1	6.45153	.239138
92	150.709	97.8716	42.8458	7.36607	1.1	7.36464	.145291
93	150.709	97.8716	48.9667	8.17143	.4	8.17122	.0578979
94	150.709	97.8716	55.0875	8.86824	359.9	8.86821	-.0227402
95	150.709	97.8716	61.2083	9.45255	359.4	9.45206	-.0962636
96	150.709	97.8716	67.3292	9.92113	359.1	9.9198	-.162299
97	150.709	97.8716	73.45	10.2716	358.8	10.2692	-.220487
98	150.709	97.8716	79.5708	10.5025	358.5	10.4991	-.270507
99	150.709	97.8716	85.6917	10.6146	358.3	10.61	-.31209
100	150.709	97.8716	91.8125	10.6101	358.1	10.6045	-.345047
101	150.709	97.8716	97.9333	10.494	358.	10.4875	-.36929
102	150.709	97.8716	104.054	10.2755	357.9	10.2683	-.384881
103	150.709	97.8716	110.175	9.96895	357.7	9.96124	-.392093
104	150.709	97.8716	116.296	9.59447	357.7	9.58648	-.391443
105	150.709	97.8716	122.417	9.17137	357.6	9.16335	-.383555
106	150.709	97.8716	128.538	8.70816	357.6	8.70034	-.368888
107	150.709	97.8716	134.658	8.20292	357.6	8.19555	-.347696
108	150.709	97.8716	140.779	7.64937	357.6	7.64267	-.320067
J9	150.709	97.8716	146.9	6.99569	357.7	6.98996	-.283176
2J1	150.709	97.8716	146.9	2.4217	358.1	2.42035	-.0808107
110	150.709	94.9206	141.867	2.18478	358.2	2.18371	-.0682332
111	150.708	91.9695	136.833	1.84944	358.4	1.84869	-.0529534
112	150.707	89.0184	131.8	1.45913	358.5	1.45864	-.0378323
113	150.707	86.0673	126.767	1.02443	358.7	1.02415	-.0237547
114	150.706	83.1162	121.733	.547119	358.8	.547005	-.011174
END	150.705	80.1651	116.7	0	0	0	0
2J1	150.709	97.8716	146.9	2.21854	358.	2.21722	-.076474
116	148.433	99.1823	141.867	2.00632	358.1	2.00526	-.0651324
117	146.157	100.493	136.833	1.69969	358.3	1.69892	-.0509318
118	143.881	101.804	131.8	1.34147	358.4	1.34097	-.0366782
119	141.605	103.114	126.767	.942141	358.6	.941854	-.0232391
120	139.329	104.425	121.733	.50339	358.7	.503269	-.0110495
END	137.053	105.736	116.7	0	0	0	0

