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Federal Communications Commission
Washington, D. C. 20554

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3060-0627
Expires 01/31/98

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.)

FOR COMMISSION USE ONLY
FILE NO. BMML-20151026AIV

SECTION I - APPLICANT FEE INFORMATION

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

CBS Corporation

MAILING ADDRESS (Line 1) (Maximum 35 characters)
1800 K St NW STE 920

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Washington	DC	20006

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
202 457 4518	WJFK	FAC ID 28638

2. A. Is a fee submitted with this application? ☑ Yes ☐ No

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

☐ Governmental Entity ☐ Noncommercial educational licensee ☐ Other (Please explain):

C. If Yes, provide the following information:

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

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
M M R	0 0 0 1	$ 690	

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

(A)	(B)	(C)	FOR FCC USE ONLY
M O R	0 0 0 1	$ 790	

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

TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
$ 1,320	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT CBS Radio WPGC (AM) Inc.		
MAILING ADDRESS 2175 K St NW Ste 350		
CITY Washington	STATE DC	ZIP CODE 20037

2. This application is for:

☑ Commercial ☐ Noncommercial

☐ AM Directional ☐ AM Non-Directional

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
WJFK	Morningside			

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

If No, explain in an Exhibit.

☑ Yes ☐ No

Exhibit No.

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

If No, state exceptions in an Exhibit.

☐ Yes ☐ No

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?

If Yes, explain in an Exhibit.

☐ Yes ☐ No

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)?

If No, explain in an Exhibit.

☐ Yes ☐ No

☑ 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	Signature	
Jo Ann Haller	Jo Ann Haller	
Title	**Date**	**Telephone Number**
Senior Vice President	10/15/2015	202 457-4518

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
CBS Radio WPGC(AM) 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	
				Night	Day
WJFK	Not Applicable	1580	Unlimited	0.27	50

2. Station location	
State	City or Town
Maryland	Morningside

3. Transmitter location			
State	County	City or Town	Street address (or other identification)
Maryland	Prince Georges	Capitol Heights	1401 S. Addison Road

4. Main studio location			
State	County	City or Town	Street address (or other identification)
DC	DC	Washington	1015 Half St, SE, Suite 200

5. Remote control point location (specify only if authorized directional antenna)			
State	County	City or Town	Street address (or other identification)
DC	DC	Washington	1015 Half St, SE, Suite 200

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.
Statement E

8. Operating constants:			
RF common point or antenna current (in amperes) without modulation for night system		RF common point or antenna current (in amperes) without modulation for day system	
2.41		32.45	
Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	-9.0	-9.0

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1	0.0	-38.8	1.000	0.544	Not Required	Not Required
2	56.9	0.0	0.670	1.000	Not Required	Not Required
3	113.8	20.3	0.980	0.753	Not Required	Not Required
4	170.2	42.3	1.054	1.441	Not Required	Not Required

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

SECTION III - Page 2

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Uniform cross section guyed	47.44	48.2	48.2	Exhibit No. Not Applicable

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 "

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. Statement E

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

Exhibit No. Not Applicable

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 Change

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

Tower repairs, renovation of ground system, replacement of tuning units, replacement of sample system, replacement of phasor, addition of filters.

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

Name (Please Print or Type)	Signature (check appropriate box below)
Garrison C. Cavell	[signature]
Address (include ZIP Code) Cavell, Mertz & Associates, Inc. 7724 Donegan Drive Manassas, VA 20109	Date 10/02/2015 Telephone No. (Include Area Code) (703) 392-9090

☐ Technical Director

☐ Registered Professional Engineer

☐ Chief Operator

☑ Technical Consultant

☐ Other (specify)

Statement E

Method of Moments Proof-of-Performance

WJFK Morningside, Maryland
Facility ID 28638
1580 kHz 50 kW-D 0.27 kW-N DA-2
CBS Radio WPGC(AM), Inc.

PREPARED BY:

CAVELL, MERTZ & ASSOCIATES, INC.

October 2, 2015
By: Garrison C. Cavell

JAN [illegible]

<u>**Statement E**</u>

Method of Moments Proof-of-Performance

WJFK Morningside, Maryland

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"Statement E" Attachment to FCC Form 302-AM for WJFK

<u>**Statement E**</u>
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

<u>**Introduction and Summary**</u>

This Statement has been prepared on behalf of *CBS Radio WPGC(AM), Inc.* ("*CBS Radio*"), licensee of Station WJFK, Morningside, Maryland, in support of an Application to modify the Station's Licensed Operating Parameters following tower repairs (section re-welding), complete replacement of the station's ground system, replacement of the sample system and associated sample lines, replacement of all tuning units, installation of a new phasor, and the addition of equipment to accommodate the sharing of this site with two other AM stations, WUST and WZHF[1].

The installation and adjustment activities for all stations participating in the triplex arrangement have been completed, the required antenna system proof-of-performance measurements[2] ("proofs") have been accomplished, and satisfactory checks have been performed for undesired interaction between the systems, which will be documented in separate FCC proof and Form 302-AM filings for each facility.

The information provided in this Statement demonstrates that the directional antenna parameters for the authorized WJFK antenna system have been determined in accordance with the requirements of Section 73.151(c) of the FCC's Rules. As will be shown in the following sections, the WJFK antenna system has been adjusted to produce antenna monitor parameters that are within +/- 5 percent in ratio and +/- 3 degrees in phase of the calculated "Method of Moments" ("MoM") modeled values. Based upon the following information and data, it is believed that the renovated triplexed WJFK facility is now operating in compliance with the FCC's rules regarding AM antenna system performance.

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[1] The relocation of WUST (Facility ID 48686) to this site was authorized under BP-20130926BCX. Construction has been completed and an Application for License has been filed and is now pending with the FCC (see BMML-20141218AFW). Similarly, authorization was also granted to WZHF (Facility ID 73306) to locate at this site under BP-20131223AFI). Construction of the WZHF system has also been completed and a proof-of-performance completed; an application for license to cover is being filed with the FCC.

[2] 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") because these antenna systems consist of series-fed, base insulated towers, using a conventional buried-wire ground system under each tower. As such, MoM proofs of performance have been or will be filed along with appropriate FCC Form 302-AM documents for each facility. WJFK had previously been licensed under the FCC's MoM rule provisions (please see FCC file number BMML-20130918AJO).

Antenna and Ground System Description

Other than the minor repairs and renovations described in the previous page, no material changes have been made in the authorized WJFK antenna system. This antenna array remains as described in the WJFK station license and associated FCC Antenna Structure Registrations. In summary, the WJFK antenna system consists of four uniform cross-section, guyed, base insulated, series fed, steel towers. All towers are 90° tall electrically at the WJFK operating frequency of 1580 kHz. All towers are used for both the daytime and nighttime modes of operation. An STL open-grid antenna system is mounted at the top of WJFK's Tower 3 and properly isolated using a commercially manufactured isocoupler installed at the tower base. The ground system is conventional in nature, and consists of 120 equally spaced buried copper radials around 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. An additional 120 radials, each 15.2 meters in length, are interspersed between the larger radials.

MoM Modeling Process

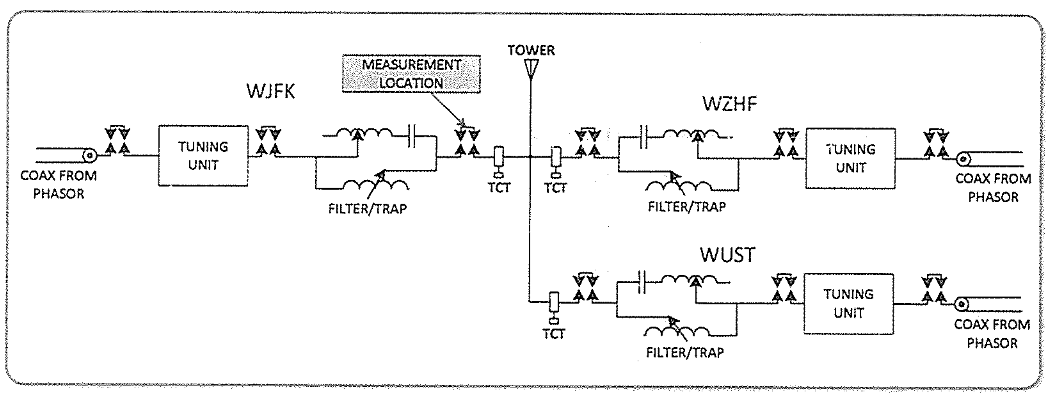
As permitted under FCC Rules, and has been done previously, the WJFK antenna array was evaluated using MoM derivative software, *Expert MININEC Broadcast Professional,* Version 14.5, published by *EM Scientific Inc*. As is now well known, the procedure for conducting a broadcast MoM proof first involves making impedance measurements at each of the towers to serve as benchmarks for calibrating the findings of the MoM calculations. After an initial model of the characteristics of each individual tower is developed from physical tower data (called the "self" condition), the model's 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 operation. 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 or technician 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 WJFK directional antenna system patterns.

Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

Tower Impedance Measurements

Following the tower re-welding, ground system replacement, replacement of the WJFK tuning units, and installation of the tuning and filtering equipment for the triplex partner stations, impedance measurements were taken at each of the WJFK tower bases (and also at other key locations throughout the RF system, as necessary) using a precision, calibrated RF impedance measurement system[3]. Upon completion of these measurements, it was found that these newly observed impedances differed materially enough from those values found in WJFK's last proof-of-performance that a new MoM analysis was warranted. The results of the reanalysis, readjustment and proof are supplied herein.

The impedance measurements described above were conducted at each tower base, as shown below at the tuning unit matching network final output jacks ("J-plugs") within each Antenna Tuning Unit ("ATU"). This point is henceforth regarded as the tower impedance "reference point" for this MoM proof. As each tower's impedance was being measured, all the other tower bases were "open circuited" at the same J-plug impedance measurement locations, referred to in the following as the "Open Circuit – Self" condition.



