

December 18, 2014

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Federal Communications Commission  
Media Bureau  
P.O. Box 979089  
St. Louis, Missouri 63197-9000

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**DEC 18 2014**

**Federal Communications Commission  
Bureau / Office**

Re: Station WUST(AM)  
Washington, D.C.  
Facility ID No. 48686  
APPLICATION FOR STATION LICENSE

Dear Sir:

Transmitted herewith, in triplicate, on behalf of New World Radio, Inc., the licensee of Station WUST(AM), Washington, D.C., is an application on FCC Form 302-AM. The application requests a license for the Station based on the completion of the construction of new facilities for the Station, as authorized in FCC File No. BP-20130926BCX.

Also enclosed is FCC Form 159, providing for a credit card payment in the amount of \$1,480.00 for the required filing fee for a license to cover a construction permit and for the AM directional antenna system.

Finally, we are also providing a copy of this submission along with a stamped, self-addressed envelope. We request that a stamped copy of the submission be returned to us in that envelope.

2014 DEC 19 PM 2:31

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Federal Communications Commission

Page 2

Should there be any questions in regard hereto, please communicate with the undersigned.

Respectfully submitted,



Barry A. Friedman

Enclosures

cc: Mr. Alan Pendleton (For Public Inspection)  
Ms. Kay Whitfield (FCC Audio Division)  
Mr. Son Nguyen (FCC Audio Division)  
Ms. Susan Crawford (FCC Audio Division)

212562

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DEC 18 2014

Federal Communications Commission  
Washington, D. C. 20554

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

FOR  
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ONLY

Federal Communications Commission  
Bureau / Office

FCC 302-AM  
APPLICATION FOR AM  
BROADCAST STATION LICENSE  
(Please read instructions before filling out form.)

FOR COMMISSION USE ONLY

FILE NO.

BAYML-20141218AFW

SECTION I - APPLICANT FEE INFORMATION

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

New World Radio, Inc.

MAILING ADDRESS (Line 1) (Maximum 35 characters)

Suite 201

MAILING ADDRESS (Line 2) (Maximum 35 characters)

2890 Emma Lee Street

CITY

Falls Church

STATE OR COUNTRY (if foreign address)

VA

ZIP CODE

22042

TELEPHONE NUMBER (include area code)

703-532-0400

CALL LETTERS

WUST

OTHER FCC IDENTIFIER (if applicable)

FIN 48686

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			
0	0	0	1

(C)

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

FOR FCC USE ONLY

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

(A)

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(B)

0	0	0	1
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(C)

\$
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FOR FCC USE ONLY

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

TOTAL AMOUNT REMITTED WITH THIS APPLICATION

\$

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<b>SECTION II - APPLICANT INFORMATION</b>		
1. NAME OF APPLICANT New World Radio, Inc.		
MAILING ADDRESS Suite 201, 2890 Emma Lee Street		
CITY Falls Church	STATE VA	ZIP CODE 22042

2. This application is for:

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

Call letters WUST	Community of License Washington, D.C.	Construction Permit File No. BP-20130926BCX	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit 1/13/2017
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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.  
1

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

If No, explain in an Exhibit.

☒ Does not apply

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).

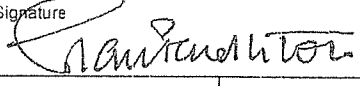
The APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations and that all the exhibits are a material part hereof and are incorporated herein as set out in full in

#### 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 Alan Pendleton	Signature 	
Title President	Date 12/16/2014	Telephone Number 703-532-0400

**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.

### SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant

New World Radio, Inc

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	
WUST	BP-20130926BCX	1120	Day & Critical Hours	Night Crit.Hrs. 3	Day 50

#### 2. Station location

State	City or Town
District of Columbia	Washington

#### 3. Transmitter location

State	County	City or Town	Street address (or other identification)
Maryland	Prince George's	Capitol Heights	1355 S. Addison Road

#### 4. Main studio location

State	County	City or Town	Street address (or other identification)
Virginia	Fairfax	Falls Church	2890 Emma Lee St, Ste 201

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

State	County	City or Town	Street address (or other identification)
Virginia	Fairfax	Falls Church	2890 Emma Lee St, Ste 201

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.  
Stmt. E

#### 8. Operating constants: CP Authorizes Daytime and Critical Hours Operation - these constants shown below

RF common point or antenna current (in amperes) without modulation for night system Critical Hours 15.13	RF common point or antenna current (in amperes) without modulation for day system 32.45
Measured antenna or common point resistance (in ohms) at operating frequency Night Critical Hours 13.1 Day 50.0	Measured antenna or common point reactance (in ohms) at operating frequency Night Critical Hours - 32.5 Day - 9.0

#### Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents DA Currents Not Required	
	Night	Day	Night	Day	Night	Day
1 (S)	N/A	0.0	N/A	1.000	N/A	N/A
2 (W)	N/A	- 8.6	N/A	0.998	N/A	N/A
3 (E)	N/A	127.1	N/A	0.914	N/A	N/A
4 (N)	N/A	- 75.1	N/A	0.557	N/A	N/A

Manufacturer and type of antenna monitor: Potomac Instruments 1901-4

SECTION III - Page 2

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

Type Radiator	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) (No Obstr. Lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Guyed, Uniform cross-section, steel towers	47.46	48.46	48.46	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 °	52 '	09 "	West Longitude	76 °	53 '	47 "
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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.  
Stmt. E

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

Exhibit No.  
Stmt. E


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

No Differences

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

Not Applicable - New Construction

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) Garrison C. Cavell	Signature (check appropriate box below) 
Address (include ZIP Code)  Cavell, Mertz & Associates, Inc. 7724 Donegan Drive Manassas, VA 20109	Date December 16, 2014
	Telephone No. (Include Area Code) (703) 392-9090

☐ Technical Director

☐ Registered Professional Engineer

☐ Chief Operator

☒ Technical Consultant

☐ Other (specify)

**EXHIBIT NO. 1**

The applicant is requesting program test authority pursuant to the provisions of Section 73.1620(a)(4) of the Commission's Rules.

**Statement E**  
**Application for License**  
*(Method of Moments Proof-of-Performance)*

**WUST Washington, DC**

**1120 kHz DA-D 50 kW, 3 kW Non-DA Critical Hours**  
**Facility ID 48686 File Number BP-20130926BCX**  
*New World Radio, Inc.*

**PREPARED BY:**

***CAVELL, MERTZ & ASSOCIATES, INC.***  
Manassas, Virginia

December 16, 2014  
Authored by: Garrison C. Cavell

**Statement E**  
**APPLICATION FOR STATION LICENSE**  
**(Method of Moments Proof-of-Performance)**  
**WUST(AM) Washington, DC**

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**(Method of Moments Proof-of-Performance)**  
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**Statement E**  
**APPLICATION FOR STATION LICENSE**  
**(Method of Moments Proof-of-Performance)**  
**WUST(AM) Washington, DC**

**Introduction and Summary**

This Statement has been prepared on behalf of *New World Radio, Inc.* (“*New World*”), licensee of Station WUST, Washington D.C. (FCC Facility ID 48686) in support of an Application for License to Cover the completion of construction authorized under an FCC Construction Permit (“CP”) File No. BP-20130926BCX. *New World* is presently licensed (under FCC File No. BL-19930513AC) to operate WUST non-directionally at 20 kilowatts during daytime hours, and with 3 kilowatts during critical hours.

Because of a loss of its transmitter site, *New World* requested and was issued a Construction Permit to relocate WUST to a replacement site, which is the existing WJFK transmitter site. WJFK’s Facility ID number is 28638. The WUST CP authorized an increase in the Station’s daytime power to 50 kilowatts using a directional antenna system. Critical hours operation was also authorized at the replacement site at a power level of 3 kilowatts using a non-directional radiator.

The WUST antenna system uses the existing WJFK directional antenna system towers and will thus be diplexed with WJFK. A CP, FCC File No. BP-20131223AFI, has also been granted to WZHF (Facility ID 73306) to locate at this site for the same reasons. (WZHF’s CP Number is BP-20131223AFI.) Construction of the WZHF system is underway and, when completed, will utilize the same towers as WUST and WJFK, thus ultimately creating a “triplexed” operation. The WJFK ground and RF systems were replaced in their entirety as part of this project. New tuning units and triplexing equipment have already been installed at the tower bases for all Stations. Host Station WJFK is now operating under an STA pending completion of phasor installation and completion of a proof of performance, as is WZHF.

Construction has been completed for the WUST portion of this system. Since the WUST system is now complete, a “Method of Moments” (“MoM”) Proof-of-Performance<sup>1</sup> (“proof”) has been conducted on WUST’s operation and is provided as attachment Statement E to WUST’s FCC Form 302-AM. All CP Conditions have been essentially satisfied as discussed herein.

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<sup>1</sup> The directional antenna arrays of each Station participating in the triplexing arrangement are eligible for licensing under Section 73.151(c) of the FCC’s Rules (the “Method of Moments” or “MoM Rules”) in that these antenna system consists of series-fed, base insulated towers, using a conventional, buried-wire, ground system under each tower. As such, MoM proofs of performance will be filed along with appropriate FCC Form 302-AM documents as the construction is completed for each facility.



**Statement E**  
**APPLICATION FOR STATION LICENSE**  
**(Method of Moments Proof-of-Performance)**  
**WUST(AM) Washington, DC**

The information provided in this Statement demonstrates that the directional antenna parameters for the authorized WUST antenna systems have been determined in accordance with the requirements of Section 73.151(c) of the Commission's Rules. As will be shown in the following Sections, the WUST antenna system has been adjusted to produce antenna monitor parameters that are within +/- 5 percent in ratio and +/- 3 degrees in phase of the MoM modeled values, and are believed to be in compliance with the Commission's Rules.

**Antenna and Ground System Description**

As described in the Application for CP, the CP and associated antenna structure registrations ("ASR"), the antenna system consists of four uniform cross-section, guyed, base insulated, series fed, steel towers. All towers are 63.83° tall electrically at the WUST operating frequency of 1120 kHz. All towers are used for the daytime mode while the southern-most tower, Tower 1, will be used for the non-directional critical hours mode. Towers 2, 3, and 4 are detuned at the WUST frequency when the Station is operating in the critical hours mode. The ground system is conventional and consists of 120 equally spaced, buried, copper radials about the base of each tower, each 67.1 meters in length except where terminated by property boundaries. Intersecting radials are shortened and bonded to a transverse copper strap midway between adjacent towers. An additional 120 radials, each 15.2 meters in length, are interspersed between the longer radials.

**MoM Modeling Process**

The WUST antenna array was evaluated using MoM derivative software, *Expert MININEC Broadcast Professional*, Version 14.5, published by *EM Scientific Inc.* The procedure for conducting a broadcast MoM proof first involves making impedance measurements at each of the towers to serve as benchmarks for calibrating the findings of the MoM calculations. An initial model of the characteristics of each individual tower is developed from physical tower data (the "self" condition). Model tower characteristics (height and width) are then adjusted, while consideration is made of the stray reactances found in the antenna base environment using circuit analysis methods. In this manner, the modeled impedance is "converged" to the measured values, thus establishing a calibrated mathematical version of the antennas.

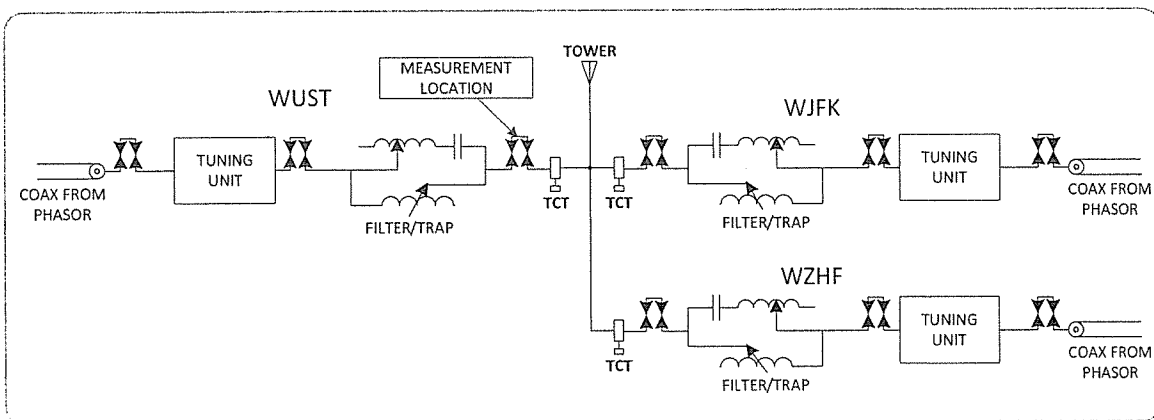
Then, using the calibrated antenna model for all towers, the theoretical field parameters are introduced into the software to synthesize the pattern for the Station in each directional mode of

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operation. Required base currents and driving point impedance conditions are then derived along with a set of antenna monitor parameters for the modeled array. These parameters are used as “targets” by the field engineer to achieve the authorized pattern by adjusting the RF phasing and coupling system to the modeled values. The following text describes the specific approach taken in the modeling and adjustment of the WUST daytime directional antenna system.

**Tower Impedance Measurements**

Impedance measurements were taken at each of the WUST tower bases (and also at other key locations throughout the RF system, as necessary) using precision, calibrated RF impedance measurement systems. The master system consisted of a *Hewlett-Packard* model 8753C network analyzer in conjunction with a *Tunwall Radio* directional coupler system and an *Electronic Navigation Industries* (ENI) Model 310 L RF amplifier. A *Delta Electronics, Inc.* Operating Impedance Bridge (model OIB-3), was also employed to verify system information under operating conditions. All equipment calibration was field verified prior to each measurement using the procedures specified in the manufacturer’s instruction manual and precision calibration standards. After this calibration verification, impedance measurements were made at each tower at the location of the final output jacks (“J-plugs”) within the respective Antenna Tuning Units (“ATUs”). This location is henceforth regarded as the tower impedance “reference point” for this MoM proof.



As each tower’s impedance was being measured, all the other WUST tower bases were “open circuited” at the same J-plug impedance measurement locations. As shown above, this J-Plug reference point at each ATU is located immediately adjacent to the toroidal “current sampling” transformer (TCT) for the antenna monitor system, which is at the output of the ATU system enclosure. Since this is a

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triplexed system, the RF system for the other Stations is also attached to each tower, as shown by the preceding representative schematic. Tests were made after diplexer filter/trap adjustment, prior to obtaining the final “open circuit base” impedance measurements and verified that no material change occurs in reference point tower impedance with the J-plugs for the other stations opened or closed.

**Tower Base Environment (Base Circuit Analysis) Calculations**

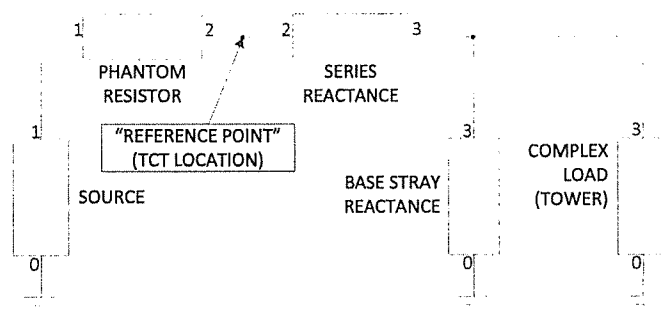
Once the base impedance measurements were harvested, tower base environment circuit calculations were performed by using the “WCAP” network analysis program software provided by *Westberg Consulting*. (The WCAP software performs nodal analysis calculations, similar to “SPICE” circuit analysis software.) These calculations were used throughout the proof process to relate the MoM modeled impedances to the ATU output reference points. As shown on the following discussion, the Open Circuit Reactance found at each tower was calculated for the assumed base conditions for all towers. This value was then used in the MoM model as a “lumped load” at ground level for the open circuited (“OC”) MoM individual model “self” (individual tower) case. Using these assumed lumped loads, base environment, and MoM analysis, initial values were derived and the model converged for each tower.

A schematic of the composite base environment circuit, along with a summary of results and a tabulation of WCAP calculated values, is provided on the following page. Base environment circuit elements were developed by taking into account manufacturer’s stated values as a reference point, and then taking measurements within the as-built tuning units with a calibrated network analyzer or an RF vector impedance meter. The approach was taken since the actual stray reactances are considerable given the lengths of interconnected conductors and the dimensions of the tuning units. For example, Towers 1, 2, and 4, the measured shunt reactance was -1,421 ohms (100 pF), which includes the base 15 pF insulators and other stray base reactances. When combined with the measured parallel static drain choke values at these towers (14,210  $\mu$ H), the total shunt reactance is -1,441.5 ohms (98.58 pF). For Tower number 3, an STL isocoupler (isolated measured value of 4.8 pF) is included in the base circuit measurement, along with the base insulator, fixed static drain and slope correction reactance, and miscellaneous strays from the tuning units and dual STL line feeds, yielding a measured shunt value of 261 ohms (37.1  $\mu$ H). The total series and shunt values are shown in the tabulation for following representative WCAP schematic diagram. In this diagram, “Nodes” are identified in subscripts for ease of identifying points of interest in the circuit tabulations.

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Specifically, “Node 2” represents the ATU output “reference point” (TCT location), “Node 3” represents the tower feed-point, and “Node 0” represents ground potential. In the Open Circuit “Tower Self” analysis tabulations for each tower, the calculated ATU output impedances appear under the “TO IMPEDANCE” columns, following the “phantom” 1 ohm resistor ( $R_{1-2}$ ). This phantom resistor is included in series with the drive current sources ( $I_{0-1}$ ) to provide a defined calculation point in the software. The tower feed-point impedances from the MoM model are represented by “complex loads” from “Node 3” to ground ( $R_{3-0}$ ).

**Representative “Open Circuit” Tower Base Environment Schematic for all Towers**



**Summary of Completed Open Circuit Analysis of WUST Tower Base Environment**

Tower Number	Stray/Series Inductance $L_{2-3}$	Stray/Series Reactance	Measured/Total Base Stray Shunt Reactance	MiniNEC Modeled Complex Load Impedance	Reference Point* $Z_{ATU}$ WCAP Modeled	Reference Point* $Z_{ATU}$ Measured
1	7.361 $\mu$ H	+j 51.80 $\Omega$	-j1441.5	17.749 -j 98.298 $\Omega$	15.55 -j40.402 $\Omega$	16.0 -j 40.4 $\Omega$
2	6.481 $\mu$ H	+j 45.61 $\Omega$	-j1441.5	17.104 -j 99.802 $\Omega$	14.96 -j47.898 $\Omega$	14.4 -j 47.9 $\Omega$
3	9.942 $\mu$ H	+j 69.96 $\Omega$	+j261	17.007 -j 96.392 $\Omega$	42.31 -j78.503 $\Omega$	43.8 -j 78.5 $\Omega$
4	6.781 $\mu$ H	+j 47.72 $\Omega$	-j1441.5	17.445 -j 104.97 $\Omega$	15.16 -j50.297 $\Omega$	14.6 -j 50.3 $\Omega$

**Notes:**

\* - At ATU Output Jack J-Plug (TCT Location); Designated as ATU “Reference Point”

As shown, the modeled and measured base impedances at the ATU reference point (with the other towers open circuited at their ATU output jacks) agree with each other to within the allowable tolerances, +/- 2 ohms and +/- 4 percent for resistance and reactance, as required under the Commission’s MoM Rules. Details of the circuit analysis are provided in the following pages.