2J1	150.709	97.8716	146.9	2.35575	356.9	2.35239	-.125892
122	153.267	99.3481	141.867	2.12073	357.	2.11778	-.111857
123	155.826	100.825	136.833	1.79067	357.	1.78826	-.0928151
124	158.384	102.301	131.8	1.40907	357.1	1.40725	-.0716184
125	160.942	103.778	126.767	.986655	357.1	.985433	-.0491003
126	163.5	105.254	121.733	.525509	357.2	.524886	-.0255682
END	166.058	106.73	116.7	0	0	0	0
GND	226.106	146.835	0	.357457	290.5	.125356	-.334756
128	226.106	146.835	6.29583	.671709	163.4	-.643756	.191757
129	226.106	146.835	12.5917	1.22853	155.3	-1.11609	.513444
130	226.106	146.835	18.8875	1.72347	152.6	-1.52983	.793717
131	226.106	146.835	25.1833	2.1711	151.2	-1.90298	1.04516
132	226.106	146.835	31.4792	2.57867	150.4	-2.2426	1.2729
133	226.106	146.835	37.775	2.94803	149.9	-2.55047	1.47852
134	226.106	146.835	44.0708	3.27885	149.5	-2.82629	1.6622
135	226.106	146.835	50.3667	3.56979	149.3	-3.0689	1.82353
136	226.106	146.835	56.6625	3.81918	149.1	-3.27676	1.96189
137	226.106	146.835	62.9583	4.02535	148.9	-3.44837	2.07658
138	226.106	146.835	69.2542	4.18684	148.8	-3.58239	2.16704
139	226.106	146.835	75.55	4.3026	148.7	-3.67785	2.23288
140	226.106	146.835	81.8458	4.3721	148.7	-3.73423	2.27393
141	226.106	146.835	88.1417	4.39549	148.6	-3.75161	2.29036
142	226.106	146.835	94.4375	4.37378	148.5	-3.73081	2.28277
143	226.106	146.835	100.733	4.3091	148.5	-3.67364	2.25226
144	226.106	146.835	107.029	4.20514	148.4	-3.58327	2.20078
145	226.106	146.835	113.325	4.06778	148.4	-3.46472	2.13133
146	226.106	146.835	119.621	3.90524	148.4	-3.32506	2.04814
147	226.106	146.835	125.917	3.72594	148.3	-3.17153	1.95553
148	226.106	146.835	132.213	3.53426	148.3	-3.00787	1.85572
149	226.106	146.835	138.508	3.32997	148.3	-2.83394	1.74856
150	226.106	146.835	144.804	3.11059	148.3	-2.64764	1.63273
J13	226.106	146.835	151.1	2.85821	148.4	-2.43379	1.49867
2J1	226.106	146.835	151.1	.939522	148.2	-.798186	.495582
152	228.035	144.61	146.067	.850663	148.2	-.722916	.448353
153	229.964	142.386	141.033	.722863	148.2	-.6145	.380684
154	231.893	140.162	136.	.572479	148.2	-.486789	.301278
155	233.822	137.937	130.967	.40343	148.3	-.343115	.212197
156	235.751	135.713	125.933	.21626	148.3	-.183955	.113705
END	237.68	133.489	120.9	0	0	0	0
2J1	226.106	146.835	151.1	.997444	149.3	-.857519	.509466
158	223.191	146.366	146.067	.906884	149.4	-.780523	.46176
159	220.275	145.897	141.033	.774732	149.5	-.667668	.392975
160	217.36	145.428	136.	.617091	149.7	-.532532	.311786
161	214.445	144.959	130.967	.437509	149.8	-.378065	.220183
162	211.53	144.49	125.933	.236017	149.9	-.204218	.118316
END	208.615	144.021	120.9	0	0	0	0
2J1	226.106	146.835	151.1	.921455	147.6	-.778083	.493624
164	227.123	149.643	146.067	.832578	147.6	-.702978	.446104
165	228.14	152.451	141.033	.705947	147.6	-.596	.378345
166	229.157	155.259	136.	.557887	147.6	-.470953	.299068
167	230.174	158.067	130.967	.39232	147.6	-.331151	.210367
168	231.191	160.875	125.933	.209861	147.6	-.17712	.112562
END	232.208	163.683	120.9	0	0	0	0

WWRV MoM License Application Tables

Table 1: Wire Model Data

Tower	1	2	3	4
Actual Radius, Meters	0.2911	0.2911	0.2911	0.2911
Model Radius, Meters	0.4	0.4	0.4	0.4
Percentage of Acual radius	137.4%	137.4%	137.4%	137.4%
FCC Height, Meters	87.78	87.78	87.78	87.78
Model Height, Meters	96.48	90.78	91.97	94.6
Percentage of Actual Height	109.9%	103.4%	104.8%	107.8%
Number of Segments	24	24	24	24

Table 2: Measured and Calculated Self Impedances

Tower	1	2	3	4
Measured self impedance R at ATU	305	201	189	270
Measured self impedance X at ATU	-486.8	-511.5	-497.7	-468.4
Shunt capacitance pf	10	10	10	10
Series Inductance uh	20	42	40	28
Shunt inductance, uH, voltage sample unit	11966	11966	11966	11966
Shunt inductance, uH, voltage sample unit	11966	11966	11966	11966
Modeled self impedance R at Tower	318	207.5	197.7	286.7
Modeled self impedance X at Tower	-525.8	-589.5	-567	-518.2
Modeled self impedance R at ATU	297.4	192.4	183.8	268.3
Modeled self impedance X at ATU	-494.2	-527.7	-508.7	-477.9
Resistance Tolerance, ohms, ±	14.20	10.04	9.56	12.80
Reactance Tolerance, ohms, ±	21.47	22.46	21.91	20.74