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 triplexed system, the RF system for the other stations are also

[3] The impedance measurement system used in this proof was a *Hewlett-Packard* model 8753C network analyzer in conjunction with a *Turnwall 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.

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 observed WJFK TCT location tower impedance with the J-plugs for the other stations opened or closed.

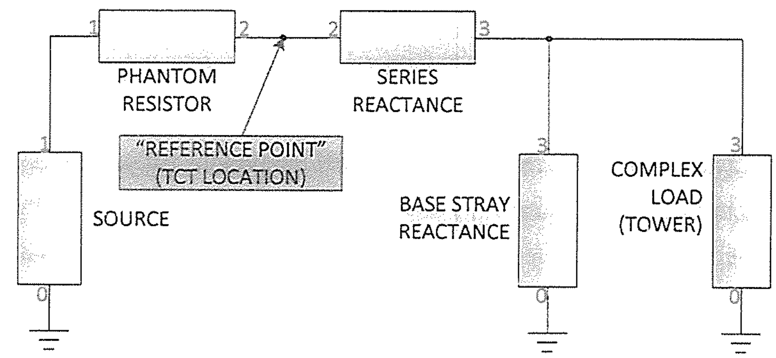
Tower Base Environment (Base Circuit Analysis) Calculations

Once the base impedance measurements were gathered, 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 measurement points ("Reference Points"). As is also shown on the following pages, 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. Given the sizes of the three tuning units surrounding at the tower bases and the interconnecting tubing, measured impedance data were taken for each station to account for the as-built conditions and all stray reactances, including the base insulators, fixed static drain chokes, slope correction reactance, miscellaneous strays from the tuning units (and for tower 3, dual STL line feeds and an STL isocoupler (with an isolated measured value of 4.8 pF). There are no shunt capacitances in excess of 250 pF. Measured series reactances (using a short circuit at the tower base) at 1580 kHz were less than 10 µH, except for that measured at tower three, which was 10.929 µH (108.5 ohms). 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 point in the circuit tabulations. 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 WJFK Tower Base Environment

Tower #	Measured Stray Series Inductance L_{2-3}	Measured 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	4.993 µH	+j 49.59 Ω	-j 503.65 Ω	60.356 +j 76.315 Ω	**82.20 +j 127.902 Ω**	**82.2 +j 127.9 Ω**
2	2.80 µH	+j 27.80 Ω	-j 503.65 Ω	59.018 +j 81.155 Ω	**82.26 +j 113.049 Ω**	**82.3 +j 113.0 Ω**
3	10.929 µH	+j 108.5 Ω	-j 719.51 Ω	57.992 +j 81.754 Ω	**73.21 +j 194.074 Ω**	**73.2 +j 194.1 Ω**
4	4.23 µH	+j 41.99 Ω	-j 503.65 Ω	54.538 +j 63.043 Ω	**70.19 +j 105.369 Ω**	**70.2 +j 105.4 Ω**

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 output jacks (with the other towers open circuited at their ATU output jacks) agree with each other to within +/- 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.

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

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz

NODE VOLTAGES

Node:	1	152.5804	∡	56.9566°	V
Node:	2	152.0374	∡	57.2725°	V
Node:	3	113.5463	∡	43.6212°	V

WCAP PART CURRENT IN CURRENT OUT

WCAP PART			**BRANCH VOLTAGE**				**BRANCH CURRENT**			
R	3→0	60.35600000	113.55	∡	43.621°	V	1.17	∡	-8.039°	A
C	3→0	0.00020000	113.55	∡	43.621°	V	0.23	∡	133.621°	A
L	2→3	4.99300000	49.57	∡	90.000°	V	1.00	∡	-0.000°	A
R	1→2	1.00000000	1.00	∡	0.000°	V	1.00	∡	0.000°	A

WCAP PART			**FROM IMPEDANCE**				**TO IMPEDANCE**			
R	**3→0**	**60.35600000**	**60.36**	**+**	**j**	**76.315**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.99300000	82.20	+	j	127.902	82.20	+	j	78.334
R	1→2	1.00000000	83.20	+	j	127.902	*82.20	+	j	127.902

(* - Calculated Z at TCT)

Measured Z at TCT: 82.2 +j 127.9 Ω

Difference: ***0.0 Ω*** ***0.002 Ω***

WCAP PART VSWR

WCAP INPUT DATA:

1.5800 0.00010000 1 (Frequency in MHz, Step)

R	**60.35600000**	**3**	**0**	**76.31500000**	**(MiniNEC Modeled Impedance)**
C	0.00020000	3	0		(Stray Shunt Capacitance)
L	4.99300000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz

NODE VOLTAGES

Node:	1	140.4025	∡	53.6276°	V
Node:	2	139.8117	∡	53.9576°	V
Node:	3	118.4701	∡	46.0223°	V

WCAP PART CURRENT IN CURRENT OUT

	WCAP PART		BRANCH VOLTAGE				BRANCH CURRENT			
R	3→0	59.01800000	118.47	∡	46.022°	V	1.18	∡	-7.952°	A
C	3→0	0.00020000	118.47	∡	46.022°	V	0.24	∡	136.022°	A
L	2→3	2.80000000	27.80	∡	90.000°	V	1.00	∡	-0.000°	A
R	1→2	1.00000000	1.00	∡	0.000°	V	1.00	∡	0.000°	A

	WCAP PART		FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**59.01800000**	**59.02**	**+**	**j**	**81.155**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	2.80000000	82.26	+	j	113.049	82.26	+	j	85.252
R	**1→2**	1.00000000	83.26	+	j	113.049	*82.26	+	j	**113.049**

(* - Calculated Z at TCT)

Measured Z at TCT: **82.3** **+j** **113.0**

Difference: ***0.04 Ω*** ***0.049 Ω***

WCAP PART VSWR

WCAP INPUT DATA:

1.5800 0.00010000 1 (Frequency in MHz, Step)

R	**59.01800000**	**3**	**0**	**81.15500000**	**(MiniNEC Modeled Impedance)**
C	0.00020000	3	0		(Stray Shunt Capacitance)
L	2.80000000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz

NODE VOLTAGES

Node:	1	207.7776	∡	69.0747°	V
Node:	2	207.4226	∡	69.3328°	V
Node:	3	112.6181	∡	49.4544°	V

WCAP PART　　CURRENT IN　　CURRENT OUT

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT			
R	3→0	57.99200000	112.62	∡	49.454°	V	1.12	∡	-5.196°	A
C	3→0	0.00014000	112.62	∡	49.454°	V	0.16	∡	139.454°	A
L	2→3	10.92900000	108.50	∡	90.000°	V	1.00	∡	0.000°	A
R	1→2	1.00000000	1.00	∡	0.000°	V	1.00	∡	0.000°	A

WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**57.99200000**	**57.99**	+	**j**	**81.754**	0.00	+	j	0.000
C	3→0	0.00014000	0.00	-	j	719.507	0.00	+	j	0.000
L	2→3	10.92900000	73.21	+	j	194.074	73.21	+	j	85.577
R	**1→2**	1.00000000	74.21	+	j	194.074	*73.21	+	j	**194.074**

(* - Calculated Z at TCT)

Measured Z at TCT: 73.2 +j 194.1

Difference: ***0.01 Ω*** ***0.026 Ω***

WCAP PART　　VSWR

WCAP INPUT DATA:

1.5800　0.00010000　1　(Frequency in MHz, Step)

R	**57.99200000**	**3**	**0**	**81.75400000**	**(MiniNEC Modeled Impedance)**
C	0.00014000	3	0		(Stray Shunt Inductance)
L	10.92900000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz

NODE VOLTAGES

Node:	1	127.1614	∡	55.9575°	V
Node:	2	126.6043	∡	56.3325°	V
Node:	3	94.5650	∡	42.0811°	V

WCAP PART CURRENT IN CURRENT OUT

WCAP PART			**BRANCH VOLTAGE**				**BRANCH CURRENT**			
R	3→0	54.53800000	94.57	∡	42.081°	V	1.13	∡	-7.056°	A
C	3→0	0.00020000	94.57	∡	42.081°	V	0.19	∡	132.081°	A
L	2→3	4.23000000	41.99	∡	90.000°	V	1.00	∡	0.000°	A
R	1→2	1.00000000	1.00	∡	0.000°	V	1.00	∡	0.000°	A

WCAP PART			**FROM IMPEDANCE**				**TO IMPEDANCE**			
R	**3→0**	**54.53800000**	**54.54**	**+**	**j**	**63.043**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.23000000	70.19	+	j	105.369	70.19	+	j	63.376
R	**1→2**	1.00000000	71.19	+	j	105.369	*70.19	+	j	**105.369**

(* - Calculated Z at TCT)

Measured Z at TCT: 70.2 +j 105.4

Difference: ***0.01 Ω*** ***0.031 Ω***

WCAP PART VSWR

WCAP INPUT DATA:

1.5800 0.00010000 1 (Frequency in MHz, Step)

R	**54.53800000**	**3**	**0**	**63.04300000**	**(MiniNEC Modeled Impedance)**
C	0.00020000	3	0		(Stray Shunt Capacitance)
L	4.23000000	2	3	0.00000000	(Stray Series Inductance)
R	1.00000000	1	2	0.00000000	("Phantom" Resistor)
I	1.00000000	0	1	0.00000000	

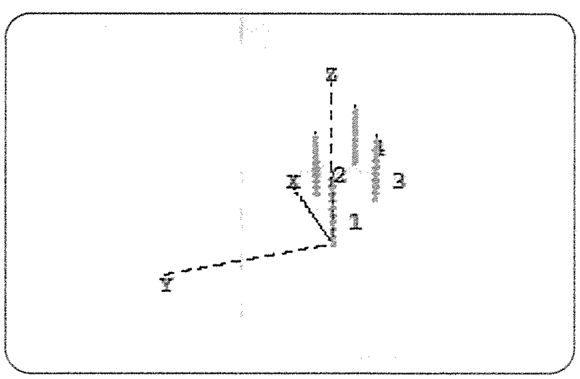
Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

Details of MoM "Open Circuit" Modeling - for 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.