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**Circuit Analysis Used for Each Tower to Verify Method of Moments Model**

**WCAP Tower Base Open Circuit "Self" Analysis – WUST Tower 1 (S)**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1 43.6611  $\angle$  -67.7203° V  
Node: 2 43.2918  $\angle$  -68.9451° V  
Node: 3 93.5047  $\angle$  -80.4252° V

WCAP PART		CURRENT IN		CURRENT OUT	
<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>		<u>BRANCH CURRENT</u>	
R	3→0 17.74900000	93.50 $\angle$	-80.425° V	0.94 $\angle$	-0.660° A
C	3→0 0.00009858	93.50 $\angle$	-80.425° V	0.06 $\angle$	9.575° A
L	2→3 7.36100000	51.80 $\angle$	90.000° V	1.00 $\angle$	0.001° A
R	1→2 1.00000000	1.00 $\angle$	0.000° V	1.00 $\angle$	0.000° A

<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>		<u>TO IMPEDANCE</u>	
R	3→0 17.74900000	17.75 - j	98.298	0.00 + j	0.000
C	3→0 0.00009858	0.00 - j	1441.500	0.00 + j	0.000
L	2→3 7.36100000	15.55 - j	40.402	15.55 - j	92.202
R	1→2 1.00000000	16.55 - j	40.402	*15.55 - j	40.402

(\* - WCAP Calculated Z at TCT)

Measured Z at TCT: 16.0 -j 40.4  $\Omega$

Difference: 0.45  $\Omega$  0.002  $\Omega$

WCAP PART VSWR

**WCAP INPUT DATA:**

1.1200 0.00010000 1 (Frequency in MHz, Step)

R	17.74900000	3	0	-98.29800000	(MiniNEC Modeled Impedance)
C	0.00009858	3	0		(Stray Shunt Capacitance)
L	7.36100000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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**WCAP Tower Base Open Circuit "Self" Analysis – WUST Tower 2 (W)**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1    50.4864     $\angle$  -71.5727°    V  
Node: 2    50.1793     $\angle$  -72.6560°    V  
Node: 3    94.6946     $\angle$  -80.9110°    V

WCAP PART	CURRENT IN	CURRENT OUT
<u>WCAP PART</u>	<u>BRANCH VOLTAGE</u>	<u>BRANCH CURRENT</u>
R 3→0    17.10400000	94.69 $\angle$ -80.911°    V	0.94 $\angle$ -0.636°    A
C 3→0    0.00009858	94.69 $\angle$ -80.911°    V	0.07 $\angle$ 9.089°    A
L 2→3    6.48100000	45.61 $\angle$ 90.000°    V	1.00 $\angle$ 0.000°    A
R 1→2    1.00000000	1.00 $\angle$ 0.000°    V	1.00 $\angle$ 0.000°    A

WCAP PART	FROM IMPEDANCE	TO IMPEDANCE
R 3→0    17.10400000	17.10    -    j    99.802	0    +    j    0
C 3→0    0.00009858	-0.00    -    j    1441.500	0    +    j    0
L 2→3    6.48100000	14.96    -    j    47.898	14.96    -    j    93.506
R 1→2    1.00000000	15.96    -    j    47.898	*14.96    -    j    47.898

(\* - WCAP Calculated Z at TCT)

Measured Z at TCT:    14.4    -j    47.9

Difference:    0.56  $\Omega$     0.002  $\Omega$

WCAP PART    VSWR

**WCAP INPUT DATA:**

1.1200    0.00010000    1 (Frequency in MHz, Step)

R	17.10400000	3	0	-99.80200000	(MiniNEC Modeled Impedance)
C	0.00009858	3	0		(Stray Shunt Capacitance)
L	6.48100000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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**WCAP Tower Base Open Circuit "Self" Analysis – WUST Tower 3 (E)**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1    89.6550     $\angle$  -61.1172°    V  
Node: 2    89.1763     $\angle$  -61.6798°    V  
Node: 3    154.3761     $\angle$  -74.0952°    V

WCAP PART		CURRENT IN			CURRENT OUT		
<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>			<u>BRANCH CURRENT</u>		
R	3→0	17.00700000	154.38	$\angle$ -74.095°	V	1.58	$\angle$ 5.899° A
L	3→0	37.08900000	154.38	$\angle$ -74.095°	V	0.59	$\angle$ -164.095° A
L	2→3	9.94200000	69.96	$\angle$ 90.000°	V	1.00	$\angle$ 0.000° A
R	1→2	1.00000000	1.00	$\angle$ 0.000°	V	1.00	$\angle$ 0.000° A

<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>		<u>TO IMPEDANCE</u>	
R	3→0	17.00700000	17.01 - j 96.392	0.00 + j	0.000
L	3→0	37.08900000	0.00 + j 261.002	0.00 + j	0.000
L	2→3	9.94200000	42.31 - j 78.503	42.31 - j	148.466
R	1→2	1.00000000	43.31 - j 78.503	*42.31 - j	78.503

(\* - WCAP Calculated Z at TCT)

Measured Z at TCT:    43.8    -j    78.5

Difference:    1.49  $\Omega$     0.003  $\Omega$

WCAP PART    VSWR

**WCAP INPUT DATA:**

1.1200    0.00010000    1 (Frequency in MHz, Step)

R	17.00700000	3	0	-96.39200000	(MiniNEC Modeled Impedance)
L	37.08900000	3	0	0.00000000	(Stray Shunt Inductance)
L	9.94200000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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**WCAP Tower Base Open Circuit "Self" Analysis – WUST Tower 4 (N)**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1    52.8277     $\angle$  -72.1931°    V  
Node: 2    52.5305     $\angle$  -73.2316°    V  
Node: 3    99.1806     $\angle$  -81.2105°    V

WCAP PART		CURRENT IN		CURRENT OUT	
	<u>WCAP PART</u>	<u>BRANCH VOLTAGE</u>		<u>BRANCH CURRENT</u>	
R	3→0    17.44500000	99.18	$\angle$ -81.211°    V	0.93	$\angle$ -0.646°    A
C	3→0    0.00009858	99.18	$\angle$ -81.211°    V	0.07	$\angle$ 8.789°    A
L	2→3    6.78100000	47.72	$\angle$ 90.000°    V	1.00	$\angle$ -0.001°    A
R	1→2    1.00000000	1.00	$\angle$ 0.000°    V	1.00	$\angle$ 0.000°    A

	<u>WCAP PART</u>	<u>FROM IMPEDANCE</u>	<u>TO IMPEDANCE</u>
R	3→0    17.44500000	17.45 - j    104.970	0.00 + j    0.000
C	3→0    0.00009858	0.00 - j    1441.500	0.00 + j    0.000
L	2→3    6.78100000	15.15 - j    50.297	15.16 - j    98.016
R	1→2    1.00000000	16.15 - j    50.297	*15.16 - j    50.297

(\* - WCAP Calculated Z at TCT)

Measured Z at TCT:    14.6    -j    50.3

Difference:    0.56  $\Omega$     0.003  $\Omega$

WCAP PART    VSWR

**WCAP INPUT DATA:**

1.1200    0.00010000    1 (Frequency in MHz, Step)

R	17.44500000	3	0	-104.97000000	(MiniNEC Modeled Impedance)
C	0.00009858	3	0		(Stray Shunt Capacitance)
L	6.78100000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	



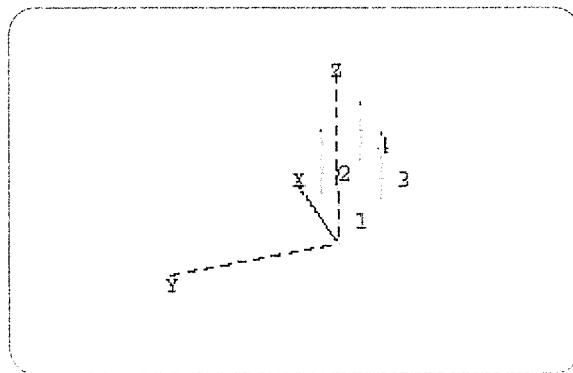
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**Details of MoM “Open Circuit” Modeling - Towers Driven Individually**

In the underlying MoM modeling used in the preceding circuit analysis work, each tower is considered individually, albeit with the companion towers of the array present in the model with the lumped loads applied to their bases.

Per the customary practice in approaching the numerical modeling of an array of towers, “Open Circuit” (“OC”) “Self” analysis calculations are initially made for each of the array towers based upon the actual physical characteristics of the array. The modeled data is then “converged” with the “as-measured” data for each tower by applying corrections to the tower dimensions to compensate for velocity of propagation, assumed stray base reactances, and other less readily quantified “real world” effects. The results of this modeling work yields the “modeled complex load impedances” shown in preceding circuit analysis. Copies of the resulting model program outputs follow this section.

In order to actually “construct” the array model in the MiniNEC program environment, all aspects of the radiating portions of the antenna system radiators are considered and entered into the program in mathematical terms the software can use. The WUST towers are identical, eighteen inch face, uniform cross-section, guyed towers. Given the diameters of the involved towers, the accepted practice of using a single thick “wire” approach to represent each tower was selected, as opposed to developing a more complicated “lattice” or wire-frame model for each tower. The wire model was created as illustrated in the sketch below, (which is oriented differently from the actual tower orientation for clarity). The effective radii for the tower “wires” were calculated in the usual manner (with the results in fractions of a meter) and used as the starting point in the model convergence. The top and bottom wire end points of each of the tower wires were specified in electrical degrees rather than meters for convenience. As the data were entered, no wire end caps were employed and a perfect ground environment was assumed.



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The horizontal plane geometry used in this analysis was taken from the theoretical directional antenna specifications for WUST as specified in the underlying Construction Permit, which were derived from an actual site survey. Distances between elements were specified in electrical degrees, while azimuths - with respect to the reference tower, Tower 1 (S) - are specified in degrees relative to True North. Distances in feet were converted to and specified in electrical degrees at the WUST frequency, while azimuths were derived from the supplied bearings, and converted to degrees relative to True North with reference to WUST Tower 1.

Care was taken to ensure compliance with the program's model restrictions and the stated FCC modeling constraints. As discussed below, the modeled array complies with FCC rule guidelines and does not trigger error messages within the modeling software.

Since the WUST towers are "physically" 63.83 electrical degrees high at 1120 kHz, for the purposes of this analysis, these towers were modeled using 10 segments per tower. The segment lengths are thus 6.4 degrees for the physical model. As such, the number of segments employed in this model satisfies the Commission's §73.151(c)(1)(iii) requirement that no less than one segment be used for each 10 electrical degrees of the tower's physical height. The model's diagnostic program was then run with the completed system and no error or warning messages were returned.

After the initial setup of antenna array information in the model, the individual WUST towers were studied iteratively, with all other array towers open circuited with appropriate lumped loads applied. Tower "wire" characteristics were then adjusted (in height and radius) until the modeled resistance approximately matched the measured resistance.

Final adjustments to converge the model reactances with the measured reactances were made through the introduction of the WCAP circuit model, shown in the preceding pages, which allowed an approximation of the series stray reactances found in the tower base environment. The model assumption included loads at ground level having the reactances that were calculated for them using the base circuit models for the open circuited towers of the WUST array.

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Per §73.151(c)(v) of the Commission's MoM rules, each tower's adjusted modeled height, relative to its physical height, falls within the required range of 75 to 125 percent.

Additionally, each modeled tower's radius falls within the required range of 80 percent to 150 percent of the radius of a circle having a circumference equal to the sum of the widths of the tower sides, in accordance with §73.151(c)(i) of the Commission's rules.

A summary of this portion of the model input data is provided below.

<b>Tower</b>	<b>Physical Height (at 1120 kHz)</b>	<b>Modeled Height</b>	<b>Modeled % of Height (125% max)</b>	<b>Radiator Physical Equivalent Radius</b>	<b>Modeled Radius</b>	<b>Modeled % of Radius (80% min)</b>
<b>1 – S</b>	63.83° electrical	67.5°	<b>105.7%</b>	0.2183 m	0.2183 m	<b>100.0%</b>
<b>2 – W</b>	63.83° electrical	67.1°	<b>105.1%</b>	0.2183 m	0.2183 m	<b>100.0%</b>
<b>3 – E</b>	63.83° electrical	68.3°	<b>107.0%</b>	0.2183 m	0.2008 m	<b>92.0%</b>
<b>4 – N</b>	63.83° electrical	67.2°	<b>105.3%</b>	0.2183 m	0.1790 m	<b>82.0%</b>

With the antenna array modeled exactly the same as the physical model and then again as described above, the model was checked using the "problem definition evaluation" function of the program. No errors or warnings were returned by the program diagnostics module.

The preceding WCAP tabulations detail the base circuit analysis; the following tabulations show the details of the MoM OC (open circuit base) models for the individually driven WUST towers.

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**MoM Model Details for Towers Driven Individually**

**WUST Tower 1 (S) OC Self Summary - (Sheet 1 of 3)**

WUST OC-Self\WUST T1 Self						
GEOMETRY						
Wire coordinates in degrees; other dimensions in meters						
Environment: perfect ground						
<u>wire</u>	<u>caps</u>	<u>Distance</u>	<u>Angle</u>	<u>Z</u>	<u>radius</u>	<u>segs</u>
1	none	0	0	0	.2183	10
		0	0	67.5		
2	none	106.21	10.2	0	.2183	10
		106.21	10.2	67.1		
3	none	98.81	45.	0	.2008	10
		98.81	45.	68.3		
4	none	195.9	27.	0	.179	10
		195.9	27.	67.2		
Number of wires = 4						
current nodes = 40						
Individual wires						
		minimum			maximum	
		wire	value		wire	value
segment length		2	6.71		3	6.83
radius		4	.179		1	.2183

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**WUST Tower 1 (S) OC Self Summary - (Sheet 2 of 3)**

WUST OC-Self\WUST T1 Self

**ELECTRICAL DESCRIPTION**

**Frequencies (MHz)**

frequency			no. of steps	segment length (wavelengths)	
no.	lowest	step		minimum	maximum
1	1.12	0	1	.0186389	.0189722

**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	0	0	0	0	0
2	11	0	-1,441.5	0	0	0
3	21	0	261.	0	0	0
4	31	0	-1,441.5	0	0	0

**IMPEDANCE**

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.12	17.749	-98.298	99.888	280.2	13.988	-1.244	-6.0368

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**WUST Tower 1 (S) OC Self Summary - (Sheet 3 of 3)**

WUST OC-Self\WUST T1 Self

CURRENT rms Frequency = 1.12 MHz Input power = 8.895E-04 watts  
Efficiency = 100. % coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	7.08E-03	79.8	1.26E-03	6.97E-03
2	0	0	6.75	6.56E-03	79.1	1.24E-03	6.44E-03
3	0	0	13.5	6.09E-03	78.6	1.21E-03	5.97E-03
4	0	0	20.25	5.56E-03	78.1	1.14E-03	5.44E-03
5	0	0	27.	4.97E-03	77.8	1.05E-03	4.86E-03
6	0	0	33.75	4.32E-03	77.4	9.41E-04	4.22E-03
7	0	0	40.5	3.61E-03	77.1	8.05E-04	3.51E-03
8	0	0	47.25	2.83E-03	76.8	6.47E-04	2.76E-03
9	0	0	54.	2.E-03	76.5	4.66E-04	1.94E-03
10	0	0	60.75	1.09E-03	76.2	2.6E-04	1.06E-03
END	0	0	67.5	0	0	0	0
GND	104.531	-18.8082	0	5.13E-05	300.8	2.63E-05	-4.41E-05
12	104.531	-18.8082	6.71	9.78E-05	300.8	5.02E-05	-8.4E-05
13	104.531	-18.8082	13.42	1.23E-04	300.9	6.31E-05	-1.05E-04
14	104.531	-18.8082	20.13	1.37E-04	301.	7.07E-05	-1.18E-04
15	104.531	-18.8082	26.84	1.42E-04	301.2	7.37E-05	-1.22E-04
16	104.531	-18.8082	33.55	1.39E-04	301.3	7.23E-05	-1.19E-04
17	104.531	-18.8082	40.26	1.28E-04	301.5	6.68E-05	-1.09E-04
18	104.531	-18.8082	46.97	1.09E-04	301.7	5.71E-05	-9.25E-05
19	104.531	-18.8082	53.68	8.23E-05	301.9	4.35E-05	-6.99E-05
20	104.531	-18.8082	60.39	4.79E-05	302.1	2.55E-05	-4.06E-05
END	104.531	-18.8082	67.1	0	0	0	0
GND	69.8692	-69.8692	0	4.95E-04	127.8	-3.04E-04	3.91E-04
22	69.8692	-69.8692	6.83	4.09E-04	127.8	-2.51E-04	3.23E-04
23	69.8692	-69.8692	13.66	3.47E-04	127.7	-2.12E-04	2.75E-04
24	69.8692	-69.8692	20.49	2.92E-04	127.6	-1.78E-04	2.31E-04
25	69.8692	-69.8692	27.32	2.41E-04	127.4	-1.46E-04	1.91E-04
26	69.8692	-69.8692	34.15	1.93E-04	127.1	-1.16E-04	1.54E-04
27	69.8692	-69.8692	40.98	1.49E-04	126.7	-8.89E-05	1.19E-04
28	69.8692	-69.8692	47.81	1.08E-04	126.2	-6.37E-05	8.7E-05
29	69.8692	-69.8692	54.64	7.01E-05	125.5	-4.07E-05	5.7E-05
30	69.8692	-69.8692	61.47	3.52E-05	124.7	-2.E-05	2.89E-05
END	69.8692	-69.8692	68.3	0	0	0	0
GND	174.548	-88.9367	0	3.21E-05	222.2	-2.38E-05	-2.15E-05
32	174.548	-88.9367	6.72	5.94E-05	222.1	-4.4E-05	-3.98E-05
33	174.548	-88.9367	13.44	7.46E-05	222.1	-5.54E-05	-4.99E-05
34	174.548	-88.9367	20.16	8.35E-05	222.	-6.21E-05	-5.58E-05
35	174.548	-88.9367	26.88	8.7E-05	221.8	-6.48E-05	-5.8E-05
36	174.548	-88.9367	33.6	8.54E-05	221.7	-6.38E-05	-5.68E-05
37	174.548	-88.9367	40.32	7.89E-05	221.5	-5.91E-05	-5.23E-05
38	174.548	-88.9367	47.04	6.75E-05	221.3	-5.07E-05	-4.46E-05
39	174.548	-88.9367	53.76	5.14E-05	221.1	-3.87E-05	-3.38E-05
40	174.548	-88.9367	60.48	3.E-05	220.9	-2.27E-05	-1.96E-05
END	174.548	-88.9367	67.2	0	0	0	0

Statement E  
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**WUST Tower 2 (W) OC Self Summary - (Sheet 1 of 3)**

WUST OC-Self\WUST T2 Self

**GEOMETRY**

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

<u>wire</u>	<u>caps</u>	<u>Distance</u>	<u>Angle</u>	<u>Z</u>	<u>radius</u>	<u>segs</u>
1	none	0	0	0	.2183	10
		0	0	67.5		
2	none	106.21	10.2	0	.2183	10
		106.21	10.2	67.1		
3	none	98.81	45.	0	.2008	10
		98.81	45.	68.3		
4	none	195.9	27.	0	.179	10
		195.9	27.	67.2		

Number of wires = 4  
 current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	2	6.71	3	6.83
radius	4	.179	1	.2183

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**WUST Tower 2 (W) OC Self Summary - (Sheet 2 of 3)**

WUST OC-Self\WUST T2 Self

**ELECTRICAL DESCRIPTION**

**Frequencies (MHz)**

frequency			no. of steps	segment length (wavelengths)	
no.	lowest	step		minimum	maximum
1	1.12	0	1	.0186389	.0189722

**Sources**

source	node	sector	magnitude	phase	type
1	9	1	1.	0	voltage

**Lumped loads**

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-1,441.5	0	0	0
2	11	0	0	0	0	0
3	21	0	261.	0	0	0
4	31	0	-1,441.5	0	0	0

**IMPEDANCE**

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 11, sector 1							
1.12	17.104	-99.802	101.26	279.7	14.845	-1.172	-6.2614



**Statement E**  
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**WUST Tower 2 (W) OC Self Summary - (Sheet 3 of 3)**

WUST OC-Self\WUST T2 Self							
CURRENT rms    Frequency    = 1.12 MHz Input power = 8.341E-04 watts							
Efficiency    = 100. %    coordinates in degrees							
current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	5.06E-05	301.3	2.63E-05	-4.33E-05
2	0	0	6.75	9.68E-05	301.3	5.04E-05	-8.27E-05
3	0	0	13.5	1.22E-04	301.4	6.35E-05	-1.04E-04
4	0	0	20.25	1.36E-04	301.5	7.12E-05	-1.16E-04
5	0	0	27.	1.41E-04	301.7	7.43E-05	-1.2E-04
6	0	0	33.75	1.38E-04	301.8	7.3E-05	-1.18E-04
7	0	0	40.5	1.27E-04	302.	6.75E-05	-1.08E-04
8	0	0	47.25	1.09E-04	302.2	5.79E-05	-9.19E-05
9	0	0	54.	8.23E-05	302.4	4.41E-05	-6.95E-05
10	0	0	60.75	4.8E-05	302.6	2.59E-05	-4.04E-05
END	0	0	67.5	0	0	0	0
GND	104.531	-18.8082	0	6.98E-03	80.3	1.18E-03	6.88E-03
12	104.531	-18.8082	6.71	6.47E-03	79.6	1.17E-03	6.36E-03
13	104.531	-18.8082	13.42	6.E-03	79.1	1.13E-03	5.89E-03
14	104.531	-18.8082	20.13	5.48E-03	78.7	1.07E-03	5.37E-03
15	104.531	-18.8082	26.84	4.9E-03	78.4	9.88E-04	4.8E-03
16	104.531	-18.8082	33.55	4.25E-03	78.	8.82E-04	4.16E-03
17	104.531	-18.8082	40.26	3.55E-03	77.7	7.55E-04	3.47E-03
18	104.531	-18.8082	46.97	2.79E-03	77.4	6.06E-04	2.72E-03
19	104.531	-18.8082	53.68	1.97E-03	77.2	4.37E-04	1.92E-03
20	104.531	-18.8082	60.39	1.08E-03	76.9	2.44E-04	1.05E-03
END	104.531	-18.8082	67.1	0	0	0	0
GND	69.8692	-69.8692	0	5.91E-04	152.	-5.22E-04	2.77E-04
22	69.8692	-69.8692	6.83	4.88E-04	152.	-4.31E-04	2.3E-04
23	69.8692	-69.8692	13.66	4.15E-04	151.6	-3.65E-04	1.97E-04
24	69.8692	-69.8692	20.49	3.49E-04	151.	-3.05E-04	1.69E-04
25	69.8692	-69.8692	27.32	2.88E-04	150.1	-2.5E-04	1.44E-04
26	69.8692	-69.8692	34.15	2.32E-04	148.7	-1.99E-04	1.21E-04
27	69.8692	-69.8692	40.98	1.8E-04	146.9	-1.51E-04	9.84E-05
28	69.8692	-69.8692	47.81	1.32E-04	144.5	-1.07E-04	7.65E-05
29	69.8692	-69.8692	54.64	8.68E-05	141.6	-6.8E-05	5.4E-05
30	69.8692	-69.8692	61.47	4.45E-05	138.	-3.3E-05	2.98E-05
END	69.8692	-69.8692	68.3	0	0	0	0
GND	174.548	-88.9367	0	5.28E-05	306.3	3.12E-05	-4.26E-05
32	174.548	-88.9367	6.72	9.76E-05	306.3	5.78E-05	-7.86E-05
33	174.548	-88.9367	13.44	1.22E-04	306.5	7.26E-05	-9.83E-05
34	174.548	-88.9367	20.16	1.36E-04	306.6	8.14E-05	-1.09E-04
35	174.548	-88.9367	26.88	1.41E-04	306.8	8.48E-05	-1.13E-04
36	174.548	-88.9367	33.6	1.38E-04	307.1	8.33E-05	-1.1E-04
37	174.548	-88.9367	40.32	1.27E-04	307.3	7.7E-05	-1.01E-04
38	174.548	-88.9367	47.04	1.08E-04	307.6	6.6E-05	-8.56E-05
39	174.548	-88.9367	53.76	8.17E-05	307.9	5.02E-05	-6.45E-05
40	174.548	-88.9367	60.48	4.74E-05	308.2	2.93E-05	-3.73E-05
END	174.548	-88.9367	67.2	0	0	0	0