Table 3: DA-Day Current and Phase Calculations

	Tower Model at Base		Circuit Model at Sample Device		Antenna Monitor	
	Voltage	Phase	Voltage	Phase	Ratio	Phase
1	1637.86	107.2	1550.21	107.95	0.661	-88.0
2	2490.74	194.6	2344.84	-164.07	1.000	0.0
3	2283.17	310.1	2175.81	-48.89	0.928	115.2
4	2011.69	77.8	1958.41	79	0.835	-116.9

Table 4: DA-Night Current and Phase Calculations

	Tower Model at Base		Circuit Model at Sample Device		Antenna Monitor	
	Voltage	Phase	Voltage	Phase	Ratio	Phase
1	1286.56	162.1	1233.49	161.27	0.436	75.5
2	3255.07	292.8	3090.82	-66.65	1.092	-152.4
3	2942.57	85.1	2830.53	85.77	1.000	0.0
4	1035.98	235.6	1025.38	-124.08	0.362	150.2

Table 5: Common Point

Common Point Impedance Measured with	OIB-3
Common Point Current Measured with	Delta TCA20-EXR
Measured Day Common Point Resistance	50
Measured Day Common Point Reactance	-8
Day Power, KW	10
Day Common Point Current,, Amperes	14.5
Measured Night Common Point Resistance	50
Measured Night Common Point Reactance	-8
Night Power, KW	3.8
Night Common Point Current,, Amperes	9

Table 6: Sample System Devices

Tower	Device	Serial	Ratio	Phase	Impedance at Sample Port	Impedance Through Sample Line
1	Phasetek P600-206-3	1330-1	1.001	-0.2	>100K	51.7 +j0.2
2	Phasetek P600-206-3	1330-2	1.000	0	>100K	51.7 +j0.2
3	Phasetek P600-206-3	1330-3	1.000	0	>100K	51.9 +j0.3
4	Phasetek P600-206-3	1330-4	1.000	0.1	>100K	51.8 +j0.2
Sample Lines are:	RFS LCF-12-50J					
Phase Monitor is:	G/R CMR, SN 1055-B					

Table 7: Sample Line Lengths

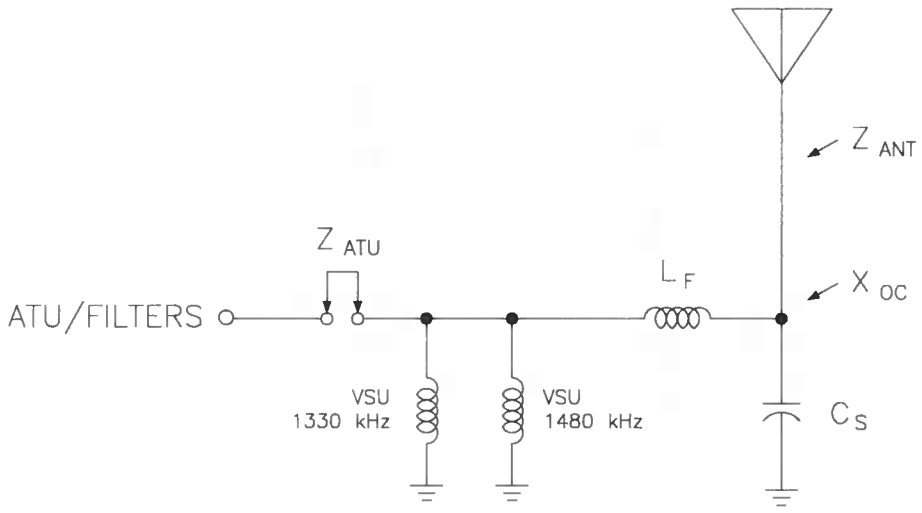
Carrier Frequency, KHz	1330			
Velocity Factor	0.88			
Tower	1	2	3	4
Odd Quarter Wave Below Carrier	0.25	0.25	0.25	0.25
Open Circuit Resonant Frequency, KHz	565	563.75	564	564.75
Resultant Length, Feet	382.96	383.81	383.64	383.13
Resultant Length, Degrees at Carrier	211.9	212.3	212.2	212.0
Odd Quarter Wave Above Carrier	0.75	0.75	0.75	0.75
Open Circuit Resonant Frequency, KHz	1705.25	1702.25	1702.25	1705.5
Resultant Length, Feet	380.66	381.33	381.33	380.61
Resultant Length, Degrees at Carrier	210.6	211.0	211.0	210.6
Average Length at Carrier, Degrees	211.2	211.6	211.6	211.3
Measured with HP 8753ES Vector Network Analyzer				