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 WJFK 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.



Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

As with the prior MoM proof for this station, the horizontal plane geometry data used in this analysis were taken from the theoretical directional antenna specifications for WJFK as specified in the station's license. (While not required for a previously magnetically proofed array, an examination of an actual site survey done for the other triplex partners indicated that the as-built geometry is within the FCC's tolerances from the WJFK license.) For the purposes of the MoM analysis, 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 WJFK frequency, while azimuths were derived from the supplied bearings, and converted to degrees relative to True North with reference to WJFK 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 WJFK towers are "physically" 90 electrical degrees high at 1580 kHz, for the purposes of this analysis, these towers were modeled using 10 segments per tower. The segment lengths are thus 9 degrees for the physical model. Thus, 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 for the completed system and no error or warning messages were returned.

After the initial setup of antenna array information in the model, the individual WJFK 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 closely 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 WJFK array.

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 fell 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.

Tower	"Physical Height" (at 1580 kHz)	Modeled Height	Modeled % of Height (125% max)	Radiator Physical Equivalent Radius	Modeled Radius	Modeled % of Radius (80% min)
1 – S	90.0° electrical	99.63°	**110.7%**	0.2183 m	0.2183 m	**100.0%**
2 – W	90.0° electrical	100.64°	**111.6%**	0.2183 m	0.2183 m	**100.0%**
3 – E	90.0° electrical	100.75°	**111.9%**	0.2183 m	0.2183 m	**100.0%**
4 – N	90.0° electrical	97.24°	**108.0%**	0.2183 m	0.2183 m	**100.0%**

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 WJFK towers.

MoM Model Details for Towers Driven Individually

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

WJFK T1 Open Circuit-Self

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

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

WJFK T1 Open Circuit-Self

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

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	-503.65	0	0	0
3	21	0	-719.51	0	0	0
4	31	0	-503.65	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							
1.58	60.356	76.315	97.298	51.7	3.6948	-4.8219	-1.7358

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

WJFK T1 Open Circuit-Self

CURRENT rms Frequency = 1.58 MHz Input power = .00318775 watts
Efficiency = 100. % coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	7.27E-03	308.3	4.51E-03	-5.7E-03
2	0	0	9.963	7.71E-03	305.3	4.45E-03	-6.3E-03
3	0	0	19.926	7.78E-03	303.5	4.3E-03	-6.48E-03
4	0	0	29.889	7.58E-03	302.2	4.04E-03	-6.41E-03
5	0	0	39.852	7.13E-03	301.1	3.68E-03	-6.1E-03
6	0	0	49.815	6.44E-03	300.2	3.24E-03	-5.57E-03
7	0	0	59.778	5.55E-03	299.4	2.72E-03	-4.83E-03
8	0	0	69.741	4.46E-03	298.7	2.14E-03	-3.91E-03
9	0	0	79.704	3.2E-03	298.	1.5E-03	-2.82E-03
10	0	0	89.667	1.77E-03	297.4	8.14E-04	-1.57E-03
END	0	0	99.63	0	0	0	0
GND	147.721	-26.0472	0	5.1E-04	107.9	-1.56E-04	4.85E-04
12	147.721	-26.0472	10.064	7.46E-04	107.8	-2.29E-04	7.1E-04
13	147.721	-26.0472	20.128	8.7E-04	107.8	-2.66E-04	8.28E-04
14	147.721	-26.0472	30.192	9.33E-04	107.7	-2.84E-04	8.89E-04
15	147.721	-26.0472	40.256	9.43E-04	107.6	-2.85E-04	8.99E-04
16	147.721	-26.0472	50.32	9.02E-04	107.5	-2.71E-04	8.6E-04
17	147.721	-26.0472	60.384	8.14E-04	107.4	-2.43E-04	7.77E-04
18	147.721	-26.0472	70.448	6.8E-04	107.2	-2.02E-04	6.5E-04
19	147.721	-26.0472	80.512	5.05E-04	107.1	-1.48E-04	4.83E-04
20	147.721	-26.0472	90.576	2.87E-04	106.9	-8.35E-05	2.75E-04
END	147.721	-26.0472	100.64	0	0	0	0
GND	98.995	-98.9949	0	3.42E-04	119.4	-1.67E-04	2.98E-04
22	98.995	-98.9949	10.075	5.7E-04	119.3	-2.79E-04	4.97E-04
23	98.995	-98.9949	20.15	6.93E-04	119.3	-3.39E-04	6.05E-04
24	98.995	-98.9949	30.225	7.63E-04	119.2	-3.72E-04	6.66E-04
25	98.995	-98.9949	40.3	7.83E-04	119.1	-3.81E-04	6.84E-04
26	98.995	-98.9949	50.375	7.58E-04	119.	-3.67E-04	6.63E-04
27	98.995	-98.9949	60.45	6.9E-04	118.8	-3.33E-04	6.04E-04
28	98.995	-98.9949	70.525	5.81E-04	118.7	-2.79E-04	5.1E-04
29	98.995	-98.9949	80.6	4.34E-04	118.5	-2.07E-04	3.81E-04
30	98.995	-98.9949	90.675	2.48E-04	118.3	-1.18E-04	2.18E-04
END	98.995	-98.9949	100.75	0	0	0	0
GND	246.715	-125.057	0	3.54E-04	338.7	3.3E-04	-1.29E-04
32	246.715	-125.057	9.724	5.15E-04	338.7	4.8E-04	-1.87E-04
33	246.715	-125.057	19.448	5.99E-04	338.7	5.58E-04	-2.18E-04
34	246.715	-125.057	29.172	6.42E-04	338.6	5.98E-04	-2.34E-04
35	246.715	-125.057	38.896	6.5E-04	338.5	6.05E-04	-2.38E-04
36	246.715	-125.057	48.62	6.23E-04	338.4	5.79E-04	-2.29E-04
37	246.715	-125.057	58.344	5.63E-04	338.3	5.23E-04	-2.08E-04
38	246.715	-125.057	68.068	4.73E-04	338.2	4.39E-04	-1.75E-04
39	246.715	-125.057	77.792	3.52E-04	338.1	3.27E-04	-1.31E-04
40	246.715	-125.057	87.516	2.02E-04	337.9	1.87E-04	-7.58E-05
END	246.715	-125.057	97.24	0	0	0	0

WJFK Tower 2 (W) OC Self Summary - (Sheet 1 of 3)

WJFK T2 Open Circuit-Self

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

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

WJFK T2 Open Circuit-Self

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

Sources

source	node	sector	magnitude	phase	type
1	11	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-503.65	0	0	0
2	11	0	0	0	0	0
3	21	0	-719.51	0	0	0
4	31	0	-503.65	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							
1.58	59.018	81.155	100.35	54.	4.0101	-4.4253	-1.9448

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

WJFK T2 Open Circuit-Self

CURRENT rms Frequency = 1.58 MHz Input power = .00293062 watts
Efficiency = 100. % coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.88E-04	105.5	-1.3E-04	4.71E-04
2	0	0	9.963	7.13E-04	105.5	-1.9E-04	6.87E-04
3	0	0	19.926	8.31E-04	105.4	-2.21E-04	8.01E-04
4	0	0	29.889	8.91E-04	105.3	-2.36E-04	8.6E-04
5	0	0	39.852	9.E-04	105.3	-2.37E-04	8.69E-04
6	0	0	49.815	8.61E-04	105.2	-2.25E-04	8.31E-04
7	0	0	59.778	7.77E-04	105.	-2.02E-04	7.5E-04
8	0	0	69.741	6.5E-04	104.9	-1.67E-04	6.28E-04
9	0	0	79.704	4.82E-04	104.8	-1.23E-04	4.66E-04
10	0	0	89.667	2.75E-04	104.6	-6.93E-05	2.66E-04
END	0	0	99.63	0	0	0	0
GND	147.721	-26.0472	0	7.05E-03	306.	4.14E-03	-5.7E-03
12	147.721	-26.0472	10.064	7.51E-03	303.	4.1E-03	-6.3E-03
13	147.721	-26.0472	20.128	7.6E-03	301.3	3.95E-03	-6.49E-03
14	147.721	-26.0472	30.192	7.41E-03	300.	3.71E-03	-6.42E-03
15	147.721	-26.0472	40.256	6.98E-03	299.	3.38E-03	-6.11E-03
16	147.721	-26.0472	50.32	6.32E-03	298.1	2.97E-03	-5.57E-03
17	147.721	-26.0472	60.384	5.44E-03	297.3	2.5E-03	-4.84E-03
18	147.721	-26.0472	70.448	4.38E-03	296.6	1.96E-03	-3.91E-03
19	147.721	-26.0472	80.512	3.14E-03	296.	1.38E-03	-2.82E-03
20	147.721	-26.0472	90.576	1.73E-03	295.4	7.43E-04	-1.57E-03
END	147.721	-26.0472	100.64	0	0	0	0
GND	98.995	-98.9949	0	4.32E-04	175.5	-4.3E-04	3.4E-05
22	98.995	-98.9949	10.075	7.19E-04	175.5	-7.17E-04	5.63E-05
23	98.995	-98.9949	20.15	8.75E-04	175.6	-8.72E-04	6.78E-05
24	98.995	-98.9949	30.225	9.61E-04	175.6	-9.58E-04	7.33E-05
25	98.995	-98.9949	40.3	9.86E-04	175.7	-9.83E-04	7.36E-05
26	98.995	-98.9949	50.375	9.53E-04	175.8	-9.5E-04	6.93E-05
27	98.995	-98.9949	60.45	8.65E-04	176.	-8.63E-04	6.1E-05
28	98.995	-98.9949	70.525	7.27E-04	176.1	-7.26E-04	4.95E-05
29	98.995	-98.9949	80.6	5.42E-04	176.3	-5.4E-04	3.53E-05
30	98.995	-98.9949	90.675	3.09E-04	176.4	-3.09E-04	1.93E-05
END	98.995	-98.9949	100.75	0	0	0	0
GND	246.715	-125.057	0	4.71E-04	116.9	-2.13E-04	4.2E-04
32	246.715	-125.057	9.724	6.84E-04	116.8	-3.09E-04	6.1E-04
33	246.715	-125.057	19.448	7.95E-04	116.8	-3.58E-04	7.09E-04
34	246.715	-125.057	29.172	8.51E-04	116.7	-3.83E-04	7.6E-04
35	246.715	-125.057	38.896	8.59E-04	116.7	-3.86E-04	7.68E-04
36	246.715	-125.057	48.62	8.21E-04	116.6	-3.68E-04	7.35E-04
37	246.715	-125.057	58.344	7.41E-04	116.5	-3.3E-04	6.63E-04
38	246.715	-125.057	68.068	6.2E-04	116.4	-2.75E-04	5.55E-04
39	246.715	-125.057	77.792	4.6E-04	116.2	-2.03E-04	4.13E-04
40	246.715	-125.057	87.516	2.62E-04	116.1	-1.15E-04	2.36E-04
END	246.715	-125.057	97.24	0	0	0	0