**Statement E**  
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**WUST Tower 3 (E) OC Self Summary - (Sheet 1 of 3)**

WUST OC-Self\WUST T3 Self

**GEOMETRY**

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

<u>wire</u>	<u>caps</u>	<u>Distance</u>	<u>Angle</u>	<u>Z</u>	<u>radius</u>	<u>segs</u>
1	none	0	0	0	.2183	10
		0	0	67.5		
2	none	106.21	10.2	0	.2183	10
		106.21	10.2	67.1		
3	none	98.81	45.	0	.2008	10
		98.81	45.	68.3		
4	none	195.9	27.	0	.179	10
		195.9	27.	67.2		

Number of wires = 12  
 current nodes = 76

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	2	6.71	3	6.83
radius	4	.179	1	.2183

Statement E  
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**WUST Tower 3 (E) OC Self Summary - (Sheet 2 of 3)**

WUST OC-Self\WUST T3 Self

**ELECTRICAL DESCRIPTION**

**Frequencies (MHz)**

frequency			no. of steps	segment length (wavelengths)	
no.	lowest	step		minimum	maximum
1	1.12	0	1	.0186389	.0189722

**Sources**

source	node	sector	magnitude	phase	type
1	21	1	1.	0	voltage

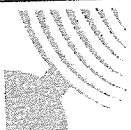
**Lumped loads**

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-1,441.5	0	0	0
2	11	0	-1,441.5	0	0	0
3	21	0	0	0	0	0
4	31	0	-1,441.5	0	0	0

**IMPEDANCE**

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 21, sector 1							
1.12	17.007	-96.392	97.881	280.	14.136	-1.231	-6.0763



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**WUST Tower 3 (E) OC Self Summary - (Sheet 3 of 3)**

WUST OC-Self\WUST T3 Self

CURRENT rms      Frequency      = 1.12 MHz      Input power = 8.876E-04 watts  
Efficiency      = 100. %      coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	5.43E-05	301.5	2.84E-05	-4.63E-05
2	0	0	6.75	1.04E-04	301.5	5.43E-05	-8.85E-05
3	0	0	13.5	1.31E-04	301.7	6.86E-05	-1.11E-04
4	0	0	20.25	1.46E-04	301.8	7.7E-05	-1.24E-04
5	0	0	27.	1.52E-04	302.1	8.05E-05	-1.29E-04
6	0	0	33.75	1.48E-04	302.3	7.92E-05	-1.25E-04
7	0	0	40.5	1.36E-04	302.6	7.34E-05	-1.15E-04
8	0	0	47.25	1.16E-04	302.8	6.3E-05	-9.77E-05
9	0	0	54.	8.81E-05	303.1	4.81E-05	-7.37E-05
10	0	0	60.75	5.13E-05	303.4	2.83E-05	-4.28E-05
END	0	0	67.5	0	0	0	0
GND	104.531	-18.8082	0	6.57E-05	325.2	5.39E-05	-3.74E-05
12	104.531	-18.8082	6.71	1.25E-04	325.5	1.03E-04	-7.08E-05
13	104.531	-18.8082	13.42	1.57E-04	326.2	1.3E-04	-8.73E-05
14	104.531	-18.8082	20.13	1.75E-04	327.1	1.47E-04	-9.5E-05
15	104.531	-18.8082	26.84	1.81E-04	328.1	1.54E-04	-9.56E-05
16	104.531	-18.8082	33.55	1.77E-04	329.3	1.52E-04	-9.01E-05
17	104.531	-18.8082	40.26	1.62E-04	330.6	1.41E-04	-7.95E-05
18	104.531	-18.8082	46.97	1.38E-04	332.	1.22E-04	-6.47E-05
19	104.531	-18.8082	53.68	1.04E-04	333.4	9.32E-05	-4.66E-05
20	104.531	-18.8082	60.39	6.07E-05	335.	5.5E-05	-2.57E-05
END	104.531	-18.8082	67.1	0	0	0	0
GND	69.8692	-69.8692	0	7.22E-03	80.	1.26E-03	7.11E-03
22	69.8692	-69.8692	6.83	6.71E-03	79.3	1.24E-03	6.6E-03
23	69.8692	-69.8692	13.66	6.24E-03	78.9	1.2E-03	6.12E-03
24	69.8692	-69.8692	20.49	5.7E-03	78.5	1.14E-03	5.59E-03
25	69.8692	-69.8692	27.32	5.1E-03	78.1	1.05E-03	4.99E-03
26	69.8692	-69.8692	34.15	4.43E-03	77.8	9.38E-04	4.33E-03
27	69.8692	-69.8692	40.98	3.7E-03	77.5	8.02E-04	3.61E-03
28	69.8692	-69.8692	47.81	2.9E-03	77.2	6.44E-04	2.83E-03
29	69.8692	-69.8692	54.64	2.05E-03	76.9	4.63E-04	1.99E-03
30	69.8692	-69.8692	61.47	1.12E-03	76.6	2.58E-04	1.09E-03
END	69.8692	-69.8692	68.3	0	0	0	0
GND	174.548	-88.9367	0	5.16E-05	295.6	2.23E-05	-4.65E-05
32	174.548	-88.9367	6.72	9.54E-05	295.6	4.12E-05	-8.6E-05
33	174.548	-88.9367	13.44	1.19E-04	295.7	5.18E-05	-1.08E-04
34	174.548	-88.9367	20.16	1.33E-04	295.8	5.81E-05	-1.2E-04
35	174.548	-88.9367	26.88	1.38E-04	296.	6.06E-05	-1.25E-04
36	174.548	-88.9367	33.6	1.35E-04	296.1	5.96E-05	-1.22E-04
37	174.548	-88.9367	40.32	1.24E-04	296.3	5.51E-05	-1.12E-04
38	174.548	-88.9367	47.04	1.06E-04	296.5	4.72E-05	-9.49E-05
39	174.548	-88.9367	53.76	8.02E-05	296.6	3.6E-05	-7.17E-05
40	174.548	-88.9367	60.48	4.66E-05	296.8	2.1E-05	-4.15E-05
END	174.548	-88.9367	67.2	0	0	0	0

Statement E  
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**WUST Tower 4 (N) OC Self Summary - (Sheet 1 of 3)**

WUST OC-Self\WUST T4 Self

**GEOMETRY**

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

<u>wire</u>	<u>caps</u>	<u>Distance</u>	<u>Angle</u>	<u>Z</u>	<u>radius</u>	<u>segs</u>
1	none	0	0	0	.2183	10
		0	0	67.5		
2	none	106.21	10.2	0	.2183	10
		106.21	10.2	67.1		
3	none	98.81	45.	0	.2008	10
		98.81	45.	68.3		
4	none	195.9	27.	0	.179	10
		195.9	27.	67.2		

Number of wires = 4  
 current nodes = 40

Individual wires	minimum		maximum	
	wire	value	wire	value
segment length	2	6.71	3	6.83
radius	4	.179	1	.2183

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**WUST Tower 4 (N) OC Self Summary - (Sheet 2 of 3)**

WUST OC-Self\WUST T4 Self

**ELECTRICAL DESCRIPTION**

**Frequencies (MHz)**

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.12	0	1	.0186389	.0189722

**Sources**

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

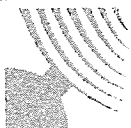
**Lumped loads**

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-1,441.5	0	0	0
2	11	0	-1,441.5	0	0	0
3	21	0	261.	0	0	0
4	31	0	0	0	0	0

**IMPEDANCE**

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 23, sector 1							
1.12	17.445	-104.97	106.41	279.4	15.784	-1.1021	-6.4951



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**WUST Tower 4 (N) OC Self Summary - (Sheet 3 of 3)**

WUST OC-Self\WUST T4 Self

CURRENT rms    Frequency    = 1.12 MHz    Input power = 7.703E-04 watts  
Efficiency    = 100. %    coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	3.02E-05	223.	-2.21E-05	-2.06E-05
2	0	0	6.75	5.79E-05	222.9	-4.24E-05	-3.94E-05
3	0	0	13.5	7.3E-05	222.8	-5.35E-05	-4.96E-05
4	0	0	20.25	8.19E-05	222.7	-6.02E-05	-5.55E-05
5	0	0	27.	8.54E-05	222.6	-6.29E-05	-5.78E-05
6	0	0	33.75	8.39E-05	222.4	-6.2E-05	-5.66E-05
7	0	0	40.5	7.76E-05	222.2	-5.74E-05	-5.22E-05
8	0	0	47.25	6.65E-05	222.	-4.94E-05	-4.45E-05
9	0	0	54.	5.07E-05	221.8	-3.78E-05	-3.38E-05
10	0	0	60.75	2.97E-05	221.6	-2.22E-05	-1.97E-05
END	0	0	67.5	0	0	0	0
GND	104.531	-18.8082	0	5.04E-05	306.6	3.E-05	-4.05E-05
12	104.531	-18.8082	6.71	9.61E-05	306.6	5.73E-05	-7.71E-05
13	104.531	-18.8082	13.42	1.21E-04	306.8	7.22E-05	-9.67E-05
14	104.531	-18.8082	20.13	1.35E-04	307.	8.1E-05	-1.08E-04
15	104.531	-18.8082	26.84	1.4E-04	307.2	8.44E-05	-1.11E-04
16	104.531	-18.8082	33.55	1.36E-04	307.4	8.29E-05	-1.08E-04
17	104.531	-18.8082	40.26	1.25E-04	307.7	7.67E-05	-9.91E-05
18	104.531	-18.8082	46.97	1.07E-04	308.	6.57E-05	-8.41E-05
19	104.531	-18.8082	53.68	8.07E-05	308.3	5.E-05	-6.33E-05
20	104.531	-18.8082	60.39	4.7E-05	308.7	2.93E-05	-3.67E-05
END	104.531	-18.8082	67.1	0	0	0	0
GND	69.8692	-69.8692	0	4.44E-04	122.7	-2.4E-04	3.73E-04
22	69.8692	-69.8692	6.83	3.66E-04	122.7	-1.98E-04	3.08E-04
23	69.8692	-69.8692	13.66	3.11E-04	122.6	-1.68E-04	2.62E-04
24	69.8692	-69.8692	20.49	2.61E-04	122.6	-1.4E-04	2.2E-04
25	69.8692	-69.8692	27.32	2.15E-04	122.4	-1.15E-04	1.82E-04
26	69.8692	-69.8692	34.15	1.73E-04	122.2	-9.2E-05	1.46E-04
27	69.8692	-69.8692	40.98	1.33E-04	121.9	-7.03E-05	1.13E-04
28	69.8692	-69.8692	47.81	9.62E-05	121.6	-5.04E-05	8.2E-05
29	69.8692	-69.8692	54.64	6.25E-05	121.1	-3.23E-05	5.35E-05
30	69.8692	-69.8692	61.47	3.13E-05	120.5	-1.59E-05	2.7E-05
END	69.8692	-69.8692	68.3	0	0	0	0
GND	174.548	-88.9367	0	6.65E-03	80.6	1.09E-03	6.56E-03
32	174.548	-88.9367	6.72	6.16E-03	79.9	1.08E-03	6.07E-03
33	174.548	-88.9367	13.44	5.71E-03	79.5	1.04E-03	5.62E-03
34	174.548	-88.9367	20.16	5.21E-03	79.1	9.89E-04	5.12E-03
35	174.548	-88.9367	26.88	4.66E-03	78.7	9.12E-04	4.57E-03
36	174.548	-88.9367	33.6	4.04E-03	78.4	8.14E-04	3.96E-03
37	174.548	-88.9367	40.32	3.37E-03	78.1	6.96E-04	3.3E-03
38	174.548	-88.9367	47.04	2.64E-03	77.8	5.59E-04	2.58E-03
39	174.548	-88.9367	53.76	1.86E-03	77.5	4.02E-04	1.81E-03
40	174.548	-88.9367	60.48	1.01E-03	77.2	2.24E-04	9.86E-04
END	174.548	-88.9367	67.2	0	0	0	0

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**Derivation of Day and Night Directional Antenna System Operating Parameters**

The process just documented establishes the antenna array model, which is then used as a basis for calculating the day and night directional antenna system operating parameters. At this point, “medium wave array synthesis” moment method calculations are made for each directional mode of operation using the respective WUST theoretical pattern antenna field ratio magnitudes and phases set forth in the CP, along with the now established converged tower heights and radii for the driven towers.

This process yields the complex voltage values for sources located at the base insulator for each tower from which current moment sums are produced for the mode of interest. These values, when normalized, equate to the theoretical field parameters for the authorized directional antenna patterns.

Tower base currents and driving point impedances are then calculated for each directional pattern. (Indicated voltages and currents not specified as “RMS” values are corresponding “peak” values in the information that follows.) This information is then used to calculate the currents at the ATU J-plug “reference points” (where the Toroidal Current Transformer derived antenna monitor samples are taken) by using the WCAP circuit modeling software, and the same base circuit environment assumptions that were derived from the single tower open-circuit measurements.

The following pages provide details of the MoM array synthesis modeling performed for the directional antenna for each pattern, along with the resulting normalized antenna monitor parameters, derived from the WCAP analysis process. The designations employed in the model output data for the antenna “wire” and corresponding base node information are as follows:

<b>Tower</b>	<b>Wire</b>	<b>Base Node</b>
<b>1 (S)</b>	1	1
<b>2 (W)</b>	2	11
<b>3 (E)</b>	3	21
<b>4 (N)</b>	4	31

The resulting normalized antenna monitor parameters, derived from the WCAP analysis, are provided after the day and night pattern synthesis model data shown in the following pages.



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**MoM Model Details – Daytime Pattern**

*Daytime Directional Antenna Array Synthesis - (Sheet 1 of 6)*

**MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS**

Frequency = 1.12 MHz

<u>Tower</u>	<u>Field Ratio</u> <u>Magnitude</u>	<u>Phase</u> <u>(deg)</u>
1	1.0	0.0
2	0.978	-7.4
3	1.533	129.8
4	0.552	-74.4

**VOLTAGES AND CURRENTS - rms**

<u>Source</u>	<u>Voltage</u> <u>Magnitude</u>	<u>Phase (deg)</u>	<u>Current</u> <u>Magnitude</u>	<u>Phase (deg)</u>
1	3,211.49	285.7	35.2903	2.0
11	3,330.79	271.8	35.0865	353.7
21	5,212.59	40.0	54.2201	129.9
31	1,867.26	207.2	19.6096	287.1

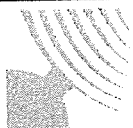
Sum of square of source currents = 11,601.6

Total power = 50,000. watts

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*Daytime Directional Antenna Array Synthesis - (Sheet 2 of 6)*

<b><u>TOWER ADMITTANCE MATRIX</u></b>			<b><u>TOWER IMPEDANCE MATRIX</u></b>		
<b><u>Admittance</u></b>	<b><u>Real (mhos)</u></b>	<b><u>Imaginary (mhos)</u></b>	<b><u>Impedance</u></b>	<b><u>Real (ohms)</u></b>	<b><u>Imaginary (ohms)</u></b>
Y(1, 1)	0.00	0.009993	Z(1, 1)	16.98	-98.3271
Y(1, 2)	0.00	-0.00094	Z(1, 2)	6.52	-8.80485
Y(1, 3)	0.00	-0.001	Z(1, 3)	7.86	-8.62311
Y(1, 4)	0.00	-0.00021	Z(1, 4)	-4.91	-5.53489
Y(2, 1)	0.000252	-0.00094	Z(2, 1)	6.52349	-8.80491
Y(2, 2)	0.001263	0.009762	Z(2, 2)	16.4602	-100.709
Y(2, 3)	0.000901	-0.0008	Z(2, 3)	12.9516	-5.77114
Y(2, 4)	0.000372	-0.00086	Z(2, 4)	7.59826	-8.37944
Y(3, 1)	0.00041	-0.001	Z(3, 1)	7.85787	-8.6229
Y(3, 2)	0.000901	-0.0008	Z(3, 2)	12.9519	-5.77037
Y(3, 3)	0.001454	0.01017	Z(3, 3)	17.2668	-96.3412
Y(3, 4)	0.000265	-0.00093	Z(3, 4)	6.62136	-8.93575
Y(4, 1)	-0.00077	-0.00021	Z(4, 1)	-4.90688	-5.53489
Y(4, 2)	0.000372	-0.00086	Z(4, 2)	7.59829	-8.37942
Y(4, 3)	0.000265	-0.00093	Z(4, 3)	6.62119	-8.93592
Y(4, 4)	0.001381	0.009397	Z(4, 4)	16.7701	-104.835



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*Daytime Directional Antenna Array Synthesis - (Sheet 3 of 6)*

WUST DA-Day - Mom

**GEOMETRY**

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

<u>wire</u>	<u>caps</u>	<u>Distance</u>	<u>Angle</u>	<u>Z</u>	<u>radius</u>	<u>segs</u>
1	none	0	0	0	.2183	10
		0	0	67.5		
2	none	106.21	10.2	0	.2183	10
		106.21	10.2	67.1		
3	none	98.81	45.	0	.2008	10
		98.81	45.	68.3		
4	none	195.9	27.	0	.179	10
		195.9	27.	67.2		

Number of wires = 4  
 current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	2	6.71	3	6.83
radius	4	.179	1	.2183

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*Daytime Directional Antenna Array Synthesis - (Sheet 4 of 6)*

WUST DA-Day - MoM

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.12	0	1	.0186389	.0189722

Sources

source	node	sector	magnitude	phase	type
1	1	1	4,541.73	285.7	voltage
2	11	1	4,710.45	271.8	voltage
3	21	1	7,371.71	40.	voltage
4	31	1	2,640.71	207.2	voltage

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.12	21.493	-88.425	91.	283.7	9.9314	-1.7551	-4.7828
source = 2; node 21, sector 1							
1.12	13.337	-93.986	94.928	278.1	17.203	-1.0109	-6.8263
source = 3; node 23, sector 1							
1.12	.11384	-96.127	96.127	270.1	2,062.6	-8.4E-03	-27.128
source = 4; node 37, sector 1							
1.12	16.779	-93.749	95.239	280.1	13.719	-1.2685	-5.9637

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*Daytime Directional Antenna Array Synthesis - (Sheet 5 of 6)*

WUST DA-Day - MoM

CURRENT rms

Frequency = 1.12 MHz

Input power = 50,000. Watts

Efficiency = 100. %

coordinates in degrees

current no.	x	y	z		mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	T1	35.3006	2.	35.2783	1.25561
2	0	0	6.75		32.9389	1.2	32.9317	.685947
3	0	0	13.5		30.7125	.6	30.7108	.330361
4	0	0	20.25		28.1748	.1	28.1747	.0619661
5	0	0	27.		25.2839	359.7	25.2835	-.135318
6	0	0	33.75		22.0378	359.3	22.0362	-.267897
7	0	0	40.5		18.4481	358.9	18.4449	-.339006
8	0	0	47.25		14.5272	358.6	14.523	-.350554
9	0	0	54.		10.2739	358.3	10.2694	-.303285
10	0	0	60.75		5.63574	358.	5.63235	-.195375
END	0	0	67.5		0	0	0	0
GND	104.531	-18.8082	0	T2	35.0969	353.7	34.8865	-3.83724
12	104.531	-18.8082	6.71		32.627	353.2	32.3978	-3.86078
13	104.531	-18.8082	13.42		30.3365	352.9	30.1014	-3.77005
14	104.531	-18.8082	20.13		27.7556	352.6	27.5233	-3.58314
15	104.531	-18.8082	26.84		24.8417	352.4	24.6207	-3.30649
16	104.531	-18.8082	33.55		21.5944	352.2	21.3924	-2.94668
17	104.531	-18.8082	40.26		18.0275	352.	17.8518	-2.51059
18	104.531	-18.8082	46.97		14.1564	351.9	14.0137	-2.00474
19	104.531	-18.8082	53.68		9.98313	351.7	9.87969	-1.43338
20	104.531	-18.8082	60.39		5.46066	351.6	5.40275	-.793138
END	104.531	-18.8082	67.1		0	0	0	0
GND	69.8692	-69.8692	0	T3	54.2406	129.9	-34.816	41.592
22	69.8692	-69.8692	6.83		50.4023	129.9	-32.3467	38.6535
23	69.8692	-69.8692	13.66		46.8196	129.9	-30.0376	35.914
24	69.8692	-69.8692	20.49		42.7921	129.9	-27.44	32.8362
25	69.8692	-69.8692	27.32		38.2564	129.9	-24.5146	29.3698
26	69.8692	-69.8692	34.15		33.2138	129.8	-21.2647	25.5141
27	69.8692	-69.8692	40.98		27.6882	129.8	-17.7083	21.285
28	69.8692	-69.8692	47.81		21.7057	129.7	-13.8651	16.7003
29	69.8692	-69.8692	54.64		15.2732	129.6	-9.74262	11.7624
30	69.8692	-69.8692	61.47		8.32337	129.6	-5.30112	6.4169
END	69.8692	-69.8692	68.3		0	0	0	0

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*Daytime Directional Antenna Array Synthesis - (Sheet 6 of 6)*

WUST DA-Day - Sum

current no.	X	Y	Z		mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	174.548	-88.9367	0	T4	19.6113	287.1	5.75114	-18.7491
32	174.548	-88.9367	6.72		18.3108	286.4	5.18185	-17.5622
33	174.548	-88.9367	13.44		17.0632	286.	4.70663	-16.4012
34	174.548	-88.9367	20.16		15.6407	285.6	4.2187	-15.061
35	174.548	-88.9367	26.88		14.0218	285.3	3.70618	-13.5231
36	174.548	-88.9367	33.6		12.2065	285.	3.16677	-11.7885
37	174.548	-88.9367	40.32		10.2025	284.8	2.60124	-9.86533
38	174.548	-88.9367	47.04		8.01807	284.5	2.01108	-7.76177
39	174.548	-88.9367	53.76		5.65421	284.3	1.39624	-5.47911
40	174.548	-88.9367	60.48		3.08459	284.1	.750269	-2.99195
END	174.548	-88.9367	67.2		0	0	0	0

**Current Moment Report and Analysis**

**CURRENT MOMENTS (amp-degrees) rms**

Frequency = 1.12 MHz      Input power = 50,000. watts

vertical current moment

Wire	Magnitude	Phase (deg)	Magnitude	Phase (deg)
1	1,459.65	0	1,459.65	0
2	1,427.54	352.6	1,427.54	352.6
3	2,237.88	129.8	2,237.88	129.8
4	805.541	285.6	805.541	285.6

Medium wave array vertical current moment (amps-degrees) rms

(Calculation assumes tower wires are grouped together. The first wire of each group must contain the source.)