Table 8: Sample Line Characteristic Impedance

Tower	+1/8 from 3/4 Wave, Frequency, kHz	Measured Resistance	Measured Reactance	-1/8 from 3/4 wave, Frequency, kHz	Measured Resistance	Measured Reactance	Calculated Impedance by Formula
1	1989.5	4.4	49.8	1421	3.2	-50.1	50.10
2	1986	4.48	49.7	1418.5	3.29	-50	50.00
3	1986	4.49	50.1	1418.5	3.3	-50.3	50.35
4	1989.8	4.5	50.1	1421.2	3.2	-50.1	50.25

FIGURE 1

WWRV TOWER IMPEDANCE MEASUREMENTS COMPARED TO METHOD OF MOMENTS MODEL



TOWER	Specified Cs (pf)	Measured L_F (µH)	Measured X_F (Ω)	Modeled Z_{ANT} (Ω)	Modeled Z_{ATU} (Ω)	Measured Z_{ATU} (Ω)
1	10	2.39	+j20.0	318.0 –j 525.8	297.4 –j 494.2	305.0 –j 486.8
2	10	5.03	+j42.0	207.5 –j 589.5	192.4 –j 527.7	201.0 –j 511.5
3	10	4.79	+j40.0	197.7 –j 567.0	183.8 –j 508.7	189.0 –j 497.7
4	10	3.35	+j28.0	286.7 –j 518.2	268.3 –j 477.9	270.0 –j 468.4

Tower	Calculated X_{OC} (Ω)
1	-j 15,697.0
2	-j 15,659.0
3	-j 15,662.5
4	-j 15,683.2

WWRV FIGURE 2

CUSTOMER : WWRV
NETWORK ID : TOWER 1 DAY

BASE NETWORK COMPUTATION

FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 20.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00, -11966.50 OHMS
TOWER IMPEDANCE (R,X) :	86.99, -364.39 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	50000.00
2	GROUND	81.92	-354.20
1	2	0.00	20.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	1550.21	107.95
2	1637.86	107.20

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	83.02	-336.31	346.41	-76.13
INPUT CURRENT (AMPS) :	-4.46	-0.32	4.48	-175.92
OUTPUT CURRENT (AMPS) :	-4.36	-0.29	4.37	-176.23

INPUT/OUTPUT CURRENT RATIO = 1.0236
INPUT/OUTPUT PHASE = 0.31 DEGREES

WWRV FIGURE 3

CUSTOMER : WWRV
NETWORK ID : TOWER 2 DAY

BASE NETWORK COMPUTATION

FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 42.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00, -11966.50 OHMS
TOWER IMPEDANCE (R,X) :	259.03, -657.51 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	50000.00
2	GROUND	232.65	-628.04
1	2	0.00	42.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	2344.87	-164.07
2	2490.71	194.60

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	238.20	-591.87	638.00	-68.08
INPUT CURRENT (AMPS) :	-0.38	-3.66	3.68	-96.00
OUTPUT CURRENT (AMPS) :	-0.42	-3.50	3.52	-96.90

INPUT/OUTPUT CURRENT RATIO = 1.0428
INPUT/OUTPUT PHASE = 0.91 DEGREES

WWRV FIGURE 4

CUSTOMER : WWRV
NETWORK ID : TOWER 3 DAY

BASE NETWORK COMPUTATION

FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 40.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	304.40, -796.33 OHMS

		IMPEDANCE (OHMS)	
NODE	TO NODE	R	X
1	GROUND	0.00	50000.00
2	GROUND	267.45	-753.02
1	2	0.00	40.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	2175.81	-48.89
2	2283.17	310.10

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	275.23	-721.84	772.54	-69.13
INPUT CURRENT (AMPS) :	2.64	0.97	2.82	20.24
OUTPUT CURRENT (AMPS) :	2.53	0.88	2.68	19.18

INPUT/OUTPUT CURRENT RATIO = 1.0517
INPUT/OUTPUT PHASE = 1.06 DEGREES

WWRV FIGURE 5

CUSTOMER : WWRV
NETWORK ID : TOWER 4 DAY

BASE NETWORK COMPUTATION
FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 28.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	565.48, -677.88 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	50000.00
2	GROUND	505.46	-664.14
1	2	0.00	28.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	1958.41	79.00
2	2011.69	77.80