WJFK Tower 3 (E) OC Self Summary - (Sheet 1 of 3)

WJFK T3 Open Circuit-Self

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

CAVELL MERTZ & Associates, Inc.

WJFK Tower 3 (E) OC Self Summary - (Sheet 2 of 3)

WJFK T3 Open Circuit-Self

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

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	-503.65	0	0	0
2	11	0	-503.65	0	0	0
3	21	0	0	0	0	0
4	31	0	-503.65	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							
1.58	57.992	81.754	100.23	54.7	4.0821	-4.3439	-1.9914

WJFK Tower 3 (E) OC Self Summary - (Sheet 3 of 3)

```
WJFK T3 Open Circuit-Self


CURRENT rms    Frequency    = 1.58 MHz    Input power = .0028861 watts
Efficiency    = 100. %    coordinates in degrees

current                                  mag       phase   real      imaginary
no.     X         Y          Z           (amps)    (deg)   (amps)    (amps)
GND     0         0          0           4.92E-04  113.5   -1.96E-04 4.51E-04
 2      0         0          9.963       7.19E-04  113.5   -2.87E-04 6.59E-04
 3      0         0          19.926      8.37E-04  113.5   -3.33E-04 7.68E-04
 4      0         0          29.889      8.98E-04  113.4   -3.56E-04 8.24E-04
 5      0         0          39.852      9.06E-04  113.3   -3.59E-04 8.32E-04
 6      0         0          49.815      8.67E-04  113.2   -3.42E-04 7.97E-04
 7      0         0          59.778      7.82E-04  113.1   -3.07E-04 7.19E-04
 8      0         0          69.741      6.53E-04  113.    -2.55E-04 6.01E-04
 9      0         0          79.704      4.85E-04  112.9   -1.88E-04 4.46E-04
 10     0         0          89.667      2.76E-04  112.7   -1.07E-04 2.54E-04
END     0         0          99.63       0         0       0         0
GND     147.721   -26.0472   0           6.48E-04  172.1   -6.42E-04 8.97E-05
 12     147.721   -26.0472   10.064      9.49E-04  172.1   -9.4E-04  1.31E-04
 13     147.721   -26.0472   20.128      1.11E-03  172.1   -1.09E-03 1.52E-04
 14     147.721   -26.0472   30.192      1.18E-03  172.2   -1.17E-03 1.62E-04
 15     147.721   -26.0472   40.256      1.2E-03   172.2   -1.18E-03 1.62E-04
 16     147.721   -26.0472   50.32       1.14E-03  172.3   -1.13E-03 1.53E-04
 17     147.721   -26.0472   60.384      1.03E-03  172.4   -1.02E-03 1.36E-04
 18     147.721   -26.0472   70.448      8.57E-04  172.5   -8.5E-04  1.11E-04
 19     147.721   -26.0472   80.512      6.34E-04  172.7   -6.29E-04 8.1E-05
 20     147.721   -26.0472   90.576      3.6E-04   172.8   -3.57E-04 4.51E-05
END     147.721   -26.0472   100.64      0         0       0         0
GND     98.995    -98.9949   0           7.05E-03  305.3   4.08E-03  -5.75E-03
 22     98.995    -98.9949   10.075      7.53E-03  302.4   4.03E-03  -6.35E-03
 23     98.995    -98.9949   20.15       7.61E-03  300.7   3.89E-03  -6.54E-03
 24     98.995    -98.9949   30.225      7.43E-03  299.5   3.65E-03  -6.47E-03
 25     98.995    -98.9949   40.3        7.E-03    298.4   3.33E-03  -6.15E-03
 26     98.995    -98.9949   50.375      6.33E-03  297.5   2.93E-03  -5.61E-03
 27     98.995    -98.9949   60.45       5.46E-03  296.8   2.46E-03  -4.87E-03
 28     98.995    -98.9949   70.525      4.39E-03  296.1   1.93E-03  -3.94E-03
 29     98.995    -98.9949   80.6        3.15E-03  295.5   1.35E-03  -2.84E-03
 30     98.995    -98.9949   90.675      1.74E-03  294.9   7.31E-04  -1.58E-03
END     98.995    -98.9949   100.75      0         0       0         0
GND     246.715   -125.057   0           4.49E-04  105.1   -1.17E-04 4.34E-04
 32     246.715   -125.057   9.724       6.53E-04  105.    -1.69E-04 6.3E-04
 33     246.715   -125.057   19.448      7.59E-04  105.    -1.96E-04 7.33E-04
 34     246.715   -125.057   29.172      8.13E-04  104.9   -2.09E-04 7.85E-04
 35     246.715   -125.057   38.896      8.2E-04   104.8   -2.1E-04  7.93E-04
 36     246.715   -125.057   48.62       7.85E-04  104.7   -2.E-04   7.59E-04
 37     246.715   -125.057   58.344      7.08E-04  104.6   -1.79E-04 6.85E-04
 38     246.715   -125.057   68.068      5.92E-04  104.5   -1.48E-04 5.73E-04
 39     246.715   -125.057   77.792      4.4E-04   104.4   -1.09E-04 4.26E-04
 40     246.715   -125.057   87.516      2.51E-04  104.2   -6.17E-05 2.44E-04
END     246.715   -125.057   97.24       0         0       0         0
```

WJFK Tower 4 (N) OC Self Summary - (Sheet 1 of 3)

WJFK T4 Open Circuit-Self

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

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

WJFK T4 Open Circuit-Self

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

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	-503.65	0	0	0
2	11	0	-503.65	0	0	0
3	21	0	-719.51	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 31, sector 1							
1.58	54.538	63.043	83.36	49.1	3.1473	-5.7175	-1.3553

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

WJFK T4 Open Circuit-Self

CURRENT rms Frequency = 1.58 MHz Input power = .00392429 watts
Efficiency = 100. % coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	4.25E-04	340.3	4.E-04	-1.44E-04
2	0	0	9.963	6.21E-04	340.2	5.85E-04	-2.1E-04
3	0	0	19.926	7.25E-04	340.2	6.82E-04	-2.46E-04
4	0	0	29.889	7.78E-04	340.1	7.32E-04	-2.65E-04
5	0	0	39.852	7.88E-04	340.1	7.41E-04	-2.69E-04
6	0	0	49.815	7.55E-04	340.	7.1E-04	-2.59E-04
7	0	0	59.778	6.83E-04	339.9	6.41E-04	-2.35E-04
8	0	0	69.741	5.73E-04	339.7	5.37E-04	-1.98E-04
9	0	0	79.704	4.26E-04	339.6	4.E-04	-1.48E-04
10	0	0	89.667	2.44E-04	339.5	2.28E-04	-8.55E-05
END	0	0	99.63	0	0	0	0
GND	147.721	-26.0472	0	5.9E-04	120.8	-3.02E-04	5.07E-04
12	147.721	-26.0472	10.064	8.63E-04	120.8	-4.42E-04	7.42E-04
13	147.721	-26.0472	20.128	1.01E-03	120.7	-5.14E-04	8.65E-04
14	147.721	-26.0472	30.192	1.08E-03	120.7	-5.51E-04	9.29E-04
15	147.721	-26.0472	40.256	1.09E-03	120.6	-5.55E-04	9.39E-04
16	147.721	-26.0472	50.32	1.04E-03	120.5	-5.29E-04	8.99E-04
17	147.721	-26.0472	60.384	9.4E-04	120.4	-4.75E-04	8.11E-04
18	147.721	-26.0472	70.448	7.85E-04	120.2	-3.95E-04	6.79E-04
19	147.721	-26.0472	80.512	5.82E-04	120.1	-2.92E-04	5.04E-04
20	147.721	-26.0472	90.576	3.31E-04	119.9	-1.65E-04	2.87E-04
END	147.721	-26.0472	100.64	0	0	0	0
GND	98.995	-98.9949	0	3.75E-04	112.4	-1.43E-04	3.46E-04
22	98.995	-98.9949	10.075	6.25E-04	112.4	-2.38E-04	5.77E-04
23	98.995	-98.9949	20.15	7.6E-04	112.3	-2.89E-04	7.03E-04
24	98.995	-98.9949	30.225	8.37E-04	112.2	-3.16E-04	7.74E-04
25	98.995	-98.9949	40.3	8.59E-04	112.1	-3.24E-04	7.96E-04
26	98.995	-98.9949	50.375	8.32E-04	112.	-3.12E-04	7.72E-04
27	98.995	-98.9949	60.45	7.58E-04	111.8	-2.82E-04	7.03E-04
28	98.995	-98.9949	70.525	6.38E-04	111.7	-2.36E-04	5.93E-04
29	98.995	-98.9949	80.6	4.77E-04	111.5	-1.75E-04	4.44E-04
30	98.995	-98.9949	90.675	2.73E-04	111.3	-9.9E-05	2.54E-04
END	98.995	-98.9949	100.75	0	0	0	0
GND	246.715	-125.057	0	8.48E-03	310.9	5.55E-03	-6.42E-03
32	246.715	-125.057	9.724	8.89E-03	308.1	5.48E-03	-6.99E-03
33	246.715	-125.057	19.448	8.9E-03	306.5	5.29E-03	-7.15E-03
34	246.715	-125.057	29.172	8.62E-03	305.3	4.98E-03	-7.03E-03
35	246.715	-125.057	38.896	8.07E-03	304.3	4.54E-03	-6.67E-03
36	246.715	-125.057	48.62	7.27E-03	303.4	4.E-03	-6.07E-03
37	246.715	-125.057	58.344	6.25E-03	302.6	3.37E-03	-5.26E-03
38	246.715	-125.057	68.068	5.02E-03	302.	2.66E-03	-4.26E-03
39	246.715	-125.057	77.792	3.59E-03	301.4	1.87E-03	-3.07E-03
40	246.715	-125.057	87.516	1.98E-03	300.8	1.02E-03	-1.71E-03
END	246.715	-125.057	97.24	0	0	0	0