Tower	Magnitude	Phase (deg)
1	1,459.65	0
2	1,427.54	352.6
3	2,237.88	129.8
4	805.541	285.6

**Above Normalized and Converted**

Tower	Ratio	Phase
1	1.000	0.0°
2	0.978	-7.4°
3	1.533	129.8°
4	0.552	-74.4°

**CP Theoretical Field Data**

Tower	Ratio	Phase
1	1.000	0.0°
2	0.978	-7.4°
3	1.533	129.8°
4	0.552	-74.4°

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The above current moment sums were run at the completion of the synthesis. As shown, when these values are normalized, they equate to the theoretical CP field parameters for the authorized directional antenna pattern.

**Directional Antenna System “Antenna Monitor” Parameters**

With the modeled directional antenna complex voltage and current values for sources located at ground level for each tower now being derived for the daytime directional pattern, WCAP circuit analysis calculations<sup>2</sup> were run to develop the current magnitude and phase information that will be present at the ATU reference point where the TCT sampling devices are located.

Since the current transformers and sampling lines are essentially identical, the antenna monitor ratios and phases corresponding to the theoretical parameters can be calculated and normalized directly from the modeled ATU currents, as shown below:

**Daytime Directional Antenna Monitor Operating Parameters**

<b>Tower</b>	<b>Modeled Current Pulse</b>	<b>Modeled Current Magnitude at Toroid</b>	<b>Modeled Current Phase at Toroid</b>	<b>Modeled Antenna Monitor Ratio</b>	<b>Modeled Antenna Monitor Phase</b>
<b>1 (S )</b>	1	37.4693 A	2.805°	1.000	0.0°
<b>2 (W)</b>	11	37.3883 A	354.198°	0.998	-8.6°
<b>3 (E)</b>	21	34.2652 A	129.860°	0.914	127.1°
<b>4 (N)</b>	31	20.8848 A	287.726°	0.557	-75.1°

The phasing and coupling systems for the authorized patterns were adjusted such that the antenna monitor phase and ratio indications were within 5% of the ratio values and 3° of the phase values shown above, per the requirements of §73.62(a) of the Commission’s Rules.

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<sup>2</sup> The circuit analysis undertaken for each tower used to develop the above tabulations is documented in the following pages. For this analysis, the same WCAP schematic diagrams and node nomenclature are employed as were described previously for the “OC-self” analysis work. As was done previously, node 2 represents the ATU TCT reference point while node 3 represents the tower feedpoint. Node 0 represents ground potential. The tower operating impedances were represented by complex loads from node 3 to ground ( $R_3 - j_0$ ).

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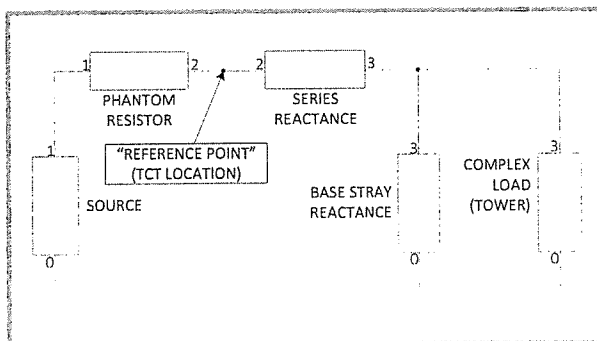
Circuit Analysis Used for Each Tower to Develop Daytime Antenna Monitor Parameters

**WCAP Directional Antenna Base Circuit Analysis – WUST Tower 1 (S) - Day**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1 1408.5396  $\angle$  -54.9143° V  
Node: 2 1388.8898  $\angle$  -56.2212° V  
Node: 3 3212.3051  $\angle$  -74.3382° V



	<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>		<u>BRANCH CURRENT</u>	
R	3→0	21.49300000	3212.31 $\angle$ -74.338° V	35.30 $\angle$ 2.000° A *		
C	3→0	0.00009858	3212.31 $\angle$ -74.338° V	2.23 $\angle$ 15.662° A		
L	2→3	7.36100000	1940.93 $\angle$ 92.805° V	37.47 $\angle$ 2.805° A		
R	1→2	1.00000000	37.47 $\angle$ 2.805° V	37.47 $\angle$ 2.805° A **		

\* Modeled Current at Tower (rounded)

\*\* Modeled Current at TCT (rounded)

	<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>	<u>TO IMPEDANCE</u>
R	3→0	21.49300000	21.49 - j 88.425	0.00 + j 0.000
C	3→0	0.00009858	-0.00 - j 1441.500	0.00 + j 0.000
L	2→3	7.36100000	19.08 - j 31.782	19.08 - j 83.582
R	1→2	1.00000000	20.08 - j 31.782	19.08 - j 31.782

**WCAP INPUT DATA:**

1.3300 0.00010000 1  
R 21.49300000 3 0 -88.42500000 (Modeled MiniNEC Base Impedance, R & X  $\Omega$ )  
C 0.00009858 3 0 (Stray Shunt Capacitance,  $\mu$ F)  
L 7.36100000 2 3 0.00000000 (Stray Series Inductance,  $\mu$ H)  
R 1.00000000 1 2 0.00000000 (Phantom Resistor,  $\Omega$ )  
I 37.46930000 0 1 2.80500000 (\*\*Modeled Current Magnitude and Phase at TCT)



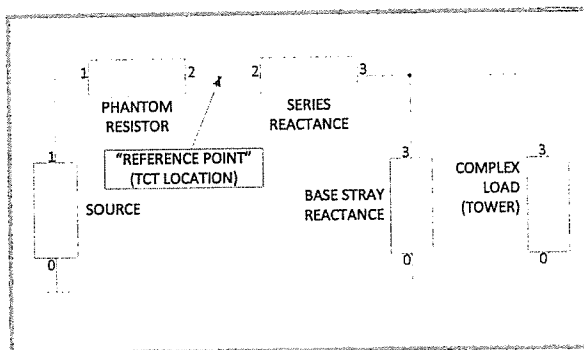
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**WCAP Directional Antenna Base Circuit Analysis – WUST Tower 2 (W) - Day**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1 1667.1487  $\angle$  -79.1825° V  
Node: 2 1656.8425  $\angle$  -80.4216° V  
Node: 3 3331.8120  $\angle$  -88.2231° V



	<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>				<u>BRANCH CURRENT</u>			
R	3→0	13.33700000	3331.81	$\angle$	-88.223°	V	35.10	$\angle$	-6.300°	A *
C	3→0	0.00009858	3331.81	$\angle$	-88.223°	V	2.31	$\angle$	1.777°	A
L	2→3	6.48100000	1705.20	$\angle$	84.198°	V	37.39	$\angle$	-5.802°	A
R	1→2	1.00000000	37.39	$\angle$	-5.802°	V	37.39	$\angle$	-5.802°	A **

\* Modeled Current at Tower (rounded)

\*\* Modeled Current at TCT (rounded)

	<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>		<u>TO IMPEDANCE</u>	
R	3→0	13.3370000	13.34	- j	93.986	0.00 + j 0.000
C	3→0	0.00009858	0.00	- j	1441.500	0.00 + j 0.000
L	2→3	6.48100000	11.75	- j	42.727	11.75 - j 88.335
R	1→2	1.00000000	12.75	- j	42.727	11.75 - j 42.727

**WCAP INPUT DATA:**

1.1200 0.00010000 1  
**R** 13.33700000 3 0 -93.98600000 (Modeled MiniNEC Base Impedance, R & X  $\Omega$ )  
**C** 0.00009858 3 0 (Stray Shunt Capacitance,  $\mu$ F)  
**L** 6.48100000 2 3 0.00000000 (Stray Series Inductance,  $\mu$ H)  
**R** 1.00000000 1 2 0.00000000 (Phantom Resistor,  $\Omega$ )  
**I** 37.38830000 0 1 354.19800000 (\*\*Modeled Current Magnitude and Phase at TCT)

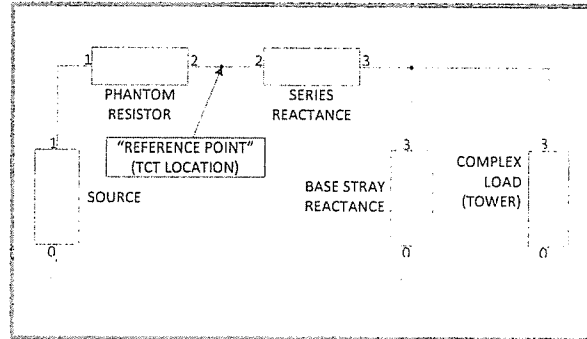
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**WCAP Directional Antenna Base Circuit Analysis – WUST Tower 3 (E) - Day**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1	318.3101	∠	40.7557°	V
Node: 2	310.5611	∠	40.0588°	V
Node: 3	304.4747	∠	39.9674°	V



<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>			<u>BRANCH CURRENT</u>		
R	3→0	0.11384000	5214.21	∠ 39.967°	V	54.24	∠ 129.900°
L	3→0	37.08900000	5214.21	∠ 39.967°	V	19.98	∠ -50.033°
L	2→3	9.94200000	2397.31	∠ -140.140°	V	34.27	∠ 129.860°
R	1→2	1.00000000	34.27	∠ 129.860°	V	34.27	∠ 129.860°

\* Modeled Current at Tower (rounded)

\*\* Modeled Current at TCT (rounded)

<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>			<u>TO IMPEDANCE</u>		
R	3→0	0.11384000	0.11	- j 96.127	0.00	+ j 0.000	
L	3→0	37.08900000	0.00	+ j 261.002	0.00	+ j 0.000	
L	2→3	9.94200000	0.29	- j 82.208	0.29	- j 152.172	
R	1→2	1.00000000	1.29	- j 82.208	0.29	- j 82.208	

**WCAP INPUT DATA:**

1.1200 0.00010000 1

R	0.11384000	3	0	-96.127	(Modeled MiniNEC Base Impedance , R & X Ω)
L	37.08900000	3	0	0.000	(Stray Shunt Inductance, μH)
L	9.94200000	2	3	0.000	(Stray Series Inductance, μH)
R	1.00000000	1	2	0.000	(Phantom Resistor, Ω)
I	34.26520000	0	1	129.860	(**Modeled Current Magnitude and Phase at TCT)

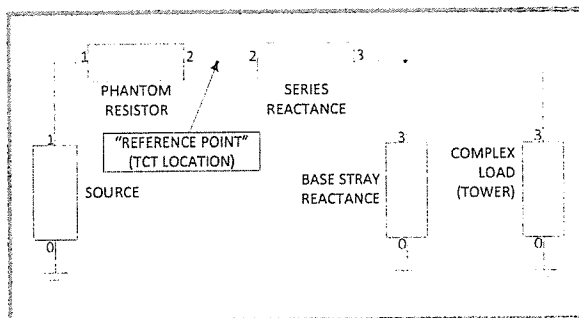
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**WCAP Directional Antenna Base Circuit Analysis – WUST Tower 4 (N) - Day**

**WCAP OUTPUT AT FREQUENCY: 1.120 MHz**

**NODE VOLTAGES**

Node: 1    907.2066     $\angle$     -140.9578°    V  
Node: 2    899.8250     $\angle$     -142.1967°    V  
Node: 3    1867.4701     $\angle$     -152.7529°    V



	<u>WCAP PART</u>		<u>BRANCH VOLTAGE</u>		<u>BRANCH CURRENT</u>	
R	3→0	16.77900000	1867.46	$\angle$ -152.753°	V    19.61	$\angle$ -72.900°    A    *
C	3→0	0.00009858	1867.46	$\angle$ -152.753°	V    1.30	$\angle$ -62.753°    A
L	2→3	6.78100000	996.60	$\angle$ 17.726°	V    20.88	$\angle$ -72.274°    A
R	1→2	1.00000000	20.88	$\angle$ -72.274°	V    20.88	$\angle$ -72.274°    A    **

\* Modeled Current at Tower (rounded)

\*\* Modeled Current at TCT (rounded)

	<u>WCAP PART</u>		<u>FROM IMPEDANCE</u>		<u>TO IMPEDANCE</u>	
R	3→0	16.77900000	16.78	- j    93.749	0.00	+ j    0.000
C	3→0	0.00009858	0.00	- j    1441.500	0.00	+ j    0.000
L	2→3	6.78100000	14.79	- j    40.467	14.79	- j    88.186
R	1→2	1.00000000	15.79	- j    40.467	14.79	- j    40.467

**WCAP INPUT DATA:**

1.1200    0.00010000    1  
**R**    16.77900000    3    0    -93.74900000    (Modeled MiniNEC Base Impedance , R & X  $\Omega$ )  
**C**    0.00009858    3    0          (Stray Shunt Capacitance,  $\mu$ F)  
**L**    6.78100000    2    3    0.00000000    (Stray Series Inductance,  $\mu$ H)  
**R**    1.00000000    1    2    0.00000000    (Phantom Resistor,  $\Omega$ )  
**I**    20.88480000    0    1    287.72600000    (\*\*Modeled Current Magnitude and Phase at TCT)

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**Antenna Monitor and Sample System**

**Antenna Monitor**

A new *Potomac Instruments Inc.* Model 1901-4 Antenna Monitor, Serial Number 906, was purchased for this project. The calibration date for this monitor is March 10, 2014. The next recommended calibration date is March, 2017 according to the manufacturer.

The manufacturer's specified accuracy for this monitor is  $\pm 0.01$  for ratio indications and the phase accuracy is  $\pm 1.0^\circ$  for relative phase. The monitor's calibration was field verified at the time of the proof of performance using the manufacturer's internal calibration check procedures and found to meet the criteria provided in the instruction manual. Additionally, the calibration was independently verified by feeding two equal length cables (supplied with RF energy from a single common "T-connected" toroidal current transformer) into each monitor port, using port 1 as a reference.

**Sample System Current Transformers**

New *Delta Electronics, Inc.* Model TCT-2-HV toroidal current transformers ("TCTs") were purchased (as part of the new RF phasing and coupling system) to provide sample currents to the antenna monitor. The operating characteristics of these TCTs were verified per the requirements of the FCC's Rules prior to antenna array adjustment.

Specifically, the TCTs were calibrated by measuring their outputs with a common reference signal using a calibrated network analyzer, by placing them side-by-side with a common conductor passing the same reference signal through each TCT. The TCT outputs were fed into inputs of the analyzer, and the relative ratios and phases of their output voltages were noted. The following table provides the results which were found for the WUST carrier frequency, 1120 kilohertz, using TCT 1 as the reference:

<b>Tower TCT</b>	<b>TCT Serial Number</b>	<b>Ratio</b>	<b>Phase</b>
1 (S)	3607	1.000	0.0°
2 (W)	3608	1.000	0.0°
3 (E)	3609	1.001	0.1°
4 (N)	3610	1.001	0.0°

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*Delta* type TCT-2-HV toroidal current transformers have a published absolute magnitude accuracy of  $\pm 2\%$  and absolute phase accuracy of  $\pm 2.0$  degrees. As the maximum measured transformer-to-transformer variations between the transformers were fractional amounts, they clearly provide far more accurate relative indications than could be the case assuming their rated accuracies.

These transformers were further tested by measuring the impedance of the sample lines with the TCT's connected to the distal ends of the lines. The results of this final test are supplied below:

Tower	Measured Impedance at 1120 kHz of Sample Line <u>with Sampling Toroid (TCT) Connected</u>
1 (S)	50.879 +j0.623 $\Omega$
2 (W)	50.668 +j0.631 $\Omega$
3 (E)	50.971 +j0.711 $\Omega$
4 (N)	51.059 +j0.656 $\Omega$

**Sample Lines**

New phase stabilized, factory "connectorized", equal length, half-inch *Andrew Corporation* Model 42394-14VA coaxial sample cables were installed at the site in a manner to ensure equal environmental conditions, all being buried except where they extend equally to terminating locations. The electrical length and characteristic impedance of these lines were verified prior to array adjustment per the Commission's MoM proof requirements. (A separate section of this Statement immediately follows which documents the sample line lengths and their characteristic impedances.)

As installed and described, this sampling system conforms to the provisions of Section 73.68(a) of the Commission's Rules that were in effect prior to January 1, 1986. Accordingly, approval of this sampling system is being requested pursuant to the FCC's Public Notice of December 9, 1985. Further, as will be demonstrated herein, the installed antenna monitor - sampling system also complies with the requirements of the newly adopted MoM Proof Rules under FCC Rule Section 73.151(c).

**Sampling System Measurements**

Impedance and length measurements were made of the antenna monitor sampling system using the precision calibrated vector network analyzer measurement system described earlier. The measurements were accomplished by connecting the measurement system to the antenna monitor ends of the sampling lines with and without the sampling lines connected to the sampling devices at the tower

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bases. The sample lines were swept for length and characteristic impedance with their ends under “open-circuit” conditions. The following table shows the frequency nearest the carrier frequency where resonance (zero reactance corresponding with low resistance) was found. As the length of a distortion-less transmission line is 180 electrical degrees at the difference frequency between adjacent frequencies of resonance, and frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sampling line length at the resonant frequency below carrier frequency, which is the closest one to the carrier frequency in terms of the ratio of frequencies, was found to be 270 electrical degrees. The electrical lengths at carrier frequency appearing in the table below were calculated by ratioing the frequencies in the customary fashion.

<b>Tower</b>	<b>Sampling Line Open-Circuited Resonance Nearest to 1120 kHz</b>	<b>Sampling Line Ratio-Calculated Electrical Length (at 1120 kHz)</b>
<b>1 (S)</b>	1489.30 kHz	203.0°
<b>2 (W)</b>	1485.80 kHz	203.5°
<b>3 (E)</b>	1489.15 kHz	203.1°
<b>4 (N)</b>	1489.58 kHz	203.0°

As shown, the maximum length difference between the sampling line lengths is 0.5°. Thus this system meets the Commission’s requirement (of §73.151(c)(2)(ii)) that all sample lines be equal in length within +/-1 electrical degree.

The characteristic impedance of each sample lines were calculated using the following formula, where  $R_1 + jX_1$  and  $R_2 + jX_2$  are the measured impedances at the +45 and -45 degree offset frequencies, respectively:

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

<b>Tower</b>	<b>-45 Degree Offset Frequency</b>	<b>-45 Degree Measured Impedance</b>	<b>+45 Degree Offset Frequency</b>	<b>+45 Degree Measured Impedance</b>	<b>Calculated Characteristic Impedance</b>
<b>1 (S)</b>	1241.08 kHz	3.336 -j 50.500 Ω	1737.52 kHz	5.010 +j 50.380 Ω	50.62 Ω
<b>2 (W)</b>	1238.17 kHz	5.898 -j 50.162 Ω	1733.43 kHz	7.450 +j50.030 Ω	50.54 Ω
<b>3 (E)</b>	1240.96 kHz	3.365 -j 50.582 Ω	1737.34 kHz	5.007 +j 50.492 Ω	50.72 Ω
<b>4 (N)</b>	1241.32 kHz	3.340 -j 50.560 Ω	1737.84 kHz	5.002 +j 50.490 Ω	50.70 Ω

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As shown, the maximum difference in sampling line measured characteristic impedance between all 4 lines is 0.18 ohms. The Commission's requirement of §73.151(c)(2)(i) states that the characteristic impedances be equal within +/-2 ohms. As such, the above tabulation demonstrates compliance with this Commission requirement. (The results of impedance measurements taken with the lines terminated with TCTs were provided in a preceding section.)