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	518.52	-639.03	822.94	-50.94
INPUT CURRENT (AMPS) :	-1.53	1.82	2.38	129.94
OUTPUT CURRENT (AMPS) :	-1.40	1.80	2.28	127.97

INPUT/OUTPUT CURRENT RATIO = 1.0443
INPUT/OUTPUT PHASE = 1.97 DEGREES

WWRV FIGURE 6

CUSTOMER : WWRV
NETWORK ID : TOWER 1 NIGHT

BASE NETWORK COMPUTATION
FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 20.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	-155.56, -447.06 OHMS

		IMPEDANCE (OHMS)	
NODE	TO NODE	R	X
1	GROUND	0.00	50000.00
2	GROUND	-144.53	-432.77
1	2	0.00	20.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	1233.49	161.27
2	1286.86	162.10

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	-146.95	-415.78	440.98	-109.47
INPUT CURRENT (AMPS) :	0.04	-2.80	2.80	-89.26
OUTPUT CURRENT (AMPS) :	0.06	-2.72	2.72	-88.71

INPUT/OUTPUT CURRENT RATIO = 1.0289
INPUT/OUTPUT PHASE = -0.55 DEGREES

WWRV FIGURE 7

CUSTOMER : WWRV
NETWORK ID : TOWER 2 NIGHT

BASE NETWORK COMPUTATION
FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 42.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	259.03, -657.51 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	50000.00
2	GROUND	232.65	-628.04
1	2	0.00	42.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	2344.87	-164.07
2	2490.71	194.60

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	238.20	-591.87	638.00	-68.08
INPUT CURRENT (AMPS) :	-0.38	-3.66	3.68	-96.00
OUTPUT CURRENT (AMPS) :	-0.42	-3.50	3.52	-96.90

INPUT/OUTPUT CURRENT RATIO = 1.0428
INPUT/OUTPUT PHASE = 0.91 DEGREES

WWRV FIGURE 8

CUSTOMER : WWRV
NETWORK ID : TOWER 3 NIGHT

BASE NETWORK COMPUTATION
FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 40.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	336.75, -1040.50 OHMS

		IMPEDANCE (OHMS)	
NODE	TO NODE	R	X
1	GROUND	0.00	50000.00
2	GROUND	284.84	-964.64
1	2	0.00	40.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	2830.53	85.77
2	2942.57	85.10

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	295.66	-940.34	985.73	-72.55
INPUT CURRENT (AMPS) :	-2.67	1.06	2.87	158.32
OUTPUT CURRENT (AMPS) :	-2.48	1.04	2.69	157.17

INPUT/OUTPUT CURRENT RATIO = 1.0672
INPUT/OUTPUT PHASE = 1.15 DEGREES

WWRV FIGURE 9

CUSTOMER : WWRV
NETWORK ID : TOWER 4 NIGHT

BASE NETWORK COMPUTATION
FREQUENCY : 1330.00 kHz

ATU SHUNT IMPEDANCE (R,X) :	0.00, 50000.00 OHMS
TOWER FEED IMPEDANCE (R,X) :	0.00, 28.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) :	0.00,-11966.50 OHMS
TOWER IMPEDANCE (R,X) :	1664.00, -2372.90 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	50000.00
2	GROUND	1143.45	-2112.92
1	2	0.00	28.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	1025.38	-124.08
2	1035.98	235.60

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	1244.41	-2145.94	2480.65	-59.89
INPUT CURRENT (AMPS) :	0.18	-0.37	0.41	-64.19
OUTPUT CURRENT (AMPS) :	0.13	-0.33	0.36	-69.44

INPUT/OUTPUT CURRENT RATIO = 1.1564
INPUT/OUTPUT PHASE = 5.25 DEGREES

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
RADIO VISION CRISTIANA MANAGEMENT

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
WWRV	BP-20131104AQW	1330	UNLIMITED	3.8	10.0

2. Station location

State	City or Town
NEW YORK	NEW YORK

3. Transmitter location

State	County	City or Town	Street address (or other identification)
NJ	BERGEN	RIDGEFIELD PARK	END OF BIRCH STREET