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 WJFK theoretical pattern antenna field ratio magnitudes and phases set forth in the station's license, 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:

Tower	Wire	Base Node
1 (S)	1	1
2 (W)	2	11
3 (E)	3	21
4 (N)	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.

MoM Model Details – Daytime Pattern

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

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.58 MHz

Tower	Field Ratio Magnitude	Phase (deg)
1	1	0
2	2.618	30.
3	1.451	60.
4	3.798	90.

VOLTAGES AND CURRENTS - rms

Source Node	Voltage Magnitude	Current Phase (deg)	Current Magnitude	Phase (deg)
1	600.891	334.4	6.75983	9.8
11	1,665.71	59.1	14.3669	42.8
21	891.821	36.9	9.65624	70.7
31	1,182.54	143.6	21.6303	94

Sum of square of source currents = 1,626.43
Total power = 50,000. watts

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

TOWER ADMITTANCE MATRIX			TOWER IMPEDANCE MATRIX		
Admittance	Real (mhos)	Imaginary (mhos)	Impedance	Real (ohms)	Imaginary (ohms)
Y(1, 1)	0.008085	-0.0067	Z(1, 1)	59.9148	72.8298
Y(1, 2)	0.002857	0.000467	Z(1, 2)	-5.98039	-29.6316
Y(1, 3)	0.003174	0.000845	Z(1, 3)	-1.018	-31.3787
Y(1, 4)	-0.00025	-0.00028	Z(1, 4)	-14.4678	14.0874
Y(2, 1)	0.002857	0.000467	Z(2, 1)	-5.97994	-29.6317
Y(2, 2)	0.006082	-0.00505	Z(2, 2)	60.0083	77.7793
Y(2, 3)	0.003601	0.00379	Z(2, 3)	30.7426	-26.5482
Y(2, 4)	0.003414	0.001197	Z(2, 4)	-0.61572	-29.9916
Y(3, 1)	0.003174	0.000845	Z(3, 1)	-1.01751	-31.3787
Y(3, 2)	0.003601	0.00379	Z(3, 2)	30.7428	-26.5482
Y(3, 3)	0.006057	-0.00505	Z(3, 3)	60.2366	78.4251
Y(3, 4)	0.003066	0.000743	Z(3, 4)	-5.3754	-28.4925
Y(4, 1)	-0.00025	-0.00028	Z(4, 1)	-14.4676	14.0877
Y(4, 2)	0.003414	0.001197	Z(4, 2)	-0.61727	-29.9914
Y(4, 3)	0.003066	0.000743	Z(4, 3)	-5.37668	-28.4922
Y(4, 4)	0.009741	-0.0071	Z(4, 4)	54.4873	59.6185

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

WJFK DA-Day - MoM

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

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

WJFK DA-Day - MoM

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

Sources

source	node	sector	magnitude	phase	type
1	1	1	849.789	334.4	voltage
2	11	1	2,355.68	59.1	voltage
3	21	1	1,261.23	36.9	voltage
4	31	1	1,672.36	143.6	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							
1.58	72.488	-51.501	88.921	324.6	2.4658	-7.4747	-.85587
source = 2; node 11, sector 1							
1.58	111.22	32.517	115.88	16.3	2.4572	-7.5042	-.84947
source = 3; node 21, sector 1							
1.58	76.761	-51.432	92.399	326.2	2.4711	-7.4564	-.85987
source = 4; node 31, sector 1							
1.58	35.406	41.649	54.664	49.6	2.7345	-6.6612	-1.0552

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

WJFK DA-Day - MoM

CURRENT rms
Frequency = 1.58 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	6.75679	9.8	6.65834	1.14921
2	0	0	9.963		6.36731	5.7	6.33613	.629369
3	0	0	19.926		5.96644	2.8	5.95907	.296347
4	0	0	29.889		5.4813	.4	5.48114	.0420862
5	0	0	39.852		4.90828	358.3	4.90615	-.144823
6	0	0	49.815		4.25304	356.4	4.24457	-.268346
7	0	0	59.778		3.52557	354.6	3.51001	-.330896
8	0	0	69.741		2.73774	353.	2.71717	-.334974
9	0	0	79.704		1.90056	351.4	1.87933	-.283312
10	0	0	89.667		1.01758	349.9	1.00195	-.177655
END	0	0	99.63		0	0	0	0
GND	147.721	-26.0472	0	T2	14.3728	42.8	10.5452	9.76608
12	147.721	-26.0472	10.064		14.7216	36.9	11.7686	8.84462
13	147.721	-26.0472	20.128		14.5951	33.4	12.1867	8.03119
14	147.721	-26.0472	30.192		14.0569	30.6	12.0953	7.16241
15	147.721	-26.0472	40.256		13.1167	28.4	11.5414	6.2325
16	147.721	-26.0472	50.32		11.792	26.4	10.5582	5.25134
17	147.721	-26.0472	60.384		10.1085	24.8	9.17876	4.23454
18	147.721	-26.0472	70.448		8.09746	23.3	7.43871	3.19913
19	147.721	-26.0472	80.512		5.78832	21.9	5.37012	2.1602
20	147.721	-26.0472	90.576		3.18768	20.6	2.98293	1.12402
END	147.721	-26.0472	100.64		0	0	0	0
GND	98.995	-98.9949	0	T3	9.65075	70.7	3.18601	9.10968
22	98.995	-98.9949	10.075		9.09603	66.3	3.65398	8.32984
23	98.995	-98.9949	20.15		8.53071	63.3	3.83843	7.61836
24	98.995	-98.9949	30.225		7.84851	60.6	3.84951	6.83962
25	98.995	-98.9949	40.3		7.04243	58.3	3.70363	5.9899
26	98.995	-98.9949	50.375		6.11838	56.1	3.4115	5.07899
27	98.995	-98.9949	60.45		5.0882	54.1	2.98357	4.12166
28	98.995	-98.9949	70.525		3.96626	52.2	2.43082	3.13407
29	98.995	-98.9949	80.6		2.76551	50.4	1.76325	2.1305
30	98.995	-98.9949	90.675		1.48798	48.6	.983664	1.11646
END	98.995	-98.9949	100.75		0	0	0	0

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

WJFK DA-Day - MoM

current no.	X	Y	Z		mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	246.715	-125.057	0	T4	21.6301	94.	-1.49675	21.5783
32	246.715	-125.057	9.724		22.2206	92.1	-.832001	22.205
33	246.715	-125.057	19.448		21.9734	91.	-.402232	21.9697
34	246.715	-125.057	29.172		21.0797	90.2	-.0687526	21.0796
35	246.715	-125.057	38.896		19.5848	89.5	.181912	19.584
36	246.715	-125.057	48.62		17.5324	88.8	.353113	17.5288
37	246.715	-125.057	58.344		14.9709	88.3	.445661	14.9642
38	246.715	-125.057	68.068		11.9519	87.8	.460021	11.9431
39	246.715	-125.057	77.792		8.52035	87.3	.396534	8.51112
40	246.715	-125.057	87.516		4.68433	86.9	.253687	4.67745
END	246.715	-125.057	97.24		0	0	0	0

Current Moment Run and Analysis

CURRENT MOMENTS(amp-degrees) rms

Frequency = 1.58 MHz Input power = 50,000. watts

vertical current moment

Wire	Magnitude	Phase (deg)	Magnitude	Phase (deg)
1	292.337	0	292.337	0
2	766.012	30	766.012	30
3	424.057	60	424.057	60
4	1,110.81	90	1,110.81	90

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	292.337	0
2	766.012	30
3	424.057	60
4	1,110.81	90

Above Normalized and Converted

Tower	Ratio	Phase
1	1.000	0°
2	2.620	30°
3	1.451	60°
4	3.800	90°

License Theoretical Field Data

Tower	Ratio	Phase
1	1.000	0.0°
2	2.618	30.0°
3	1.451	60.0°
4	3.798	90.0°

MoM Model Details – Nighttime Pattern

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

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.58 MHz

Tower	Field Ratio Magnitude	Phase (deg)
1	1	0
2	0.84	59.4
3	0.925	132
4	1.002	191.6