**Reference Field Strength Measurements**

FCC Rule Section 73.151(c)(3) states that "Reference field strength measurement locations shall be established in directions of pattern minima and maxima" as companion information for a method of moments proof of performance. The following tabulations are presented in accordance with the requirements of this rule. (The day licensed CP specified "monitored radials" correspond to the "minima" locations and the main lobe. The pattern minor lobe maximum was derived by inspection of the standard pattern.) Accordingly, measurement points were then selected at three locations along each of the radials in the daytime pattern minima (46.5°, and 137.5°), on the (major lobe) maxima radial of 272.5°, and on the local (minor lobe) maxima of 96°.

The radial directions, measured field strengths, measurement point distance, location descriptions, and GPS coordinates (with datum reference) for these reference points are shown in the following tables. A *Potomac Instruments, Inc.* model FIM-41 field strength meter, Serial Number 2181, was used for these measurements. Calibration was verified by comparing meter indications against a Potomac Instruments FIM-21, serial number 900, last factory calibrated on January 11, 2013. Mr. Kurt R. Gorman, the RF equipment manufacturer, collected the reference measurements, as tabulated in the following:

**Daytime Reference Field Strength Measurements – 46.5° (Minima)**

<b>Point</b>	<b>Date and Local Time</b>	<b>Distance (km)</b>	<b>Field (mV/m)</b>	<b>Coordinates (WGS-84)</b>	<b>Description</b>
1	12/12/14 12:44 pm	0.49	910	38° 52' 20.7" N 76° 53' 32.7" W	Ronald Rd. at storm drain, opposite Maple Shade
2	12/12/14 12:56 pm	1.13	290	38° 52' 35.1" N 76° 53' 13.6" W	Driveway, Walker Hill Middle School (SW Side)
3	12/12/14 1:08 pm	2.17	165	38° 52' 58.4" N 76° 52' 42.3" W	Millwood neighborhood park top of hill @ last parking space

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**Daytime Reference Field Strength Measurements – 96° (Maxima - Minor Lobe)**

Point	Date and Local Time	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	12/12/14 1:18 pm	0.96	1140	38° 52' 06.3" N 76° 53' 32.7" W	Driveway – 160 Gould Drive
2	12/12/14 1:24 pm	1.27	860	38° 52' 5.3" N 76° 52' 55.0" W	Intersection Chapparral Drive & Shady Glen Drive
3	12/12/14 1:46 pm	3.0	218	38° 51' 59.3" N 76° 51' 43.3" W	Intersection Laura Lane & Lanaskin (NE corner)

**Daytime Reference Field Strength Measurements – 137.5° (Minima)**

Point	Date and Local Time	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	12/12/14 2:04 pm	1.73	76.0	38° 51' 28.7" N 87° 52' 42.8" W	Opposite 7201 Kipling Pkwy in center median
2	12/12/14 2:00 pm	2.29	40.0	38° 51' 15.9" N 76° 52' 41.9" W	NW corner, intersection of Mason Street & Kirtland Avenue
3	12/12/14 1:53 pm	3.11	29.5	38° 50' 56.5" N 76° 52' 19.0" W	South driveway of CJ Car Wash off Richie Road

**Daytime Reference Field Strength Measurements – 272.5° (Maxima – Main Lobe)**

Point	Date and Local Time	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	12/12/14 2:42 pm	1.17	1980	38° 52' 10.8" N 76° 54' 35.9" W	Brooke Road, 40 feet north of Rugged Lane on west side
2	12/12/14 2:31 pm	2.20	580	38° 52' 12.5" N 76° 55' 18.8" W	Parking lot, Suburban Seafood 5025 Marlboro Pike (center of lot)
3	12/12/14 2:24 pm	2.90	313	38° 52' 12.5" N 76° 55' 47.7" W	Driveway of 1543 Nova Avenue

**Direct Measurement of Power – Daytime Directional Mode**

Common point impedance measurements were made using the previously described network analyzer equipment. The “as adjusted” common point impedance measurements were made at the phasor cabinet input jack adjacent to the common point current meter that is used to determine daytime operating power. The results are as follows:



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Mode	Common Point Resistance	Common Point Reactance
Daytime Directional	50 $\Omega$	-9.0 $\Omega$

The authorized common point input power of the **nominal 50 kW daytime** directional antenna system is **52,560 Watts**. This value is obtained by applying the provisions of §73.51(b)(2) of the Commission's Rules, i.e. 50,000 Watts x 1.053 = 52,650 Watts. Accordingly, the daytime common point current, found by the following calculation  $(52,650 \text{ Watts} / 50\Omega \text{ Resistance})^{1/2}$  is **32.45 Amperes**.

This current value is maintained as required by §73.1560(a)(1) of the Commission's Rules, through the use of the station's common point ammeter, a *Delta Electronics* TCA-40-EXR-HV.

**Direct Measurement of Power – Non-Directional Critical Hours Mode**

Tower 1 (S) is used for the WUST Non-Directional Critical Hours Mode. MiniNEC Calculations were run to determine appropriate values for detuning reactances to ground after the WUST filter systems to achieve zero fields from the unused towers. After adjustments of these circuits, the base impedance of Tower 1 was taken at the antenna ammeter location and found to be 13.1 -j32.5  $\Omega$ . For the authorized critical hours power of 3 kW, a base current of 15.13 Amperes must be maintained based upon the following formula:  $(3000 \text{ Watts} / 13.1 \Omega \text{ Resistance})^{1/2}$

**As-Constructed Certified Array Geometry**

A land survey was conducted to confirm proper antenna array construction. A copy of the professional land surveyor's combined certification and survey plat is provided at page 46 of this document.

The survey plat provides the relative distances in feet and relative azimuths in degrees, referenced to true north. This information was compared to the relative distances and azimuths relative to true north of the array elements using the Construction Permit array geometry as the baseline, and the "Law of Cosines" analysis method. The following tabulation shows those distances and other information along with error determination.

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**“As-Built” Array Geometry Summary – All 4 Towers**

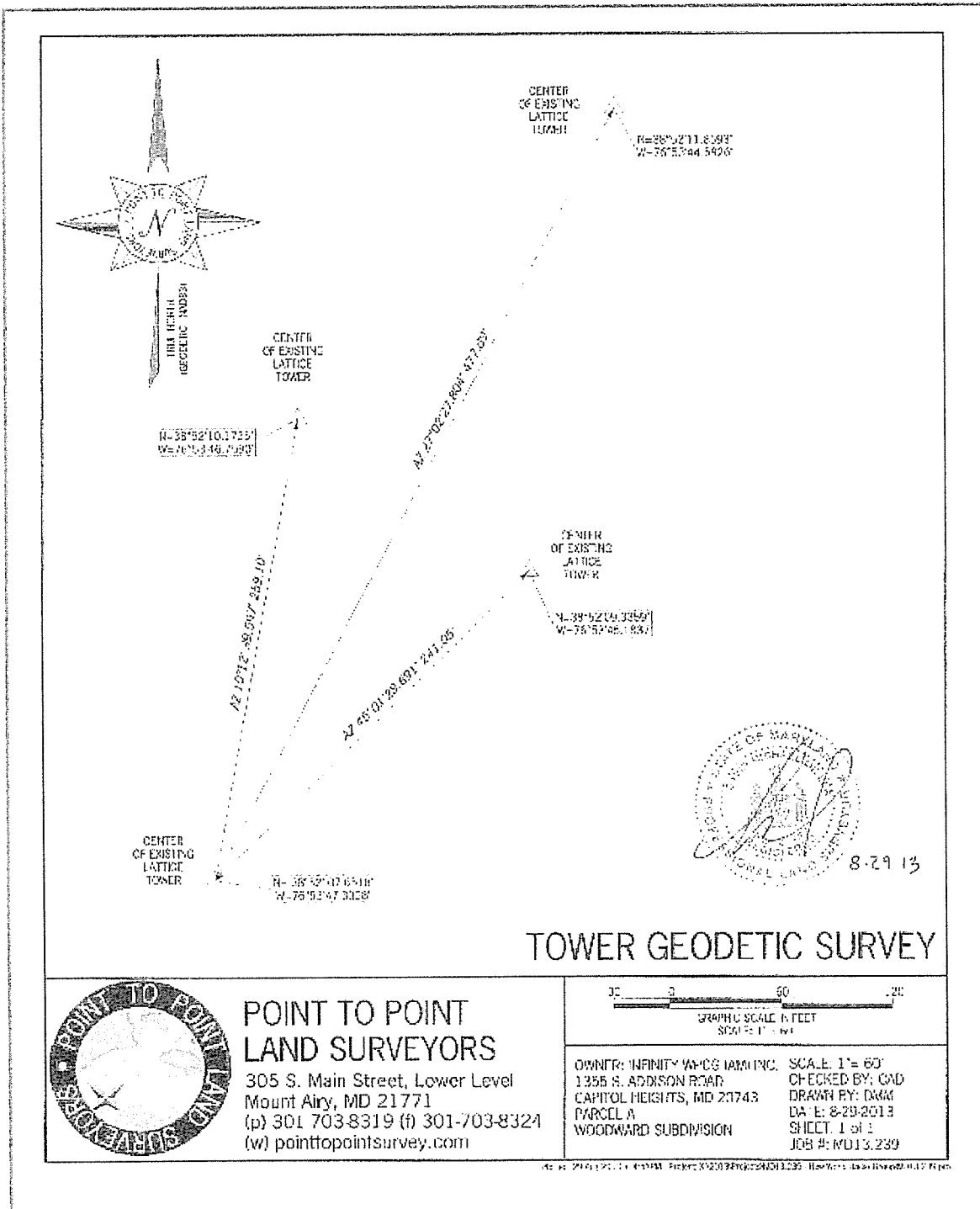
Tower Pair Evaluated	Array Geometry per WUST CP			“As-Built” Survey Data			“As-Built” Error/Deviation	
	Specified CP Spacing (in degrees)	CP Spacing (converted from degrees to feet)	Specified CP Orientation (Degrees True)	Surveyed Spacing (in feet)	<u>Spacing</u> Converted to Electrical Degrees	<u>Surveyed Orientation</u> (Azimuth Converted to Degrees)	In Feet	In Electrical Degrees
<b>1 (ref) S</b>	0.0 °	0.0	0.0°	0.0	0.0 °	0.0° T	0.00	<b>0.00</b>
<b>1 to 2 W</b>	106.21°	259.09	10.2°	259.10	106.21°	10.2110° T	0.05	<b>0.02</b>
<b>1 to 3 E</b>	98.81°	241.04	45.0°	241.05t	98.81°	45.0246° T	0.10	<b>0.04</b>
<b>1 to 4 N</b>	195.90°	477.88	27.0°	477.89	195.90°	27.0411° T	0.34	<b>0.14</b>

The results shown above are within the +/- 3 degree operating phase range specified for antenna monitor parameters by the FCC Rules *and well within the 1.5° location error tolerance* specified in the Commission’s DA 09-2340 Public Notice. As such, it has been proven that this antenna array has been physically constructed in accordance with the terms of its Construction Permit and the pertinent Rules and Regulations of the Federal Communications Commission.

A copy of the land surveyor’s report is shown in the following page.

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**Survey Certification – “As Built” Survey**



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**RF Exposure Evaluation**

The operation of the broadcast facility described herein will not result in the exposure of workers or the general public to levels of radio frequency radiation in excess of the limits specified in Section 1.1310 of the Commission's Rules. *New World* has installed fences around each of the tower bases to restrict access. As discussed in the underlying Application for CP, the tower base fence distances exceed those necessary to prevent electric and magnetic field exposure above the levels described in the Commission's Rules.

Further, a tall chain link fence, topped with barbed wire, encloses the entire site. Two locked gates prevent casual site access. Based upon this information, it is believed that the Commission's RF exposure prevention requirements are met in that public access is limited. Further, all fence enclosure areas and the perimeter fence are posted with RF exposure warning signs on all fence sides, and all fence gates are securely locked. Additionally, all metal fence materials are connected into the station RF ground system.

With respect to worker safety, no work will be permitted that will endanger employees or subcontractors. Access to high exposure or shock/burn areas will be controlled and supervised by knowledgeable responsible Station personnel. If it is necessary for workers to be inside the tower base fence enclosures for extended periods of time, the Station may temporarily terminate operation entirely while work is performed within the enclosures. No one will be permitted to climb an energized tower.

It is therefore believed that the constructed facility is in full compliance with the FCC's requirements with regard to radio frequency energy exposure.

**CP Conditions**

The WUST Construction Permit is subject to five Special Operating Conditions, which are discussed in the following paragraphs. All five Special Operating Conditions are being essentially met with the filing of this License Application. Specifically:

**FCC Special Operating Condition 1** requires that the Permittee submit a proof of performance as set forth in either Section 73.151(a) or 73.151(c) of the Rules before program tests are authorized. Further, the Condition requires that, if a Moment Method proof of performance is being submitted, as set forth in Section 73.151(c), the facility must use series-fed radiators, and in addition, the sampling system must be constructed as described in Section 73.151(c)(2)(i).

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This Statement, which is attached to this Application, provides a Moment Method proof of performance, as set forth in Section 73.151(c) of the Commission's Rules. This antenna system uses series-fed radiators and the associated sampling system is constructed as described in Section 73.151(c)(2)(i) of the Commission's Rules. Therefore this Special Operating Condition is satisfied. Accordingly, Program Test Authority is herein respectfully requested.

**FCC Special Operating Condition 2** requires that the Permittee install a type-accepted transmitter. A type-accepted transmitter has been acquired and properly installed at the authorized transmitter site. Therefore, this Special Operating Condition is satisfied.

**FCC Special Operating Condition 3** states that, before program tests are authorized,

- sufficient data shall be submitted to show that adequate filters, traps and other equipment have been installed and adjusted to prevent interaction, intermodulation and/or generation of spurious radiation products which may be caused by common usage of the same antenna system by Stations WUST and WJFK, and
- there shall be filed with the license application copies of a firm agreement entered into by the involved stations clearly fixing the responsibility of each with regard to the installation and maintenance of such equipment.
- In addition, field observations shall be made to determine whether spurious emissions exist and any objectionable problems resulting therefrom shall be eliminated.
- Following construction, and prior to authorization of program test under this grant, Stations WUST and WJFK, shall each measure antenna or common point resistance and submit FCC Form 302 as application notifying the return to direct measurement of power.

As illustrated by the representative schematic excerpt in this Statement, filters and traps were installed at each tuning unit of each station's RF system. Additionally, filters are installed at the phasor input to further assure that undesired interaction did not occur. (Full copies of the RF system schematic

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will be made available upon request.) These systems were adjusted on-site by factory representatives of the RF equipment supplier, Phasetek, and assisted and witnessed by the undersigned and Station personnel. As will be discussed in the following, tests for out of band emissions were then conducted, with favorable results.

The agreement between the licensees/permittees of co-located Stations, WUST, WZHF and WJFK is attached herewith as Attachment I. *New World* herein affirms its responsibility to properly maintain and adjust all filters and traps as necessary to assure the elimination of undesired, spurious emissions from the combined facilities.

As required, field observations have been made to determine whether spurious emissions exist, and that objectionable problems resulting therefrom do not exist or have been eliminated. Specifically, spurious emissions, intermodulation and harmonic emission measurements were taken on December 12<sup>th</sup> and 15<sup>th</sup>, 2014 at two separate locations. WUST was operated normally while the co-located WJFK and WZHF facilities were operated with their STA facilities. As discussed informally with FCC staff, as each of the co-located facilities commences operation with permanent facilities, emissions measurements will be repeated and filed with the Commission as part of their respective Applications for License/Direct Measurement, and Proof of Performance materials.

For the emissions measurement tests, Measurement Point 1 is located 272.5° from the station at a distance of 1.17 km. This measurement spot is described as being on Brooke Road, 40 feet North of Rugged Lane on the west side of the street. Measurement Point 2 is located 287.5° from the station at a distance of 0.6 km. NRSC measurements were taken at this location. The measurement equipment used for Measurement Point 1 was the same *Potomac Instruments* FIM-41 field strength meter that was used for the reference point measurements. A tabulation of field observations thus obtained is provided below.

**Spectrum Analyzer Check for Undesired Emissions and NRSC Compliance**

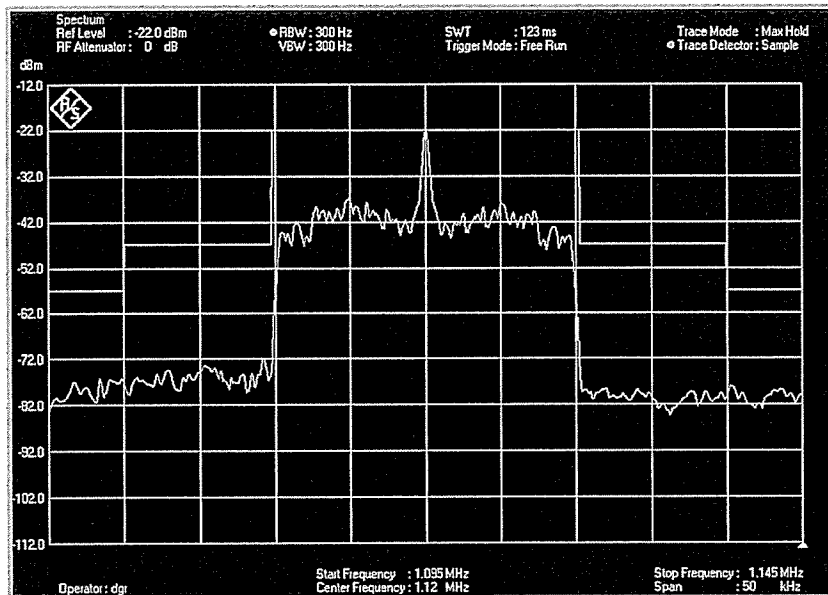
The NRSC mask compliance observations were made at Measurement Point 2 with a *Rohde & Schwarz* FSH-4.14 spectrum analyzer and a *Chris Scott & Associates, Inc.* LP-3 standard H-Field loop antenna in accordance with the procedures outlined in the Commission's Rules. The results of the NRSC measurement, indicating mask compliance for WUST, are summarized below and are provided in more detail in the customary report that will be placed in the station's engineering and Public Files.

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Screen captures were made of the spectrum analyzer system after the mandatory ten minute peak-hold period while the station was operating with normal program material.

The first plot (shown below) covers a span of 50 kHz, with the WUST carrier placed at the center of the plot. Each horizontal division represents an increment of 5 kHz. Each vertical division represents an increment of 10 dB. As shown:

- The WUST carrier amplitude is -22 dBm.
- Emissions 10.2 kHz to 20 kHz removed from the WUST carrier (shown in the center of the plot) are attenuated at least 25 dB below the -22 dBm carrier.
- Emissions 20 kHz to 30 kHz removed by from the WUST carrier are attenuated by more than 35 dB below the -22 dBm carrier level.

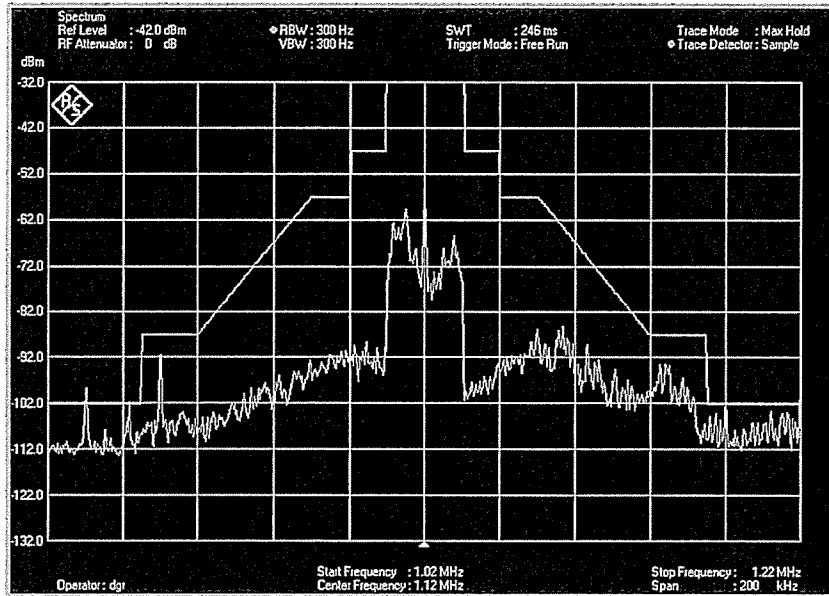


This data demonstrates that the emissions for this radio station at this time were measured as meeting the required FCC/NRSC mask within 25 kHz of the carrier.

The second spectrum analyzer plot, shown below, covers a span of 200 kHz, with the WUST carrier again placed at the center of the plot. No change was made in measurement location or receive

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antenna orientation. In this plot, each horizontal division represents an increment of 20 kHz. Each vertical division represents an increment of 10 dB. A notch filter tuned to 1120 kHz permitted a 20 dB reduction of input attenuation without the WUST signal overloading the spectrum analyzer. Therefore, the amplitudes shown below range from -10 dBc (top graticule line) to -110 dBc (bottom graticule line).



As shown, emissions from 30 kHz to 60 kHz removed from the WUST carrier are shown to be attenuated at least  $5 + 1 \text{ dB/kHz}$  below the carrier (or -35 dBc to -65 dBc). Emissions attributable to WUST that are more than 75 kHz removed from center carrier are shown to be attenuated at least 80 dBc. Emissions shown above 80 dBc occur at 10 kHz spacings and thought to be broadcast signals of *other* radio stations<sup>3</sup> in the area.