4. Main studio location

State	County	City or Town	Street address (or other identification)
NJ	PASSAIC	Paterson	419 Broadway

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

State	County	City or Town	Street address (or other identification)
NJ	PASSAIC	Paterson	419 Broadway

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

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

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

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
9	14.5

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	-J 8	-J 8

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1 SE	+75.5	-88.0	0.436	0.661		
2 SC	-152.4	0.0	1.092	1.000		
3 NC	0.0	+115.2	1.000	0.928		
4 NW	+150.2	-116.9	0.362	0.835		

Manufacturer and type of antenna monitor: Gorman Redlich CMR

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.
Guyed Towers	87.8	89.0	89.9	Exhibit No. See Eng.

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 °	50 '	42 "	West Longitude	74 °	01 '	12 "

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

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

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

N/A

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

No Changes

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 I
Clarence M. Beverage	
Address (include ZIP Code)	Date
Communications Technologies, Inc. P.O. Box 1130 Marlton, NJ 08053	04/12/2019
	Telephone No. (Include Area Code) 609-451-5296

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☑ Other (specify) Broadcast Engineering Consultant

APPENDIX 1 4 PAGES

WWRV
10 KW Day
Reference Field Strength Measurements
March 6, 2018, except 227.5° March 19 2018

Radial	Point	Distance KM	2018 Tme	2018 Field mV/m	Coordinates (NAD 27)		Description
66.5°	1	1.45	14:15	52	40 51 00.8	74 00 15.2	Edge of road IFO NAC Foods at double doors
	2	1.50	14:21	44	40 51 01.0	74 00 12.5	Opp 159 Roosevelt PL at signs on sidewalk
	3	1.60	14:28	79	40 51 02.8	74 00 09.0	On sidewalk near Do Not Enter sign by driveway W Central Blvd
147°	1	1.86	15:08	1510	40 50 31.4	74 01 25.7	On sewer grate at intersection of Abbott & Linden Ct
	2	1.98	15:21	1410	40 49 47.7	74 00 26	IFO 459 Morse Ave
	3	2.15	15:27	1390	40 49 42.9	74 00 22.2	Corner of white fence by sign
227.5°	1	0.50	15:58	1060	40 50 31.4	74 01 25.7	Left rear corner of apt parking lot
	2	2.54	13:52	74	40 49 45.9	74 02 31.1	50' from end of drive on left side of Bind Right Services
	3	3.01	14:29	89	40 49 36.2	74 02 46.7	MOR 600 Commerce Blvd right side entrance
308.5°	1	1.79	12:57	195	40 51 17.7	74 02 11.4	On path opp 23 Lakeview Ave by lake
	2	2.09	13:11	250	40 51 24.0	74 02 21.3	On sidewalk at drive 142 Summit Circle
	3	2.26	13:16	183	40 51 27.1	74 02 27.1	On sidewalk at drive 87 Summit Circle
345.5°	1	0.96	11:29	270	40 51 11.6	74 01 22.0	On sidewalk at drive #93 Hobart St
	2	1.14	11:34	280	40 51 17.2	74 01 23.4	On sidewalk @ drive #96 Cedar St
	3	1.30	11:53	251	40 51 22.0	74 01 25.6	On sidewalk @ No Dumping sign of brown brick apt bldg Mt Vernon St

Note: All measurements made with Potomac Instruments FIM-41, SN 2065, last calibrated 2/25/10
Meter compared to a meter of recent calibration with agreement within manufacturer's specifications.
Measurements performed by Charles A. Hecht.

WWRV
3.8 KW Night
Reference Field Strength Measurements
March 6, 2018, except 226° March 19, 2018