VOLTAGES AND CURRENTS - rms

Source Node	Voltage Magnitude	Current Phase (deg)	Current Magnitude	Phase (deg)
1	136.153	39.2	1.03767	12.8
11	119.189	116.3	0.790261	69.7
21	64.6193	181.1	0.993037	137.4
31	61.4424	256.2	1.10892	194.5

Sum of square of source currents = 7.8342
Total power = 270. watts

Nighttime Directional Antenna Array Synthesis - (Sheet 2 of 6)

TOWER ADMITTANCE MATRIX			TOWER IMPEDANCE MATRIX		
Admittance	Real (mhos)	Imaginary (mhos)	Impedance	Real (ohms)	Imaginary (ohms)
Y(1, 1)	0.008085	-0.0067	Z(1, 1)	59.9148	72.8298
Y(1, 2)	0.002857	0.000467	Z(1, 2)	-5.98039	-29.6316
Y(1, 3)	0.003174	0.000845	Z(1, 3)	-1.018	-31.3787
Y(1, 4)	-0.00025	-0.00028	Z(1, 4)	-14.4678	14.0874
Y(2, 1)	0.002857	0.000467	Z(2, 1)	-5.97994	-29.6317
Y(2, 2)	0.006082	-0.00505	Z(2, 2)	60.0083	77.7793
Y(2, 3)	0.003601	0.00379	Z(2, 3)	30.7426	-26.5482
Y(2, 4)	0.003414	0.001197	Z(2, 4)	-0.61572	-29.9916
Y(3, 1)	0.003174	0.000845	Z(3, 1)	-1.01751	-31.3787
Y(3, 2)	0.003601	0.00379	Z(3, 2)	30.7428	-26.5482
Y(3, 3)	0.006057	-0.00505	Z(3, 3)	60.2366	78.4251
Y(3, 4)	0.003066	0.000743	Z(3, 4)	-5.3754	-28.4925
Y(4, 1)	-0.00025	-0.00028	Z(4, 1)	-14.4676	14.0877
Y(4, 2)	0.003414	0.001197	Z(4, 2)	-0.61727	-29.9914
Y(4, 3)	0.003066	0.000743	Z(4, 3)	-5.37668	-28.4922
Y(4, 4)	0.009741	-0.0071	Z(4, 4)	54.4873	59.6185

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

WJFK DA-Night - MoM

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2183	10
		0	0	99.63		
2	none	150.	10.	0	.2183	10
		150.	10.	100.64		
3	none	140.	45.	0	.2183	10
		140.	45.	100.75		
4	none	276.6	26.88	0	.2183	10
		276.6	26.88	97.24		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.724	3	10.075
radius	1	.2183	1	.2183

Nighttime Directional Antenna Array Synthesis - (Sheet 4 of 6)

WJFK DA-Night - MoM

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.58	0	1	.0270111	.0279861

Sources

source	node	sector	magnitude	phase	type
1	1	1	192.55	39.2	voltage
2	11	1	168.559	116.3	voltage
3	21	1	91.3855	181.1	voltage
4	31	1	86.8926	256.2	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							
1.58	117.53	58.391	131.23	26.4	3.0257	-5.9654	-1.2679
source = 2; node 11, sector 1							
1.58	103.71	109.51	150.82	46.6	4.6542	-3.7915	-2.3484
source = 3; node 21, sector 1							
1.58	47.069	44.948	65.083	43.7	2.4547	-7.5127	-.84764
source = 4; node 31, sector 1							
1.58	26.282	48.771	55.401	61.7	3.9873	-4.4517	-1.93

Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

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

WJFK DA-Night - MoM

CURRENT rms
Frequency = 1.58 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	1.0375	12.8	1.0118	.229511
2	0	0	9.963		1.08797	6.8	1.08043	.127892
3	0	0	19.926		1.09361	3.2	1.09186	.0619195
4	0	0	29.889		1.06428	.6	1.06423	.0106818
5	0	0	39.852		1.00131	358.4	1.00092	-.0278302
6	0	0	49.815		.906301	356.6	.904685	-.0541054
7	0	0	59.778		.781376	355.	.778388	-.0682694
8	0	0	69.741		.629061	353.6	.625107	-.0704149
9	0	0	79.704		.451703	352.3	.447616	-.0606295
10	0	0	89.667		.249832	351.1	.246812	-.0387265
END	0	0	99.63		0	0	0	0
GND	147.721	-26.0472	0	T2	.790262	69.7	.273649	.74137
12	147.721	-26.0472	10.064		.866034	64.6	.371189	.782453
13	147.721	-26.0472	20.128		.891098	61.8	.420501	.785642
14	147.721	-26.0472	30.192		.881685	59.8	.443263	.762159
15	147.721	-26.0472	40.256		.840065	58.2	.442271	.714217
16	147.721	-26.0472	50.32		.76806	56.9	.419039	.643679
17	147.721	-26.0472	60.384		.66772	55.8	.37492	.552526
18	147.721	-26.0472	70.448		.541352	54.9	.311335	.442868
19	147.721	-26.0472	80.512		.391083	54.1	.229583	.316603
20	147.721	-26.0472	90.576		.217442	53.3	.129996	.174305
END	147.721	-26.0472	100.64		0	0	0	0
GND	98.995	-98.9949	0	T3	.99288	137.4	-.731096	.671796
22	98.995	-98.9949	10.075		1.02425	134.9	-.723586	.724916
23	98.995	-98.9949	20.15		1.01553	133.5	-.698451	.737198
24	98.995	-98.9949	30.225		.976022	132.3	-.656588	.722158
25	98.995	-98.9949	40.3		.907876	131.3	-.59908	.68216
26	98.995	-98.9949	50.375		.813183	130.4	-.527358	.619
27	98.995	-98.9949	60.45		.694337	129.7	-.443127	.53455
28	98.995	-98.9949	70.525		.553937	129.	-.348228	.430794
29	98.995	-98.9949	80.6		.394335	128.3	-.244334	.309517
30	98.995	-98.9949	90.675		.216251	127.7	-.1321	.171213
END	98.995	-98.9949	100.75		0	0	0	0

Nighttime Directional Antenna Array Synthesis - (Sheet 6 of 6)

WJFK DA-Night - MoM

current no.	X	Y	Z		mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	246.715	-125.057	0	T4	1.10905	194.5	-1.07363	-.278052
32	246.715	-125.057	9.724		1.14631	193.2	-1.11614	-.261261
33	246.715	-125.057	19.448		1.13737	192.4	-1.11097	-.24364
34	246.715	-125.057	29.172		1.09378	191.7	-1.07091	-.222505
35	246.715	-125.057	38.896		1.01812	191.2	-.998695	-.197922
36	246.715	-125.057	48.62		.912767	190.8	-.896744	-.170279
37	246.715	-125.057	58.344		.780327	190.3	-.767647	-.140106
38	246.715	-125.057	68.068		.623565	190.	-.614146	-.107974
39	246.715	-125.057	77.792		.444873	189.6	-.43861	-.0743866
40	246.715	-125.057	87.516		.244736	189.3	-.241522	-.0395344
END	246.715	-125.057	97.24		0	0	0	0

Current Moment Run and Analysis

CURRENT MOMENTS(amp-degrees) rms

Frequency = 1.58 MHz Input power = 270. watts

vertical current moment

Wire	Magnitude	Phase (deg)	Magnitude	Phase (deg)
1	57.5243	360	57.5243	360
2	48.326	59.4	48.326	59.4
3	53.2078	132	53.2078	132
4	57.6531	191.6	57.6531	191.6

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	57.5243	360
2	48.326	59.4
3	53.2078	132
4	57.6531	191.6

Above Normalized and Converted

Tower	Ratio	Phase
1	1.000	0.0°
2	0.840	59.4°
3	0.925	132°
4	1.002	191.6°

License Theoretical Field Data

Tower	Ratio	Phase
1	1.000	0.0°
2	0.840	59.4°
3	0.925	132.0°
4	1.002	191.6°

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

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[4] were run to develop the current magnitude and phase information that will be present at the ATU reference point where the toroidal current transformer (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

Tower	Modeled Current Pulse	Modeled Current Magnitude at Toroid	Modeled Current Phase at Toroid	Modeled Antenna Monitor Ratio	Modeled Antenna Monitor Phase
1 (S)	1	7.51639 A	17.239°	**0.544**	**-38.8°**
2 (W)$_{ref}$	11	13.81098 A	56.082°	**1.000**	**0.0°**
3 (E)	21	10.39349 A	76.386°	**0.753**	**20.3°**
4 (N)	31	19.90013 A	98.382°	**1.441**	**42.3°**

Nighttime Directional Antenna Monitor Operating Parameters

Tower	Modeled Current Pulse	Modeled Current Magnitude at Toroid	Modeled Current Phase at Toroid	Modeled Antenna Monitor Ratio	Modeled Antenna Monitor Phase
1 (S)$_{ref}$	1	0.95053 A	27.586°	**1.000**	**0.0°**
2 (W)	11	0.63675 A	84.442°	**0.670**	**56.9°**
3 (E)	21	0.93186 A	141.391°	**0.980**	**113.8°**
4 (N)	31	1.00233 A	197.807°	**1.054**	**170.2°**

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.

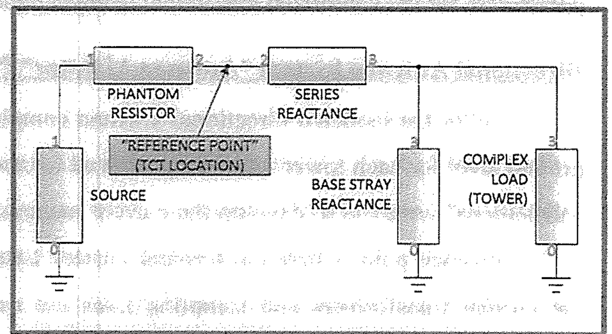
[4] **The circuit analysis undertaken for each tower used to develop the above tabulations is documented in the following pages.** For this analysis, the same WCAP schematic diagrams and node nomenclature are employed as were described previously for the "OC-self" analysis work. As was done previously, 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_{3-0}).

Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

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

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	449.9047	∡	12.6247°	V
Node:	2	442.4131	∡	12.5464°	V
Node:	3	601.2548	∡	-25.5930°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	72.48800000	601.25	∡	-25.593°	V	**6.76**	**∡**	**9.800°**	**A**	*
C	3→0	0.00020000	601.25	∡	-25.593°	V	1.19	∡	64.407°	A	
L	2→3	4.99300000	372.57	∡	107.239°	V	7.52	∡	17.239°	A	
R	**1→2**	1.00000000	7.52	∡	17.239°	V	**7.52**	**∡**	**17.239°**	**A**	**

*** Modeled Current at Tower (rounded)**
**** Modeled Current at TCT (rounded)**

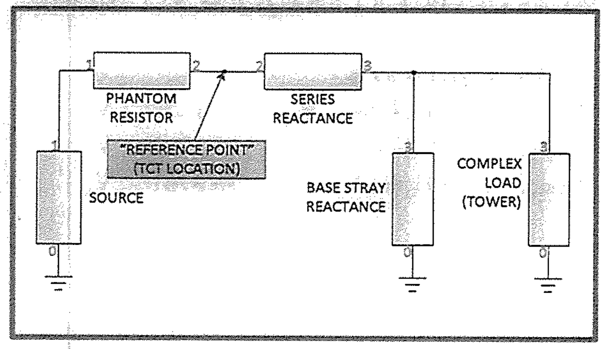
WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**72.48800000**	**72.49**	-	j	**51.501**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.99300000	58.66	-	j	4.815	58.66	-	j	54.383
R	1→2	1.00000000	59.66	-	j	4.815	58.66	-	j	4.815

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**72.48800000**	**3**	**0**	**-51.50100000**	**(Modeled MiniNEC Base Impedance , R & X Ω)**
C	0.00020000	3	0		**(Stray Shunt Capacitance, μF)**
L	4.99300000	2	3	0.00000000	**(Stray Series Inductance, μH)**
R	1.00000000	1	2	0.00000000	**(Phantom Resistor, Ω)**
I	7.51639000	0	1	17.23900000	**(Modeled Current Magnitude and Phase at TCT)**

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	1741.5862	∡	71.7887°	V
Node:	2	1728.2950	∡	71.9126°	V
Node:	3	1665.0491	∡	59.0967°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	111.22000000	1665.05	∡	59.097°	V	**14.37**	∡	**42.800°**	**A**	*
C	3→0	0.00020000	1665.05	∡	59.097°	V	3.31	∡	149.097°	A	
L	2→3	2.80000000	383.90	∡	146.082°	V	13.81	∡	56.082°	A	
R	**1→2**	1.00000000	13.81	∡	56.082°	V	**13.81**	∡	**56.082°**	**A**	**

*** Modeled Current at Tower (rounded)**
**** Modeled Current at TCT (rounded)**

WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**111.22000000**	**111.22**	**+**	**j**	**32.517**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	2.80000000	120.39	+	j	34.137	120.39	+	j	6.340
R	1→2	1.00000000	121.39	+	j	34.137	120.39	+	j	34.137

WCAP INPUT DATA:

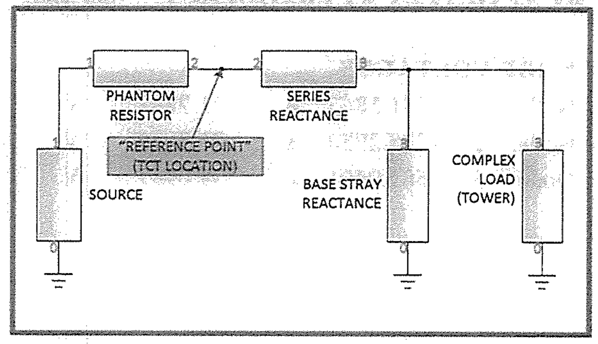
1.5800 0.00010000 1

R	**111.22000000**	**3**	**0**	**32.51700000**	**(Modeled MiniNEC Base Impedance , R & X Ω)**
C	0.00020000	3	0		**(Stray Shunt Capacitance, μF)**
L	2.80000000	2	3	0.00000000	**(Stray Series Inductance, μH)**
R	1.00000000	1	2	0.00000000	**(Phantom Resistor, Ω)**
I	**13.81098000**	**0**	**1**	**56.08200000**	**(Modeled Current Magnitude and Phase at TCT)**

Statement E
Method of Moments Proof-of-Performance
WJFK Morningside, Maryland

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	895.4154	∡	115.1189°	V
Node:	2	887.3315	∡	115.5389°	V
Node:	3	891.8661	∡	36.8767°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	76.76100000	891.87	∡	36.877°	V	**9.65**	**∡**	**70.700°**	**A**	*
C	3→0	0.00014000	891.87	∡	36.877°	V	1.24	∡	126.877°	A	
L	2→3	10.92900000	1127.66	∡	166.386°	V	10.39	∡	76.386°	A	
R	**1→2**	1.00000000	10.39	∡	76.386°	V	**10.39**	**∡**	**76.386°**	**A**	**

* Modeled Current at Tower (rounded)

** Modeled Current at TCT (rounded)

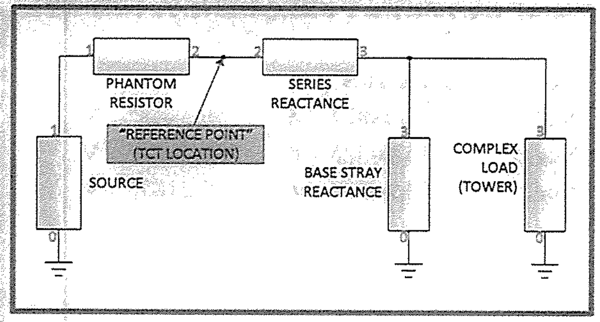
WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**76.76100000**	**76.76**	**-**	**j**	**51.432**	0.00	+	j	0.000
C	3→0	0.00014000	0.00	-	j	719.507	0.00	+	j	0.000
L	2→3	10.92900000	66.20	+	j	53.904	66.20	-	j	54.593
R	1→2	1.00000000	67.20	+	j	53.904	66.20	+	j	53.904

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**76.76100000**	**3**	**0**	**-51.43200000**	(Modeled MiniNEC Base Impedance , R & X Ω)
C	0.00014000	3	0		(Stray Shunt Inductance, μH)
L	10.92900000	2	3	0.00000000	(Stray Series Inductance, μH)
R	1.00000000	1	2	0.00000000	(Phantom Resistor, Ω)
I	10.39349000	0	1	76.38600000	(Modeled Current Magnitude and Phase at TCT)

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

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node: 1	1879.7615	∡	161.4175°	V
Node: 2	1870.8221	∡	161.9607°	V
Node: 3	1182.4328	∡	143.6317°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	35.40600000	1182.43	∡	143.632°	V	**21.63**	∡	**94.000°**	**A**	*
C	3→0	0.00020000	1182.43	∡	143.632°	V	2.35	∡	-126.368°	A	
L	2→3	4.23000000	835.67	∡	-171.618°	V	19.90	∡	98.382°	A	
R	**1→2**	1.00000000	19.90	∡	98.382°	V	**19.90**	∡	**98.382°**	**A**	**

* Modeled Current at Tower (rounded)
** Modeled Current at TCT (rounded)

WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**35.40600000**	**35.41**	**+**	**j**	**41.649**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.23000000	41.83	+	j	84.191	41.83	+	j	42.198
R	1→2	1.00000000	42.83	+	j	84.191	41.83	+	j	84.191

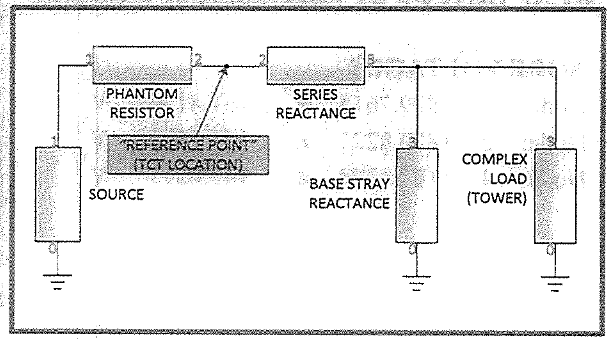
WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**35.40600000**	**3**	**0**	**41.64900000**	**(Modeled MiniNEC Base Impedance , R & X Ω)**
C	0.00020000	3	0		**(Stray Shunt Capacitance, µF)**
L	4.23000000	2	3	0.00000000	**(Stray Series Inductance, µH)**
R	1.00000000	1	2	0.00000000	**(Phantom Resistor, Ω)**
I	**19.90013000**	**0**	**1**	**98.38200000**	**(Modeled Current Magnitude and Phase at TCT)**

Circuit Analysis Used for Each Tower to Develop *Nighttime* Antenna Monitor Parameters

WCAP Directional Antenna Base Circuit Analysis – WJFK Tower 1 (S) - Night

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	153.8831	∡	56.5948°	V
Node:	2	153.0525	∡	56.7674°	V
Node:	3	136.4294	∡	39.2187°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	117.53000000	136.43	∡	39.219°	V	**1.04**	∡	**12.800°**	**A**	*
C	3→0	0.00020000	136.43	∡	39.219°	V	0.27	∡	129.219°	A	
L	2→3	4.99300000	47.12	∡	117.586°	V	0.95	∡	27.586°	A	
R	**1→2**	1.00000000	0.95	∡	27.586°	V	**0.95**	∡	**27.586°**	**A**	**