With the WUST notch filter still installed, a study of measurable emissions<sup>4</sup> or spurs attributable to WUST was conducted from 200 kHz to 5 MHz. For completeness, these observations were repeated with a field strength meter as summarized in the following table. No significant harmonic emissions or spurs attributable to WUST were observed or measured.

<sup>3</sup> In particular, signals from WWGB Indian Head, MD (1030 kHz) and WFAX Falls Church, VA (1220 kHz) are evident.

<sup>4</sup> Emissions obscured by the noise floor or other carriers cannot, as a consequence be readily observed or proven in the field measurement environment. As such, compliance must be assumed given the methodology employed.



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**Field Strength Survey for Undesired Emissions**

Field strength observations were made on the WUST system to determine the existence of any out of band emissions or intermodulation products between the as-constructed WUST operation and the STA facilities of WJFK or WZHF. (Studies of WJFK/WZHF related interactions were not included as those facilities are in the completion stage of construction.) As discussed informally with members of the FCC Staff, harmonic and intermodulation tests will be repeated as each of the co-sited Stations retires their STA facilities and commences operation with restored or CP "permanent" facilities. The results of these measurements, sorted by frequency order, are summarized below.

**WUST Harmonic Check**

Signal	Frequency (kHz)	Signal Strength (mV/m)	Relative dB Down	Observed Audio
F1 (WUST)	1120	1980	0	WUST
2F1	2240	0.015	102.4	WUST
3F1	3360	0.07	89.0	WUST
4F1	4480	0.023	98.7	WUST

**WUST Intermodulation and Spurious Emissions Check**

Signal	Frequency (kHz)	Field Strength (mV/m)	Relative dB To WUST	Observed Audio
F1 (WUST)	1120	1980	0	WUST
F2 (WZHF)	1390	65	n/a	WZHF
F3 (WJFK)	1580	430	n/a	WJFK
3F1 - 2F2	580	NOISE	n/a	None
2F1 - F3	660	0.026	-97.6	WJFK Audio
2F1 - F2	850	-	n/a	None
3F1 - F3	1780	0.018	-100.8	None
3F1 - F2	1970	-	n/a	None
F1 + F2	2510	0.013	-103.7	None
F1 + F3	2700	0.014	-103.0	None
2F1 + F2	3630	-	n/a	None
2F1 + F3	3820	0.022	-99.1	WJFK Audio
F1 + 2F2	3900	-	n/a	None
F1 + 2F3	4280	-	n/a	None
3F1 + F2	4750	-	n/a	None
3F1 + F3	4940	-	n/a	None

**Notes:**

- Any frequencies not shown in the above table are those that fall either above or below the frequency range of the meter.
- A "--" entry denotes no emission observed or audible.

**Statement E**  
**APPLICATION FOR STATION LICENSE**  
**(Method of Moments Proof-of-Performance)**  
**WUST(AM) Washington, DC**

As shown in the preceding two tables, it is believed that following the adjustment of the various filter and trap systems, no significant spurious emissions, harmonics, or intermodulation products exist, thus satisfying this requirement of **CP Condition 3**. Again, these tests will be repeated as each of the co-sited Stations retires their STA facilities and commences operation with restored or CP “permanent” facilities.

Finally, **CP Condition 3** also requires that each Station measure its antenna or common point resistance and submit an FCC Form 302 application, thereby notifying the FCC of the Station’s return to direct measurement of power. Inasmuch as WJFK and WZHF facilities are still under construction and operating with STA facilities, impedance measurements and FCC Form 302-AM cannot be completed at this time. It is expected that the WJFK renovation and WZHF construction will be completed within the next few weeks. At that time, as each Station becomes ready to go into full service, a proof-of-performance will be conducted and filed for each of these Stations in association with FCC Form 302-AM. The temporary operating power has been determined for each of the Stations operating under STA by their respective licensee pending completion of construction. The common point impedance data for the WUST daytime operation and the base impedance data for the WUST Critical Hours operation have been measured, as discussed in this document, and is noted in the included FCC Form 302-AM to which this Statement is attached as “**Statement E**”. This incremental filing of FCC Form 302-AM materials has been discussed informally with FCC Staff, who agreed that such an approach would satisfy the WUST CP Conditions, and that limited Program Test Authority would be granted after a review of this application, but that application processing and a grant of license would not be completed until all involved Stations had completed their respective proofs-of-performance, measured their operating impedances, and filed their individual FCC Form 302-AM materials.

**FCC Special Operating Condition 4** requires that a ground system be installed that consists of 120 equally spaced, buried, copper radials about the base of each tower, each 67.1 meters in length except where terminated by property boundaries or where intersecting radials are shortened and bonded to a transverse copper strap midway between adjacent towers, plus 120 interspersed radials 15.2 meters in length. This system has been installed as required, thus satisfying this CP Condition.

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FCC **Special Operating Condition 5** requires that the Permittee be responsible for satisfying all reasonable complaints of blanketing interference within the 1 V/m contour as required by Section 73.88 of the Commission's Rules. *New World* herein acknowledges its responsibility under this Rule and has Station personnel prepared and available to respond appropriately.

**Satisfaction of CP Conditions**

As demonstrated in the preceding, it is believed that all five WUST Special Operating Conditions are essentially being met with the filing of this License Application.

**"Statement E" Preparer's Certification**

These **Statement E** application materials, which are attached to FCC Form 302-AM, Section III, have been prepared on behalf of *New World Radio, Inc.*, by the undersigned or under his direction and are true and correct to the best of his knowledge and belief. Mr. Cavell's qualifications are a matter of record before the FCC.

Respectfully submitted,



Garrison C. Cavell    December 16, 2014  
**Cavell, Mertz & Associates, Inc.**  
7724 Donegan Drive, Manassas, Virginia 20109  
703.392.9090; Facsimile 703.392.9559  
E-Mail: [gcavell@cavellmertz.com](mailto:gcavell@cavellmertz.com)

# Attachment I

## Tower Site License Agreement Between WUST and WJFK

## TOWER SITE LICENSE AGREEMENT

This TOWER SITE LICENSE AGREEMENT (this "Agreement") is made as of the 10<sup>th</sup> day of FEB, 2014, by and among CBS RADIO INC. OF MARYLAND, a Delaware corporation ("CBS Maryland"), CBS RADIO WPGC(AM), INC. ("CBS WPGC"), and, together with CBS Maryland, ("Owner") and NEW WORLD RADIO, INC. a Maryland corporation ("Licensee") (Owner and Licensee may individually be referred to herein as a "Party" or collectively as the "Parties").

WHEREAS, CBS Maryland owns certain real property located at 1355 Addison Road South, Capitol Heights, Maryland (the "Tower Site") and the four antenna towers (collectively, the "Towers") and transmitter building (the "Building") currently located thereon;

WHEREAS, Owner uses the Towers and the Building, for the operation of the radio station, currently known by the call letters WJFK(AM) ("WJFK") licensed to CBS WPGC;

WHEREAS, Licensee is currently authorized by the FCC to operate the radio station known by the call letters WUST ("Licensee's Station");

WHEREAS, Owner, Licensee, Way Broadcasting Licensee, LLC ("Way") and Multicultural Radio Broadcasting Inc. ("Multicultural") and, together with Way, "Other Licensee") are entering into a Tri-Plex Agreement, of even date herewith (the "Tri-Plex Agreement"), to establish the terms and conditions of their collaborative installation at the Tower Site of a combining tri-plex network system for use by Owner, Licensee and Other Licensee (the "Tri-Plex System"), as further described in the Tri-Plex Agreement (Owner, Licensee and Other Licensee are sometimes referred to collectively as the "Tri-Plex Collaborators") and Way and Multicultural shall be deemed one entity for the purpose of allocating costs among the Tri-Plex Collaborators hereunder);

WHEREAS, Owner desires to license space to Licensee at the Tower Site and Licensee desires to license space from Owner at the Tower Site, for the operation of Licensee's Station, making use of the Tri-Plex System.

NOW, THEREFORE, in consideration of the foregoing and the mutual covenants herein contained, the receipt and sufficiency which are hereby acknowledged, the parties hereto agree as follows:

NOW THEREFORE, the parties hereto, for themselves, their successors and assigns, hereby covenant and agree as follows:

1. Grant of Non-Exclusive License. In consideration of the covenants of Licensee hereinafter set forth, and subject to the terms and conditions of this Agreement, Owner hereby licenses and agrees to permit Licensee to install, operate and maintain throughout the Term certain radio broadcasting telecommunications equipment (hereinafter referred to as "Equipment") on the Towers and in the Building (such space on the Towers and the Building being referred to as the "Licensed Space"). Such Equipment which is installed in the Licensed Space requiring prior approval by Owner pursuant to the provisions hereof shall be referred to herein as "Designated Equipment". The locations of such Licensed Space are identified on Exhibit "A" attached hereto. A list of the Designated Equipment as of the date hereof is identified on Exhibit "B" attached hereto. For the avoidance of doubt, the term

"Designated Equipment" is not intended to incorporate all Equipment used by Licensee at the Tower Site and is limited to the items of Equipment set forth on Exhibit "B".

2. Access by Owner/Licensee. The license hereby granted is a non-exclusive license, and Owner shall retain all rights of access to and use and occupation of the Tower Site for itself and may license space to other licensees to which it chooses to license space thereon, subject to the terms of this Agreement. Licensee acknowledges that Owner will be entering into a tower site license agreement with Other Licensee for use of the Tower Site in accordance with the terms of the Tri-Plex Agreement. Provided Licensee is not in default of its obligations hereunder, Owner shall provide Licensee with quiet possession of the Licensed Space during the Term, subject to the terms and conditions of this Agreement.

3. Use and Compliance with Laws. Licensee may use the Licensed Space only in connection with Licensee's radio broadcasting operations for the operation of Licensee's Station through the Tri-Plex System and for no other purpose. Licensee shall not install or use on the Tower Site the Designated Equipment or any of the types of equipment set forth on Exhibit "B-1" attached hereto without first complying with the procedures set forth in this Agreement, including, without limitation, Paragraphs 7 and 8 herein. Licensee shall install, operate, maintain, repair and remove its Equipment during the Term hereof in compliance in all material respects with applicable zoning requirements, applicable laws, statutes and regulations imposed by any local, state or federal authority having jurisdiction with respect thereto (including, without limitation, the rules and regulations of the Federal Communications Commission (the "FCC") and the Federal Aviation Administration (the "FAA") (collectively, the "Regulations")) and otherwise in accordance with the provisions of this Agreement. Licensee further agrees that it shall install, operate, maintain, repair and remove its Equipment in accordance with the manufacturer's or recognized industry standards. Licensee represents and warrants that it holds (or will hold prior to installation of the Equipment) all proper authorizations required by the FCC to install and operate the Equipment and such authorizations will remain in effect throughout the Term. Licensee will not use the Licensed Space or any portion thereof for any purpose or use in violation of the Regulations. Attached as Exhibit "C" are copies of all FCC authorizations which have been issued to Licensee as of the date hereof in connection with the operations contemplated under this Agreement. Licensee will provide to Owner as they become available copies of any subsequently-issued authorizations.

4. Tower Study. Prior to connection by Licensee of any Equipment to the Towers, Licensee shall conduct the tower inspection in accordance with Section 1.3 of the Tri-Plex Agreement. Prior to any expansion of Licensee's use of the Towers after the initial connection of Licensee's Equipment, Owner may require, at Owner's option, to be exercised in a reasonable and good faith manner, that Licensee (at its sole cost and expense), conduct: (i) a structural analysis of the Towers and (ii) an engineering analysis to ensure that any proposed Equipment will not interfere with any existing equipment on the Towers and not exceed the electrical capabilities of the Towers. If Owner requires such analyses, then Licensee shall procure the services of an engineering firm as may be approved by Owner, acting in Owner's commercially reasonable and good faith discretion, for the analyses set forth in items (i) and (ii) above; provided, however, that Licensee shall be permitted to use, without Owner's prior approval, any engineer that has been authorized to provide engineering services to Owner, Licensee or Other Licensee under the Tri-Plex Agreement, unless Owner has notified Licensee that such engineer is no longer authorized to provide engineering services at the Tower Site. Copies of any analysis conducted by or on behalf of Licensee shall be promptly provided to Owner.

5. Term. The initial term of this Agreement (the "Initial Term") shall commence on the date hereof (the "Commencement Date"), and, subject to the provision for earlier termination, shall be in force until December 31, 2018. The Initial Term shall automatically renew for two (2) successive five

(5) year renewal terms (each, a "Renewal Term" and, together, the "Renewal Terms") unless Licensee provides Owner with written notice of non-renewal at least ninety (90) days prior to the end of the then-current term (the Initial Term and any Renewal Term shall collectively be referred to herein as the "Term").

6. Fees, Costs and Security Deposit.

7. Alterations.

(a) The initial Site Work (as defined in the Tri-Plex Agreement) to be performed by Licensee shall be governed by the terms of the Tri-Plex Agreement. Prior to the performance of any Additional Work (as hereafter defined), Licensee shall submit detailed plans and specifications for such Additional Work for Owner's written approval at the address given in Paragraph 19, which approval shall not be unreasonably withheld, conditioned or delayed. "Additional Work" shall mean (i) any work at the Tower Site beyond the Site Work that requires any ground disturbance, (ii) any work beyond the Site Work attaching anything to the structure of the Towers, (iii) any installation or removal of any Designated Equipment or (iv) any installation or removal of any of the types of equipment set forth on Exhibit "B-1" attached hereto (the "Additional Work"). The Parties acknowledge and agree that, throughout the Term, upon the installation at the Tower Site by Licensee of any of the types of equipment listed on Exhibit "B-1", such equipment shall be deemed Designated Equipment for the purposes of this Agreement. Licensee shall cooperate in all respects with Owner's reasonable requests for documentation in connection with this Paragraph. All such plans and specifications shall be submitted to Owner and any such engineers and consultants selected by Owner for review and approval no later than fifteen (15) business days prior to commencing any Additional Work. Owner shall, within fifteen (15) business days of receipt thereof, either (i) reasonably approve or (ii) acting in a reasonable manner, specify conditions for approval or (iii) disapprove Licensee's plans and specifications. If the plans and specifications have been approved with conditions, Licensee shall resubmit revised plans and specifications reflecting Owner's conditions or, in the event the plans and specifications have been disapproved and Licensee wishes to proceed with the proposed Additional Work, Licensee shall submit new plans and specifications for Owner's consideration within ten (10) business days of receipt of Owner's response to Licensee's plans and specifications.

(b) Any Additional Work requiring modification to the approved plans and specifications, or any Additional Work requiring modification(s) to the Designated Equipment, must be submitted to Owner in writing for approval, which approval shall not be unreasonably withheld, conditioned or delayed, and pertaining thereto, the same time periods and conditions set forth hereinabove in subparagraph (a) shall apply. At its option, Owner may dispatch a representative who may supervise installation aspects of the Additional Work that requires any ground disturbance or attaching anything to the structure of the Towers. If such representative is a third party hired by Owner, Licensee shall be responsible for the cost thereof.

(c) All Additional Work shall be performed (i) in a good and workmanlike manner, (ii) only by contractors reasonably approved in advance by Owner (which contractors shall have acceptable evidence of worker's compensation insurance and liability insurance) (provided that contractors who are Project Vendors (as defined in the Tri-Plex Agreement) shall be deemed approved by Owner) and (iii) at Licensee's sole cost and expense. Owner shall have the right if, in Owner's reasonable good faith discretion, any Additional Work on the Towers, to be performed by Licensee, requires structural modifications or repairs to be made to any portion of the Tower Site, including the Towers, (x) to require Licensee, at its sole cost and expense, to perform such structural modifications or repairs or (y) where such structural modifications or repairs involve areas used commonly by the Tri-Plex Collaborators, to perform such structural modifications or repairs itself and charge the cost and expense of such structural modifications and repairs to Licensee.



(d) In the event Owner, in its reasonable opinion, determines that any structural modifications or any repairs, including, but not limited to electrical service upgrades, HVAC systems installations, cabling and riser infrastructure improvements and security and access system installations, are needed to be made to any portion of the Tower Site or the Towers, due to any Additional Work proposed by Licensee, Owner shall notify Licensee of such requirements at the time Owner issues its consent for such Additional Work. Upon receipt of such consent, Licensee may decide, at its option, not to proceed with the proposed Additional Work. If, however, Licensee elects to proceed with such Additional Work, Licensee shall reimburse Owner for the reasonable cost and expense of such modifications and repairs within five (5) days of receipt of a detailed invoice therefor.

8. Owner's Requirements. Prior to and in connection with the performance of any Additional Work and throughout the Term of this Agreement, in addition to any other requirements set forth in this Agreement, Licensee shall comply with the following:

(a) All Additional Work done by or for the benefit of Licensee (as well as the installation of any Equipment) shall be contracted for and paid for directly by Licensee. Such Additional Work shall be done only with the prior written consent of Owner, which consent shall not be unreasonably withheld, conditioned or delayed. No Additional Work shall commence until reasonably complete and satisfactory documentation detailing such Additional Work has been provided to and approved by Owner and any consultant engaged by Owner. All Additional Work must be completed to Owner's reasonable satisfaction in a manner reasonably approved by Owner and any such consultant.

(b) Licensee shall obtain the required approvals of all applicable federal, state and local agencies for any Additional Work to be performed. Licensee shall promptly deliver to Owner written evidence of compliance with all applicable Regulations in connection with Licensee's Additional Work.

(c) Licensee's Additional Work and Equipment shall conform to Owner's design specifications and requirements as provided by Owner, including weight and wind-load requirements. Promptly upon request of Licensee and in advance of Licensee's submission of its detailed plans and specifications for Additional Work, Owner shall provide to Licensee in writing such design specifications and requirements

(d) All of Licensee's Designated Equipment and its equipment racks housing multiple units of smaller types of Equipment shall be clearly marked in a visible location with numbered one inch high waterproof labels to show Licensee's name, address, telephone number and the name of the person to contact in case of emergency, FCC call sign (if applicable), frequency and location, and power output of its transmitter. All coaxial cable relating to the Equipment shall be identified in the same manner at the base of the Towers or the Enclosures (as defined in the Tri-Plex Agreement). All of Licensee's Equipment shall be installed in a manner so as to be reasonably inaccessible to unauthorized persons and to pose no hazard to safety of life or property with respect to persons or property in, on or about the Tower Site.

(e) Licensee shall furnish Owner with Certificates of Insurance confirming that Licensee and any contractor of Licensee have the insurance coverage required under this Agreement.

(f) The term "Hazardous Materials" as used hereinafter shall mean, collectively, any pollutant, contaminant, flammable, explosive, radioactive material, hazardous waste, toxic substance or related material and any other substance or material defined or designated as a hazardous or toxic substance, material or waste by any Regulations or the removal of which is required, or the manufacture,

use, maintenance, storage, ownership or handling of which is restricted, prohibited, regulated or penalized by any Regulations. Neither Licensee nor Owner shall receive, store or otherwise handle Hazardous Materials at the Tower Site, except in compliance with applicable laws. If Licensee or Owner removes any Equipment or other personal property from the Tower Site which contains chlorofluorocarbons (CFCs) or other hazardous Materials, the removal of such Equipment or other personal property shall conform to all Regulations and industry practices. In the event Licensee encounters any Hazardous Materials during the course of Licensee's Additional Work, Licensee shall immediately halt its Additional Work and contact Owner. Licensee shall not re-commence any work at the Tower Site until notified in writing by Owner that it may do so. Notwithstanding the provisions of Paragraph 11(a) hereof, if the presence of Hazardous Materials on the Tower Site predates the commencement of the Term, Owner shall be responsible for compliance with applicable laws in connection with such Hazardous Materials and shall act in accordance with all Regulations and industry practices.

9. Interference and Operation of Equipment.

(a) Licensee's Equipment and Owner's equipment at the Tower Site shall at all times be operated in such a manner as not to cause Objectionable Interference as hereafter defined in Paragraph 9(b). If it is claimed that the equipment of any one or more of the Tri-Plex Collaborators is creating Objectionable Interference to the operation of any of the Tri-Plex Collaborators' radio stations operating on the Tri-Plex System, the affected Party(ies) and Other Licensee (if applicable) shall first endeavor to resolve the matter amongst themselves, failing which, such dispute shall be resolved by an independent third party, knowledgeable in broadcast engineering and mutually acceptable to the Parties and Other Licensee (if applicable) involved in the dispute. The cost of such third party shall be equally divided among the affected Parties and Other Licensee (as applicable).

(b) "Objectionable Interference" shall be deemed to exist if: (i) a determination to that effect is made by an authorized representative of the FCC or (ii) a condition exists which constitutes interference within the meaning of the provisions of the Rules and Regulations of the FCC at the time in effect, or (iii) there is a material impairment of sound in any material portions of the protected service area of such activity as such area(s) is or may be defined by the FCC, at any hour during the period of operations of such activity, as compared with that which would be obtained if no other licensees were transmitting from the Tower Site or had any equipment at the Tower Site.

(c) Owner shall not permit any third party to use the Tower Site during the Term without the prior written consent of Licensee, which consent shall not be unreasonably withheld, conditioned or delayed. Any such permitted third party user of the Tower Site shall not interfere with Licensee's operations permitted hereunder or the broadcast signal and transmissions of Licensee's Station as permitted hereunder. In the event of any such interference, Owner shall cause such third party user to immediately suspend its operations until such interference is cured to the reasonable satisfaction of Licensee.

(d) Neither Owner nor its partners, employees, agents or consultants shall be held responsible or liable, directly or indirectly, for Objectionable Interference caused by other tenants or licensees of Owner with Licensee's transmission or reception of signals, or damages or related costs arising therefrom.