Radial	Point	Distance KM	2014 Tme	2014 Field mV/m	Coordinates (NAD 27)		Description
8°	1	1.10	12:17	55	40 51 17.0	74 01 04.7	SE corner Ovedrpeck & Mt Vernon at Veterans Park sign
	2	1.25	12:11	44	40 51 22.0	74 01 04.5	On sidewalk @ house air conditioner Park St
	3	1.37	12:03	59	40 51 25.7	74 01 03.3	On sidewalk at fence corner green house Poplar St
68°	1	1.37	14:46	178	40 50 58.4	74 00 17.1	In ctr of drive left side Sushi House in line with chrome door
	2	1.53	14:41	128	40 51 00.0	74 00 11.0	Opp 159 Roosevelt Pl on sidewalk @ sign
	3	1.64	14:34	210	40 51 01.4	74 00 06.5	SE corner W Central & Grand
147°	1	1.86	15:07	780	40 49 51.4	74 00 27.8	On sewer grate at intersection of Abbott & Linden Ct
	2	1.98	15:20	620	40 49 47.7	74 00 26	IFO 459 Morse Ave
	3	2.15	15:26	630	40 49 42.9	74 00 22.2	Corner of white fence by sign
226°	1	0.47	16:09	435	40 50 31.2	74 01 26.0	Extreme right corner of Kenworth pkg area near river bank
	2	2.58	13:58	61	40 49 43.8	74 02 30.8	Ctr of rear pkg lot Bind Rite Services
	3	2.67	14:40	53	40 49 42.1	74 02 34.4	MOR @ fire hydrant left side (far rear) 777 Central Blvd
286°	1	1.15	12:35	158	40 50 51.7	74 01 58.7	Sidewalk @ drive brick house Riverside Ave
	2	1.49	12:41	120	40 50 54.7	74 02 12.7	IFO 27 Pickens St on sidewalk
	3	1.68	12:46	124	40 50 56.4	74 02 20.7	IFO 41 Grove St on sidewalk

Note: All measurements made with Potomac Instruments FIM-41, SN 2065, last calibrated 2/25/10
Meter compared to a meter of recent calibration with agreement within manufacturer's specifications.
Measurements performed by Charles A. Hecht.

DAY MODE SPURIOUS RADIATION MEASUREMENTS
WWRV 1330 KHZ 10 KW DA
WZRC 1480 KHZ 5 KW DA

Frequency khz	Day Field (mV/m)	Attenuation (dB) relative to WWRV	WZRC
1330	1620		
1480	1400		
300	.0170	99.6	98.3
450	.0160	100.1	98.8
1030	.0607	88.6	87.3
1180	.1290	82.0	80.7
1630	.1280	82.1	80.8
1780	.0185	98.9	97.6
2510	.0160	100.1	98.8
2660	.0250	96.3	95.0
2810	.0495	90.6	89.3
2960	.0690	87.5	86.2
3110	.0117	102.9	101.6
3990	.0558	89.3	88.0
4140	.0616	88.4	87.1
4290	.0272	95.5	94.2
4440	.0107	103.6	102.3

Measurements taken with Potomac Instruments FIM-4100, serial number 249, last calibrated January 21, 2016. The distance from the array to the measuring point is 0.99 km on a bearing of 147.0° True. Point Coordinates (NAD27): N 40° 50' 15.3", W 74° 00' 48.5". Point description is: Bell Drive, north side at drain, approximately 75 feet west of entrance to house number 2, between house numbers 2 and 4.

Measurements meet required daytime attenuation of 80 dB for WZRC and WWRV.

NIGHT MODE SPURIOUS RADIATION MEASUREMENTS
WWRV 1330 KHZ 3.8 KW DA
WZRC 1480 KHZ 5 KW DA

Frequency khz	Day Field (mV/m)	Attenuation (dB) relative to WWRV	WZRC
1330	1160		
1480	1400		
300	.0173	96.6	98.2
450	.0154	97.6	99.2
1030	.0497	87.4	89.0
1180	.1300	79.0	80.6
1630	.1190	79.8	81.4
1780	.0156	97.5	99.1
2510	.0108	100.7	102.3
2660	.0215	94.7	96.3
2810	.0438	88.5	90.1
2960	.0735	84.0	85.6
3110	.0127	99.3	100.9
3990	.0162	96.1	98.7
4140	.0418	88.9	90.5
4290	.0347	90.5	92.1
4440	.0145	98.1	99.7

Measurements taken with Potomac Instruments FIM-4100, serial number 249, last calibrated January 21, 2016. The distance from the array to the measuring point is 0.99 km on a bearing of 147.0° True. Point Coordinates (NAD27): N 40° 50' 15.3", W 74° 00' 48.5". Point description is: Bell Drive, north side at drain, approximately 75 feet west of entrance to house number 2, between house numbers 2 and 4.

Measurements meet required nighttime attenuation of 80 dB for WZRC and 78.8 db for WWRV.