(e) Owner and Licensee will ensure, and Owner shall cause Other Licensee to ensure, that all harmonic products and spurious emissions from their respective broadcast transmitters at the Tower Site are dealt with in accordance with FCC regulations and requirements under the supervision

of the Project Engineer (as defined in the Tri-Plex Agreement). Owner and Licensee will provide and install, and Owner shall cause Other Licensee to provide and install, each at its sole expense, all filters, cavities, and other required items as may be needed to cause its respective transmission system to work properly with the Tri-Plex System while meeting said FCC regulations and requirements.

(f) For the benefit of the use and operation of the Tower Site by the Tri-Plex Collaborators or as necessary to allow any one of the Tri-Plex Collaborators to install, remove, relocate, maintain and repair its equipment at the Tower Site, it may be necessary from time to time for one of the Tri-Plex Collaborators to request that the others temporarily switch to non-directional operation or cease transmission and broadcasting activities, to turn off electrical power, and/or to make other adjustments to their equipment and operations. Owner and Licensee, each at its own expense and without seeking recovery or reimbursement from the other, agree to cooperate with each other and to honor such reasonable requests as necessary to allow orderly performance and carrying out of such work. The Parties will, except in the case of emergencies, take such actions required by this subparagraph (f) during FCC licensed nighttime hours (or at hours outside of FCC licensed nighttime hours if all Tri-Plex Collaborators consent). Any failure to comply with any reasonable written request in this regard shall constitute a default under this Agreement. Each Tri-Plex Collaborator shall endeavor to provide the others with notice at least 48 hours prior to any such temporary cessation.

#### 10. Utility Connections and Generator Use.

(a) Licensee will be permitted to use and make connections with Owner's electrical distribution system at the Tower Site. Licensee's use of electrical energy shall not at any time exceed the capacity of the electrical conductors and equipment in or otherwise serving the Tower Site. Licensee shall set up its own account with the utility provider for the Licensed Space and the Equipment (currently PEPCO) and pay the utility provider directly for such service. Owner shall not be liable in any way to Licensee for any loss, failure or defect in the supply or character of electrical energy furnished to Licensee (unless such loss, failure or defect is caused by the gross negligence or willful misconduct of Owner).

(b) Licensee will be responsible for telecommunications and heating, ventilating and air conditioning systems serving the Licensed Space and the Equipment at the Tower Site. Licensee shall set up its own account with a telecommunications vendor serving the Tower Site for the provision of telecommunications services to the Licensed Space, as may be required by Licensee.

(c) Subject to receipt of all necessary permits, licenses and authorizations, including any required zoning and building authorizations, Licensee shall have the right to install at the Tower Site for its exclusive use a back-up emergency power generator and associated fuel tank (together, the "Generator"). The size, design, location and means of installation of the Generator shall be subject to Owner's prior written approval, which approval shall not be unreasonably withheld, conditioned or delayed. Licensee shall be responsible for maintaining the Generator in good operating repair and condition and in accordance with all applicable laws and regulations, including laws and regulations regarding generators and hazardous materials. Upon the expiration or earlier termination of this Agreement, Licensee shall remove the Generator and shall repair any damage to the Tower Site caused by the Generator. Licensee shall indemnify and hold harmless Owner from and against any liability incurred by or threatened against Owner as a result of the installation, use, maintenance, repair or removal of the Generator. No additional compensation shall be due Owner under this Agreement for Licensee's installation and use of the Generator.

11. Non-Liability: Indemnification.

(a) Licensee acknowledges that it has examined and knows the condition of the Licensed Space, and that no representations not herein expressed have been made by Owner or any person for Owner as to the condition of the Licensed Space. Licensee hereby accepts the Licensed Space in its present "as is" condition, subject to Owner's obligations pursuant to the terms of the Tri-Plex Agreement and this Agreement. In no event shall either Party or any of its respective partners, officers, agents or employees be liable to the other Party for any injury to persons or damage to or theft of any property located on or in the Tower Site unless and to the extent such injury, damage or loss is directly caused by such Party's negligence. Notwithstanding anything in this Agreement, neither Party shall be liable to the other Party for and each Party hereby waives any rights to consequential, punitive or special damages or lost profits.

(b) Licensee agrees to indemnify and save harmless Owner against and from any loss, damage or expense (including all reasonable attorneys' fees and costs of suit) to the extent arising out of any occurrence causing injury to any person or property whomsoever or whatsoever which directly or indirectly relates to the condition of the Tower Site, Towers or Building or from conduct upon or use or neglect of the Tower Site, Towers or Building or any part thereof, or of the Equipment or appliances therein, by Licensee, its employees, agents, licensees, independent contractors, invitees, or any person or persons holding under Licensee or for whom Licensee is responsible (collectively, "Licensee Parties"). Licensee further agrees that Owner shall not be liable or accountable to Licensee, or to anyone claiming under or through Licensee, for any damage occasioned by or from plumbing, gas, water, steam, sewerage, wiring, or other pipes or apparatus, or the bursting, leaking or running of any water closet, tank, plumbing or other damage occasioned by water being or coming upon the Licensed Space through the roof, skylight, trap-door or elsewhere, nor for any damage arising from any act or neglect of any other licensee or occupant of the Licensed Space or the Tower Site, or of any owner or occupant of property in the proximity thereof, nor for any damage resulting from an act of God, such as a slide, earthquake or similar event.

(c) Owner agrees to indemnify and save harmless Licensee against and from any loss, damage or expense (including all reasonable attorneys' fees and costs of suit) to the extent arising out of any occurrence causing injury to any person or property whomsoever or whatsoever which directly or indirectly relates to the condition of the Tower Site, Towers or Building or any part thereof, or from conduct upon or use or neglect of the Tower Site, Towers or Building or any part thereof, or of Owner's equipment or appliances therein, by Owner, its employees, agents, licensees (other than Licensee or Other Licensee), independent contractors, invitees, or any person or persons holding under Owner or for whom Owner is responsible (collectively, "Owner Parties").

(d) Licensee shall indemnify, defend (at Owner's option) and hold Owner and its affiliated corporations, subsidiaries, partnerships, their respective directors, officers, employees, consultants, and agents, and their successors and assigns, harmless from and against all claims, losses, liabilities, damages, judgments, liens and other reasonable and necessary costs and expenses (including without limitation, reasonable attorneys' fees whether or not litigation is brought) (1) arising out of any breach of warranty, representation or undertaking made by Licensee with respect to this Agreement or any part hereof, or (2) which may be imposed upon, incurred by or asserted against Owner by reason of any of the following: (i) any misconduct or negligence on the part of Licensee or Licensee Parties; (ii) any use of the Tower Site, Towers or Building by Licensee resulting in an injury, death, or damage to person or property occurring upon, in or about the Tower Site, Towers or Building (unless caused by Owner's gross negligence or willful misconduct); or (iii) any failure to perform or comply in any material respect with any covenant required to be performed or complied with by Licensee hereunder.

(e) Owner shall indemnify, defend (at Licensee's option) and hold Licensee and its affiliated corporations, subsidiaries, partnerships, and their respective directors, officers, employees, consultants, and agents, and their successors and assigns, harmless from and against all claims, losses, liabilities, damages, judgments, liens and other reasonable and necessary costs and expenses (including without limitation, reasonable attorneys' fees whether or not litigation is brought) (1) arising out of any breach of warranty, representation or undertaking made by Owner with respect to this Agreement or any part hereof, or (2) which may be imposed upon, incurred by or asserted against Licensee by reason of any of the following: (i) any misconduct or negligence on the part of Owner or Owner Parties; (ii) any use of the Tower Site, Towers or Building by Owner resulting in an injury, death, or damage to person or property occurring upon, in or about the Tower Site, Towers or Building (unless caused by Licensee's gross negligence or willful misconduct); or (iii) any failure to perform or comply in any material respect with any covenant required to be performed or complied with by Owner hereunder.

(f) The provisions of this Paragraph 11 shall survive the termination or earlier expiration of this Agreement.

12. Maintenance, Repairs and Surrender of Possession.

(a) Licensee, at its sole cost and expense (except as specifically provided for herein), shall be responsible for the repair and maintenance of its Equipment and shall keep the Licensed Space, as well as the area immediately adjacent to the Licensed Space, in a neat, clean and tenantable condition, free from dirt and accumulation of waste, all in accordance with Regulations. Licensee shall be solely responsible for securing the safety and security of its Equipment. Owner shall have no obligation to obtain or maintain any license, permit, or other approval of any federal, state or local agency having jurisdiction for Licensee's benefit or to maintain or insure Licensee's Equipment. All maintenance and repair work shall be subject to the terms of this Agreement, including, without limitation, Paragraphs 7 and 8 herein. Owner shall have the right to place such signs and notices of responsibility on the Tower Site in connection with any such repairs and maintenance or other work performed by or on behalf of Licensee, or as may be necessary to protect owner against loss from mechanics' liens or otherwise.

(b) Licensee will be responsible for the removal of all of Licensee's trash from the Tower Site. Trash shall not be allowed to accumulate but shall be removed each time Licensee's employees, and/or authorized agents, visits the Tower Site. Except as expressly provided for herein or in the Tri-Plex Agreement, Owner shall not be required to make any repairs, alterations, additions or improvements whatsoever in, to or about the Licensed Space or any part thereof. Owner reserves the right for itself, its agents or representatives, either alone or with workmen or others, to enter upon the Licensed Space without prior notice to Licensee (provided, except in the case of a bona fide emergency and except for Owner's access to the Building electrical systems and to Owner's generator control system, Owner shall give Licensee reasonable prior notice of such access so that a representative of Licensee may be present) to make any repairs that Owner may consider necessary or desirable for the preservation of the Towers and/or the Tower Site (excluding Licensee's Equipment); however, the making of any such repairs by Owner shall in no event constitute a waiver of Owner's right to require Licensee to keep the Licensed Space in such state of repair as hereinbefore provided, and Licensee shall reimburse Owner upon demand as additional fees hereunder for the cost of any such repairs made by Owner pursuant hereto which were Licensee's obligation.

(c) Owner shall maintain in good condition throughout the Term the Tower Site, including, but not limited to, the Towers, the Building, the ground system, the antenna array, the fencing,

the access road, the grounds, the common tri-plex circuits installed in the Enclosures (as defined in the Tri-Plex Agreement) and all other common features of the Tri-Plex System. Owner shall be responsible for complying with lighting, marking and painting Regulations with respect to the Towers. Owner shall maintain the Tower Site in compliance with all applicable Regulations. Owner, Licensee and Other Licensee shall share equally in all such maintenance and repair costs for the Tower Site. Licensee shall pay Owner, as Additional Rent, within ten (10) days of receipt of an invoice therefor, its share of such costs.

(d) Owner shall be responsible for maintaining, at its sole cost and expense, in good condition and repair throughout the Term, subject to ordinary wear and tear, the Networks (as defined in the Tri-Plex Agreement) of WJFK, and Licensee shall be responsible for maintaining, at its sole cost and expense, in good condition and repair throughout the Term, subject to ordinary wear and tear, the Networks for Licensee's Station. Owner shall include a similar obligation for Other Licensee to maintain its Networks in the tower site license agreement entered into between Owner and Other Licensee.

(e) Upon the expiration or earlier termination of this Agreement, Licensee shall, within a reasonable period of time, remove all of Licensee's Equipment, except as otherwise provided in the Tri-Plex Agreement. All other alterations, additions or improvements made by or on behalf of Licensee to the Licensed Space (other than Licensee's Equipment) shall become the property of Owner and shall remain upon and be surrendered with the Licensed Space upon the expiration or earlier termination of this Agreement. Any required removals shall be made at Licensee's sole cost and expense and shall be performed by Licensee or a contractor previously approved by Owner in accordance with a previously approved removal plan and otherwise in accordance with the terms of this Agreement. The Licensed Space shall be restored to substantially the condition existing prior to the Commencement Date, except for any alterations, additions or improvements made by Licensee, normal wear and tear and actions of other tenants or licensees. Any damage to the Tower Site or any equipment of Owner or other tenant or licensee of Owner caused by such removal shall be immediately repaired by Licensee at its sole cost and expense. If Licensee fails to make such repairs within twenty-one (21) days after the occurrence of such damage, Owner may perform the necessary repairs at Licensee's cost and expense and the cost thereof shall be immediately due upon the rendering of an invoice to Licensee. The provisions of this Paragraph 12(e) shall survive the termination or earlier expiration of this Agreement.

13. Assignments and Sub-Licensing. Licensee shall not directly or indirectly assign or transfer this Agreement, or any interest therein, or sublet the whole or any part of the Licensed Space, or permit or suffer the interest, or any part thereof, hereby vested in it, to pass to or vest in any other person(s) or entity(ies), including by operation of law or by the transfer of an interest of 50% or more in any corporation or partnership which is the Licensee or a successor to the Licensee named herein, without the prior written consent of Owner, which consent shall not be unreasonably withheld, conditioned or delayed; provided, however, it shall be deemed reasonable for Owner to condition its consent to an assignment or transfer upon a commercially reasonable increase in the Security Deposit. Notwithstanding the foregoing, in the event of an assignment of Licensee's rights under the Tri-Plex Agreement in accordance with the terms of the Tri-Plex Agreement, Licensee shall assign its rights under this Agreement to such assignee of the Tri-Plex Agreement. This Agreement shall be binding upon and inure to the benefit of the Parties hereto, their heirs, executors, administrators, successors and assigns, subject to the remainder of this Paragraph 13. Consent to one transfer shall not be deemed consent to other, subsequent transfers. Notwithstanding any assignment or transfer, Licensee shall not be released from its obligations hereunder without the written consent of Owner, which consent shall be (a) subject to Owner's good faith consideration of the proposed assignee's financial qualifications to perform the terms and conditions of this Agreement for the remainder of the Initial Term or a Renewal Term, as the

case may be, and (b) granted where an assignee has materially performed all of the terms and conditions of this Agreement, without default, for a consecutive period of 24 months during the Initial Term or a Renewal Term, as the case may be.

14. Rules and Regulations. Licensee shall comply at all times with all reasonable rules, regulations and requirements established in good faith by Owner and are made known to Licensee relating to the installation and use of Licensee's Equipment and the Tower Site, provided, however, that the requirements set forth in this Agreement and the Tri-Plex Agreement shall be controlling.

15. Insurance.

16. Liability of Owner. The term "Owner" as used in this Agreement means only the owner, or mortgagee in possession, for the time being of the Licensed Space, and in the event of any transfer or transfers of Owner's interest in such Licensed Space, other than a transfer for security purposes only, the transferor shall be automatically relieved of all Owner's obligations and liabilities accruing from and after the date of such transfer; provided, however, that any funds held by Owner at the time of such transfer in which Licensee has an interest shall be turned over to the transferee, it being intended hereby that Owner's obligations shall, subject to the foregoing, be binding on Owner, its successors and assigns, only during and in respect of their respective periods of ownership. Licensee agrees to look solely to Owner's interest in the Tower Site for the satisfaction of a judgment (or other judicial process) requiring the payment of money by Owner in the event of any default by Owner hereunder, and no other assets of Owner shall be subject to levy, execution or other enforcement procedure for the satisfaction of Licensee's remedies under or with respect to this Agreement.

17. Waiver. No waiver of any default by either Party shall be implied from any omission by the other Party to take action on account of such default if such default persists or is repeated. No express waiver shall affect any default other than the default specified in the waiver, and then such waiver shall be operative only for the time and to the extent therein stated. The waiver of any default by any Party shall be limited to that particular instance and shall not constitute a waiver of any other default, past and future. The subsequent acceptance of License Fees or Additional Rent hereunder by Owner shall not be deemed to be a waiver of any prior breach by Licensee of any term, covenant, or condition of this Agreement, other than the failure of Licensee to pay the particular License Fee or Additional Rent so accepted, regardless of Owner's knowledge of such prior breach at the time of acceptance of such fee. The consent or approval by Owner or of any act or thing requiring its consent or approval shall not be deemed to waive or render unnecessary Owner's consent or approval to or of any subsequent similar acts.

18. Default and Remedies.

(a) The occurrence of any of the following shall constitute a default under this Agreement by Licensee:

- (i) Any failure by Licensee to pay the License Fees or any other monetary sums required hereunder within five (5) business days after the date of written notice by Owner to Licensee of such failure;
- (ii) A failure by Licensee to observe any other provision of this Agreement to be observed or performed by Licensee, where such failure continues for thirty (30) days (or such shorter period as may be specifically provided for in this Agreement) after written notice thereof by Owner to Licensee; provided, however, that if such failure is of a nature that it cannot be completely remedied within thirty (30) days, the failure by Licensee to commence to remedy such failure within said thirty (30) days and thereafter diligently prosecute to completion all steps necessary to remedy such failure, provided in all events the same is completed within ninety (90) days;
- (iii) The making by Licensee of any general assignment for the benefit of creditors; the filing by or against Licensee of a petition to have Licensee adjudged a bankrupt or of a petition for reorganization or arrangement under any law relating to bankruptcy (unless, in the case of a petition filed against Licensee, the same is dismissed within sixty (60) days); the appointment of a trustee or



receiver to take possession of substantially all of Licensee's assets located at the Licensed Space or of Licensee's interest in this Agreement, where possession is not restored to Licensee within sixty (60) days; or the attachment, execution or other judicial seizure of all or substantially all of Licensee's assets located at the Licensed Space or of Licensee's interest in this Agreement, where such seizure is not discharged within sixty (60) days; or

(iv) The installation of any equipment not specifically authorized by this Agreement.

(b) In the event of any such default under this Agreement by Licensee that is not cured within the applicable cure period set forth in subparagraph (a) of this Paragraph 18, then Owner, in addition to any other rights or remedies, shall have the right after fifteen (15) days' notice to disconnect and/or remove property from the Licensed Space. Such property may be removed and stored in any other place on the Licensed Space or the Tower Site or in any other place, for the account of and at the expense and risk of Licensee. Licensee hereby waives all claims against Owner for damages which may be caused by disconnecting, removing or storing the property as herein provided and will indemnify and hold Owner harmless from any loss, costs or damages (including all reasonable attorney's fees and costs of suit) resulting therefrom (unless caused by the intentional misconduct of Owner), and no such actions shall be considered or construed to be forcible entry. Owner shall also have the right, at Owner's option: (i) to discontinue Licensee's operation after thirty (30) days' notice for failure to pay the License Fee, and prior to reinstatement of service and access, Licensee shall pay to Owner all back-fees due and restore the Security Deposit to the full amount specified in Paragraph 6(c) hereof; or (ii) terminate this Agreement and Licensee's right to possession. Such termination may be effected only after ten (10) days' written notice thereof to Licensee. On such termination, Owner may exercise any and all rights available to it including without limitation, the right to recover from Licensee all damages specifically provided for in this Agreement and/or permitted by law.

(c) In the event of any default by Licensee under this Agreement, Owner may, at Owner's option, decline to terminate Licensee's right to possession, in which event this Agreement shall continue in effect for so long as Owner does not terminate Licensee's right to possession, and Owner may enforce all of its rights and remedies under this Agreement, including the right to recover the License Fee as it becomes due. The following do not constitute a termination of Licensee's right to possession:

(i) Acts of maintenance or preservation or efforts to relet the Licensed Space.

(ii) The appointment of a receiver on initiative of Owner to protect its interest under this Agreement.

(d) The foregoing remedies of Owner shall not be exclusive but shall be cumulative and in addition to all rights and remedies now or hereafter provided or allowed by law.

(e) Owner shall be in default under this Agreement if Owner fails to observe any provision of this Agreement to be observed or performed by Owner, where such failure continues for thirty (30) days after written notice thereof by Licensee to Owner; provided, however, that if such failure is of a nature that it cannot be completely remedied within thirty (30) days, then Owner shall be in default hereunder if Owner fails to commence to remedy such failure within said thirty (30) days and thereafter diligently prosecute to completion all steps necessary to remedy such failure, provided in all events the same is completed within ninety (90) days. In the event of such a default by Owner hereunder that is not cured within the applicable cure period, Licensee may seek such recourse to remedies available to Licensee, at law or in equity, including specific performance or injunctive relief, to enforce

the terms and condition of this Agreement; provided, in no event shall Licensee be permitted to enjoin the radio broadcasting operations of WJFK.

19. Notices. All notices required or permitted hereunder shall be given by overnight courier service or by certified or registered mail, postage prepaid, to the respective address set forth below or such other address notice of which has been given in such manner.

If to Owner:

CBS Radio Inc. of Maryland  
4200 Parliament Place  
Lanham, MD 20706  
Attention: General Manager -- WJFK-AM

with a copy to:

CBS Corporation  
51 West 52<sup>nd</sup> Street  
New York, New York 10036  
Attention: General Counsel

If to Licensee:

New World Radio, Inc.  
2131 Crummins Lane  
Falls Church, VA 22043  
Attention: Alan Pendleton, President

with copies to:

New World Radio, Inc.  
11417 Hounds Way  
Rockville, MD 20852  
Attention: James M. Weitzman, Chairman

-and-

Barry A. Friedman, Esq.  
Thompson Hine LLP  
1919 M Street, NW  
Washington, DC 20036

20. Holding Over. If Licensee remains in possession of the Licensed Space after the expiration or earlier termination of this Agreement, all the terms, covenants and agreements hereof shall continue to apply to and bind Licensee so long as Licensee shall remain in possession, insofar as the same are applicable, except that the License Fee shall be increased to one and one-half (1-1/2) times the License Fee payable for the last month of the term hereof, prorated on a daily basis for each day that Licensee remains in possession.

21. Liens. Licensee shall not permit any mechanics' or materialmen's lien or liens or other encumbrances that are caused by or resulting from any work performed, materials furnished or obligations incurred by or at the request of Licensee (including any unpaid taxes which are the responsibility of Licensee that become a lien on the Tower Site) to be placed upon the Tower Site, or upon other property of Owner during the Term. In the event any such lien or encumbrance arises, Licensee shall at its own expense, cause the same to be discharged of record or bonded around within thirty (30) days after Licensee obtains actual knowledge of the filing thereof. Licensee shall have the right to contest the validity or amount of such lien or encumbrance, provided that such lien is removed from record by Licensee by the posting of a bond or other such security in an amount sufficient to remove such lien from record within the thirty (30) day period. If Licensee shall default in its obligations under this Paragraph, Owner shall, in addition to and not in lieu of any other right set forth herein, including termination, have the right to pay, bond, contest or otherwise remove of record any such lien or encumbrance, and Licensee shall reimburse Owner upon demand for all costs and expenses (including reasonable attorneys' fees) incurred by Owner in connection therewith.

22. Force Majeure. Neither Party shall be liable in any way for delay or failure in performance due to any events of force majeure, including fire, embargo, explosion, power blackout, earthquake, hurricane, flood, war, water, the elements, strikes or other labor disputes not involving the parties, civil disturbances, government requirement, order of military authorities, acts of God or public enemy, or any acts beyond such Party's reasonable control; provided, however, Licensee's obligation to pay the License Fee and any Additional Rent hereunder shall not be affected, impaired or excused by any such force majeure occurrence.

23. Authority and Good Standing. Each Party represents and warrants to the other that (i) it has the right, power and authority to enter into and perform its obligations under this Agreement, (ii) it is duly established or organized, validly existing and in good standing under the laws of the State in which it is incorporated and (iii) the individual(s) signing on behalf of such Party is duly authorized to sign and bind such Party. Each Party agrees to maintain such right, power, authority and good standing throughout the term of this Agreement.

24. Non-ionizing Radiation Rules and Regulations. The Parties shall at all times comply with any federal, state or local law, rule or regulation pertaining to non-ionizing radiation, currently enacted or laws, rules or regulations that are enacted, changed or promulgated. Compliance shall be on an individual basis or as it pertains to the Tri-Plex System. It is each Party's sole responsibility to provide documentation to any agency requiring such documentation for permission to operate any equipment and to prove compliance with Regulations with respect to Licensee's Station or WJFK, as applicable. Should any law, rule or regulation change, each Party must, at its sole expense, take all steps necessary to comply with said change as may be required.

25. Taxes. Licensee shall be responsible for payment of all taxes, assessments, license fees, and other charges that are levied and assessed by a government agency against Licensee's personal property installed or located in or on the Tower Site.

26. Rights of Termination.

(a) Owner may, at its option, terminate this Agreement upon not less than ninety (90) days' prior written notice to Licensee specifying the basis for such termination, without any liability under the following circumstances:

(i) city, county, state or federal statutes, ordinances, orders, rules or regulations prohibiting the use or continued use of the Tower Site for the uses presently being made thereof by the Tri-Plex Collaborators; or

(ii) damage to or destruction of the Towers from any cause including, but not limited to, acts of God such as floods, earthquakes, or other acts of force majeure, whether or not covered by insurance, which damage or destruction renders the Towers unusable for the purposes intended by the Tri-Plex Collaborators.

Under no circumstances shall Owner be under any obligation to restore or rebuild the Licensed Space, the Towers or any other portion of the Tower Site in the event of any destruction or any taking or condemnation, which destruction, taking or condemnation renders the Towers or the Tower Site unusable for the purposes intended by the Tri-Plex Collaborators.

(b) Licensee agrees that it will in good faith apply for and proceed with reasonable due diligence to obtain any governmental licenses, permits or other approvals, including local zoning and building approvals (collectively, the "Approvals") required for the installation of Licensee's Equipment at the Tower Site and the operation of Licensee's Station as contemplated by this Agreement and for the work contemplated by the Tri-Plex Agreement. Owner shall reasonably cooperate in such efforts and join in any applications where the action, consent or acknowledgment of the owner of the real property constituting the Tower Site is required. If, notwithstanding such good faith efforts, including the payment of any commercially reasonable fees assessed by the applicable governmental authorities, Licensee is unable to secure the Approvals so as to enable Licensee to commence operations at the Tower Site on or before August 1, 2014, Licensee may, at its option, terminate this Agreement upon written notice to Owner. In the event of such termination by Licensee, this Agreement and Licensee's rights and obligations under the Tri-Plex Agreement shall be deemed null and void.

## 27. Subordination, Estoppel Certificate, Attornment.

(a) This Agreement shall be subject and subordinate to any present or future ground leases or mortgages and/or deeds of trust which now or hereafter may affect the Tower Site, and to all renewals, modifications, consolidations, replacements and extensions thereof. Licensee agrees to sign and deliver a reasonable and customary written statement in recordable form requested by or on behalf of any ground lessor or lender to acknowledge and evidence such subordination. Owner agrees to use commercially reasonable efforts to secure from any such ground lessor or mortgagee a non-disturbance agreement, in reasonable and customary form, in favor of Licensee.

(b) Licensee and Owner each shall at any time and from time to time, within fifteen (15) days after delivery of written notice from the other Party, execute, acknowledge and deliver to the requesting Party a statement in writing certifying (i) that this Agreement is unmodified and in full force and effect (or, if modified, stating the nature of such modification and certifying that this Agreement, as so modified, is in full force and effect), (ii) the dates to which fees and other charges are paid in advance, if any, (iii) that there are not, to its knowledge, any uncured defaults on the part of the requesting Party hereunder or specifying such defaults if any are claimed, and (iv) such other matters as may reasonably be requested by the requesting Party relating to this Agreement. It is expressly understood and agreed that any such statement made by Licensee may be relied upon by any prospective purchaser or lender of all or any portion of the Tower Site. The failure of either Party to deliver such statement within such time shall be conclusive upon the requesting Party that this Agreement is in full force and effect, without modification except as may be represented by the requesting Party in such statement, that there are no

uncured defaults in the requesting Party's performance and that not more than one (1) month's fee has been paid by Licensee in advance.

(c) In the event any proceedings are brought for default under any ground lease or under any underlying lease or in the event of judicial or nonjudicial foreclosure or the exercise of the power of sale under any mortgage or deed of trust encumbering the Licensed Space, or in the event of any other transfer of the Licensed Space by Owner, Licensee shall attorn to Owner's successor in interest and recognize such successor as Owner under this Agreement.

28. Owner's Representation. Owner represents and warrants that there are not now presently in existence ground leases, mortgages or deeds of trust which affect the Tower Site.

29. Miscellaneous.

(a) This Agreement, together with the Tri-Plex Agreement, supersedes and terminates all prior representations, agreements and understandings and constitutes the entire understanding between the parties with respect to its subject matter and can only be amended in writing signed by all parties.

(b) This Agreement and the rights and obligations of the parties hereto shall be governed by, and construed in accordance with, the laws of the State of Maryland.

(c) This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

(d) Any provision of this Agreement which shall prove to be invalid, void, or illegal shall in no way affect, impair or invalidate any other provision hereof and such other provisions shall remain in full force and effect, except that if such invalid, void or illegal provision is material to this Agreement, either Party shall have the right to terminate this Agreement and render it null and void.

(e) Time is of the essence as to all date and time limitations set forth herein.

(f) Subject to the restrictions contained herein, this Agreement shall inure to the benefit of and be binding upon the parties and their respective successors and assigns.

(g) If Licensee or Owner shall bring any action or arbitration for any relief against the other, declaratory or otherwise, arising out of this Agreement, including, but not limited to, any suit by Owner for the recovery of fees or possession of the Licensed Space, the prevailing Party shall be entitled to recover from the other Party reasonable attorneys' fees, and such attorneys' fees shall be deemed to have accrued on the commencement of such action.

(h) Submission of this instrument for examination or signature by Licensee does not constitute a reservation of or option for Agreement, and it is not effective as an Agreement or otherwise until execution and delivery by both Owner and Licensee.

(i) This Agreement shall not be recorded. Licensee, at its expense, shall have the right to record a memorandum of this Agreement; provided, however, Licensee hereby agrees to record a termination of such memorandum upon the expiration or earlier termination of this Lease and in the event Licensee fails to record such a termination, Licensee hereby appoints Owner as its attorney in fact for the sole purpose of recording a termination of such memorandum.

(j) The parties hereto specifically waive any right to trial by jury in any court with respect to any contract, tort or statutory claim, counterclaim or crossclaim against the other arising out of or connected in any way to this Agreement.

(k) Notwithstanding any obligation from one Party to the other herein, the Parties hereto state that they have not created and do not intend to create by this Agreement a joint venture or partnership relationship between them, it being their sole purpose and intent to create only a licensor-licensee relationship.

[signatures appear on the following page]

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first above written.

OWNER:

LICENSEE:

CBS RADIO INC. OF MARYLAND

NEW WORLD RADIO, INC.

By: \_\_\_\_\_

Name: Kenneth J. Cooper  
Title: SVP - Administrator

By: \_\_\_\_\_

Name: Alan Pondleten  
Title: President

CBS RADIO WPGC(AM), INC.

By: \_\_\_\_\_

Name: Kenneth J. Cooper  
Title: SVP - Administrator

EXHIBIT "A"

LOCATION OF LICENSED SPACE



New World Radio  
 2/6/2014

W1FK AB1 ADDITION ROAD TRANSMITTER SITE  
 Transmitter and Phasor Placement  
 November 1, 2013 rev.

Transmitter and Phasor placement  
November 1, 2013 rev.

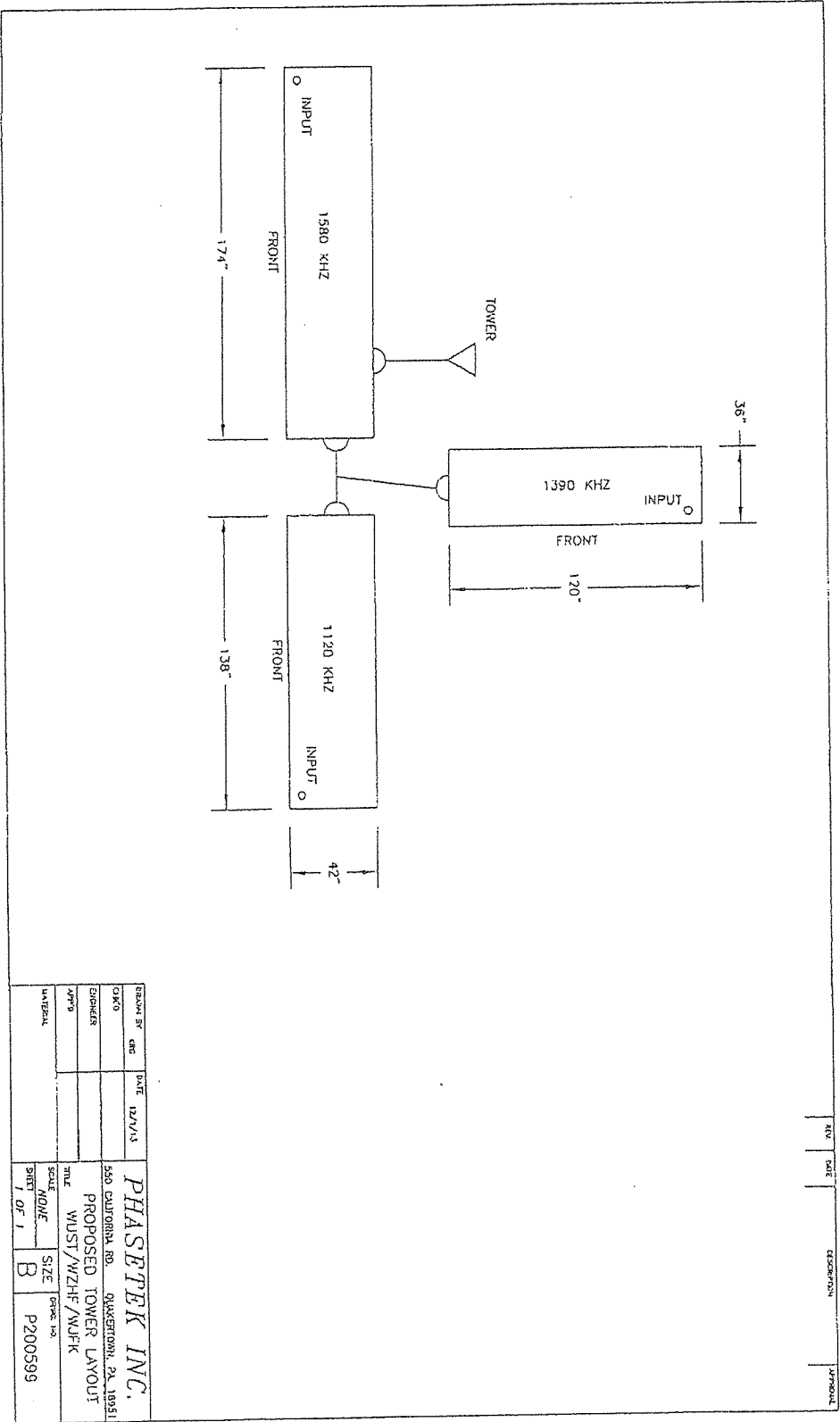


EXHIBIT "B"

LIST OF DESIGNATED EQUIPMENT

**Transmitter:**

Manufacturer & Model: Nautel Model NX-50

**Phasors:**

Manufacturer & Description: Phasetek Custom Antenna Phasing and Switching System, including:  
4 Tower Phasor, 4 Antenna Tuning Units  
(one Unit per Tower), Triplex Filtering System,  
Antenna Switching System and Custom external  
dummy load and switching system.

**Antenna Monitor:**

Manufacturer & Model: Potomac Instruments Model 1900  
Digital Antenna Monitor

**Final Audio Limiter(s):**

Manufacture & Model: Orban Model 9300 Digital Optimod - AM

**Emergency Electric Generator:**

Manufacturer & Model: N/A

**Emergency Transfer Switch:**

Manufacturer & Model: N/A

EXHIBIT "B-1"

EQUIPMENT TYPES

1. Any RF generating device capable of providing power to the antenna system, including, but not limited to, analog and digital transmitters.
2. Any devices, regardless of where these devices are installed in the transmissions chain, capable of altering the amplitude or phase of the transmitter's power or injecting additional carriers and/or sidebands into the antenna beyond those produced by normal monophonic amplitude modulation, including, but not limited to, coupling, tuning, filtering and phase/impedance shifting networks, phasors, ATUs, digital exciters, stereo generators and oscillators.
3. Coaxial cables used for power delivery to the antenna system and antenna monitoring.
4. Final audio limiters.
5. Antenna monitor.
6. Emergency electrical generator and transfer switch.

EXHIBIT "C"

FCC AUTHORIZATIONS



United States of America  
FEDERAL COMMUNICATIONS COMMISSION  
AM BROADCAST STATION CONSTRUCTION PERMIT

Authorizing Official:

Official Mailing Address:

NEW WORLD RADIO, INC.  
2132 CRIMMINS LANE  
FAIRFAX CHURCH VA 22043

Son Nguyen  
Supervisory Engineer  
Audio Division  
Media Bureau

Grant Date: January 13, 2014

Facility Id: 48686

Call Sign: WUST

Permit File Number: BP-20130926BCX

This permit expires 3:00 a.m.  
local time, 36 months after the  
grant date specified above.

Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this permit, the permittee is hereby authorized to construct the radio transmitting apparatus herein described. Installation and adjustment of equipment not specifically set forth herein shall be in accordance with representations contained in the permittee's application for construction permit except for such modifications as are presently permitted, without application, by the Commission's Rules.

Commission rules which became effective on February 16, 1999, have a bearing on this construction permit. See Report & Order, Streamlining of Mass Media Applications, MM Docket No. 98-43, 13 FCC RCD 23056, Para. 77-90 (November 25, 1998); 63 Fed. Reg. 70039 (December 18, 1998). Pursuant to these rules, this construction permit will be subject to automatic forfeiture unless construction is complete and an application for license to cover is filed prior to expiration. See Section 73.3596.

Equipment and program tests shall be conducted only pursuant to Sections 73.1610 and 73.1620 of the Commission's Rules.

Hours of Operation: Daytime

Average hours of sunrise and sunset:  
Local Standard Time (Non-Advanced)

Jan.	7:30 AM	5:15 PM	Jul.	5:00 AM	7:30 PM
Feb.	7:00 AM	5:45 PM	Aug.	5:15 AM	7:00 PM
Mar.	6:15 AM	6:15 PM	Sep.	5:45 AM	6:15 PM
Apr.	5:30 AM	6:45 PM	Oct.	6:15 AM	5:30 PM
May	5:00 AM	7:15 PM	Nov.	6:45 AM	5:00 PM
Jun.	4:45 AM	7:30 PM	Dec.	7:15 AM	4:45 PM

Callsign: WUST

Permit No.: BP-20130926BCX

Name of Permittee: NEW WORLD RADIO, INC.

Station Location: WASHINGTON, DC

Frequency (kHz): 1120

Station Class: D

Antenna Coordinates:

Day

Latitude: N 38 Deg 52 Min 09 Sec

Longitude: W 76 Deg 53 Min 47 Sec

Critical

Latitude: N 38 Deg 52 Min 09 Sec

Longitude: W 76 Deg 53 Min 47 Sec

Transmitter(s): Type Accepted. See Sections 73.1660, 73.1665 and 73.1670 of the Commission's Rules.

Nominal Power (kW): Day: 50.0

Critical: 3.0

Antenna Mode: Day: DA

Critical: ND

(DA=Directional Antenna, ND=Non-directional Antenna; CH=Critical Hours)

Antenna Registration Number(s):

Day:

Tower No. ASRN

1 None 48.46

2 None 48.46

3 None 48.46

4 None 48.46

Critical:

Tower No. ASRN

1 None 48.46

Callsign: WUST

Permit No.: BP-20130926BCX

DESCRIPTION OF DIRECTIONAL ANTENNA SYSTEM

Theoretical RMS (mV/m/km): Day: 2113.279

Standard RMS (mV/m/km): Day: 2220.26

Augmented RMS (mV/m/km):

Q Factor: Day:

Theoretical Parameters:

Day Directional Antenna:

Tower No.	Field Ratio	Phasing (Deg.)	Spacing (Deg.)	Orientation (Deg.)	Tower Ref Switch *	Height (Deg.)
1	1.0000	0.000	0.0000	0.000	0	63.8
2	0.9780	-7.400	106.2100	10.200	0	63.8
3	1.5330	129.800	98.8100	45.000	0	63.8
4	0.5520	-74.400	155.9000	27.000	0	63.8

\* Tower Reference Switch

0 = Spacing and orientation from reference tower

1 = Spacing and orientation from previous tower

Non-Directional Antenna: Critical

Radiator Height: 47.46 meters; 63.83 deg

Theoretical Efficiency: 288.74 mV/m/kw at 1km

Inverse Distance Field Strength:

The inverse distance field strength at a distance of one kilometer from the above antenna in the directions specified shall not exceed the following values:

Day:

Azimuth:	Radiation:
46.5	470 mV/m
137.5	85 mV/m
272.5	3191.7 mV/m



Special operating conditions or restrictions:

- 1 The permittee must submit a proof of performance as set forth in either Section 73.151(a) or 73.151(c) of the rules before program tests are authorized.  
A proof of performance based on field strength measurements, per Section 73.151(a), shall include a complete nondirectional proof of performance, in addition to a complete proof on the (day) directional antenna system. The nondirectional and directional field strength measurements must be made under similar environmental conditions. The proof(s) of performance submitted to the Commission must contain all of the data specified in Section 73.154 of the rules.  
Permittees who elect to submit a moment method proof of performance, as set forth in Section 73.151(c), must use series-fed radiators. In addition, the sampling system must be constructed as described in Section 73.151(c) (2) (i).
- 2 Permittee shall install a type accepted transmitter, or submit application (FCC Form 301) along with data prescribed in Section 73.1560(b) should non-type accepted transmitter be proposed.
- 3 Before program tests are authorized, sufficient data shall be submitted to show that adequate filters, traps and other equipment has been installed and adjusted to prevent intermodulation, intermodulation and/or generation of spurious radiation products which may be caused by common usage of the same antenna system by Stations WUST(AM), Facility ID: 48686, and WJFX(AM), Facility ID: 28638, and there shall be filed with the license application copies of a firm agreement entered into by the two stations involved clearly fixing the responsibility of each with regard to the installation and maintenance of such equipment. In addition, field observations shall be made to determine whether spurious emissions exist and any objectionable problems resulting therefrom shall be eliminated. Following construction, and prior to authorization of program test under this grant, Stations WUST(AM), Facility ID: 48686, and WJFX(AM), Facility ID: 28638, shall each measure antenna or common point resistance and submit FCC Form 302 as application notifying the return to direct measurement of power.
- 4 Ground system consists of 120 equally spaced, buried, copper radials about the base of each tower, each 67.1 meters in length except where terminated by property boundaries or where intersecting radials are shortened and bonded to a transverse copper strap midway between adjacent towers, plus 120 interspersed radials 15.3 meters in length.
- 5 Licensee shall be responsible for satisfying all reasonable complaints of blanketing interference within the 1 V/m contour as required by Section 73.88 of the Commission's rules.

\*\*\* END OF AUTHORIZATION \*\*\*