* Modeled Current at Tower (rounded)
** Modeled Current at TCT (rounded)

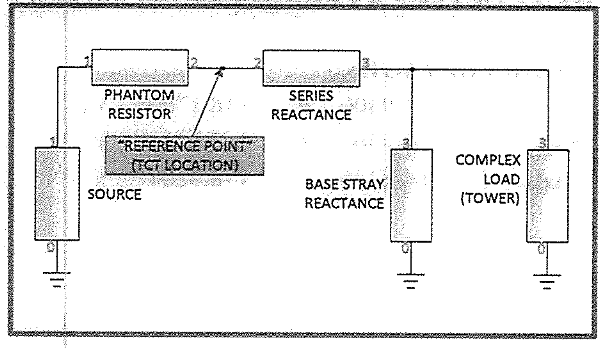
WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**117.53000000**	**117.53**	**+**	**j**	**58.391**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.99300000	140.58	+	j	78.509	140.58	+	j	28.941
R	1→2	1.00000000	141.58	+	j	78.509	140.58	+	j	78.509

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**117.53000000**	**3**	**0**	**58.39100000**	(Modeled MiniNEC Base Impedance , R & X Ω)
C	0.00020000	3	0		(Stray Shunt Capacitance, µF)
L	4.99300000	2	3	0.00000000	(Stray Series Inductance, µH)
R	1.00000000	1	2	0.00000000	(Phantom Resistor, Ω)
I	0.95053000	0	1	27.58600000	(Modeled Current Magnitude and Phase at TCT)

WCAP Directional Antenna Base Circuit Analysis – WJFK Tower 2 (W) - Night

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	129.3920	∡	122.7836°	V
Node:	2	128.8932	∡	122.9592°	V
Node:	3	118.6815	∡	116.2583°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	103.71000000	118.68	∡	116.258°	V	**0.79**	**∡**	**69.700°**	**A**	*
C	3→0	0.00020000	118.68	∡	116.258°	V	0.24	∡	-153.742°	A	
L	2→3	2.80000000	17.70	∡	174.442°	V	0.64	∡	84.442°	A	
R	**1→2**	1.00000000	0.64	∡	84.442°	V	**0.64**	**∡**	**84.442°**	**A**	**

* Modeled Current at Tower (rounded)
** Modeled Current at TCT (rounded)

WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**103.71000000**	**103.71**	**+**	**j**	**109.510**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	2.80000000	158.38	+	j	126.059	158.38	+	j	98.262
R	1→2	1.00000000	159.38	+	j	126.059	158.38	+	j	126.059

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**103.71000000**	**3**	**0**	**109.51000000**	(Modeled MiniNEC Base Impedance , R & X Ω)
C	0.00020000	3	0		(Stray Shunt Capacitance, μF)
L	2.80000000	2	3	0.00000000	(Stray Series Inductance, μH)
R	1.00000000	1	2	0.00000000	(Phantom Resistor, Ω)
I	0.63675000	0	1	84.44200000	(Modeled Current Magnitude and Phase at TCT)

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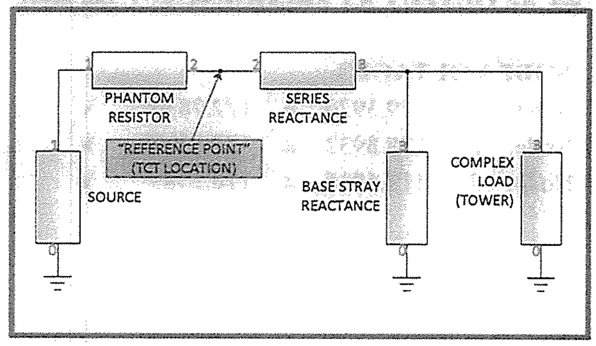
WCAP Directional Antenna Base Circuit Analysis – WJFK Tower 3 (E) - Night

WCAP OUTPUT AT FREQUENCY: 1.580 MHz

NODE VOLTAGES

Node: 1	151.0400	∡ -148.1789°	V
Node: 2	150.7304	∡ -147.8451°	V
Node: 3	64.5326	∡ -178.9209°	V



WCAP PART			BRANCH VOLTAGE			BRANCH CURRENT			
R	**3→0**	47.06900000	64.53	∡ -178.921°	V	**0.99**	**∡ 137.400°**	**A**	*
C	3→0	0.00014000	64.53	∡ -178.921°	V	0.09	∡ -88.921°	A	
L	2→3	10.92900000	101.10	∡ -128.609°	V	0.93	∡ 141.391°	A	
R	**1→2**	1.00000000	0.930	∡ 141.391°	V	**0.93**	**∡ 141.391°**	**A**	**

*** Modeled Current at Tower (rounded)**
**** Modeled Current at TCT (rounded)**

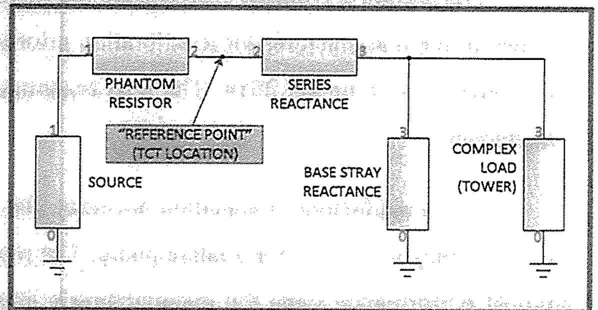
WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	**3→0**	**47.06900000**	**47.07 + j 44.948**	0.00 + j 0.000
C	3→0	0.00014000	0.00 - j 719.507	0.00 + j 0.000
L	2→3	10.92900000	53.29 + j 152.721	53.29 + j 44.225
R	1→2	1.00000000	54.29 + j 152.721	53.29 + j 152.721

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**47.06900000**	**3**	**0**	**44.94800000**	**(Modeled MiniNEC Base Impedance , R & X Ω)**
C	0.00014000	3	0		**(Stray Shunt Inductance, μH)**
L	10.92900000	2	3	0.00000000	**(Stray Series Inductance, μH)**
R	1.00000000	1	2	0.00000000	**(Phantom Resistor, Ω)**
I	0.93186000	0	1	141.39100000	(Modeled Current Magnitude and Phase at TCT)

WCAP Directional Antenna Base Circuit Analysis – WJFK Tower 4 (N) - Night

WCAP OUTPUT AT FREQUENCY: 1.580 MHz



NODE VOLTAGES

Node:	1	100.0241	∡	-91.5722°	V
Node:	2	99.696	∡	-91.0287°	V
Node:	3	61.3823	∡	-103.8193°	V

WCAP PART			BRANCH VOLTAGE				BRANCH CURRENT				
R	**3→0**	26.28200000	61.38	∡	-103.819°	V	**1.11**	**∡**	**-165.500°**	**A**	*
C	3→0	0.00020000	61.38	∡	-103.819°	V	0.12	∡	-13.819°	A	
L	2→3	4.23000000	42.09	∡	-72.193°	V	1.00	∡	-162.193°	A	
R	**1→2**	1.00000000	1.00	∡	-162.193°	V	**1.00**	**∡**	**-162.193°**	**A**	**

* Modeled Current at Tower (rounded)
** Modeled Current at TCT (rounded)

WCAP PART			FROM IMPEDANCE				TO IMPEDANCE			
R	**3→0**	**26.28200000**	**26.28**	**+**	**j**	**48.771**	0.00	+	j	0.000
C	3→0	0.00020000	0.00	-	j	503.655	0.00	+	j	0.000
L	2→3	4.23000000	32.11	+	j	94.138	32.11	+	j	52.145
R	1→2	1.00000000	33.11	+	j	94.138	32.11	+	j	94.138

WCAP INPUT DATA:

1.5800	0.00010000	1			
R	**26.28200000**	**3**	**0**	**48.77100000**	(Modeled MiniNEC Base Impedance , R & X Ω)
C	0.00020000	3	0		(Stray Shunt Capacitance, μF)
L	4.23000000	2	3	0.00000000	(Stray Series Inductance, μH)
R	1.00000000	1	2	0.00000000	(Phantom Resistor, Ω)
I	1.00233000	0	1	197.80700000	(Modeled Current Magnitude and Phase at TCT)

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Antenna Monitor and Sample System

Antenna Monitor

The Station's *Potomac Instruments Inc.* Model 1901-4 Antenna Monitor, Serial Number 678, was returned to the manufacturer for recalibration prior to the adjustment of the array. The calibration date for this monitor was June 20, 2014. The next recommended calibration date is June 2017, according to the manufacturer.

The manufacturer's specified accuracy for this monitor is +/- 0.01 for ratio indications and the phase accuracy is +/- 1.0° 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 and the respective reference ports.

Sample System Current Transformers

New *Phasetek Inc.* Model P600-205 dual output[5] 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 calibration of the TCTS was verified by measuring their outputs (in each output mode) with a common reference signal using a calibrated network analyzer, by placing them side-by-side with a common conductor passing the same 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 WJFK carrier frequency, 1580 kilohertz, using TCT 2 as the daytime mode reference and TCT 1 as the nighttime mode reference:

TCT Location (Tower No.)	TCT Serial Number	Normalized High Power (Day) Ratio	Normalized High Power (Day) Phase	Normalized Low Power (Night) Ratio	Normalized Low Power (Night) Phase
1 (S) Night Ref	S1	1.000	0.18°	1.000	0.00°
2 (W) Day Ref	S2	1.000	0.00°	0.996	0.00°
3 (E)	S3	0.998	0.01°	0.992	-0.04°
4 (N)	S4	0.998	-0.19°	0.995	-0.04°

[5] Dual output toroids were deemed necessary since the daytime operating mode employs 50,000 Watts while the nighttime mode employs 270 Watts. The high power mode sensitivity is 0.5 V/A; the low power mode is 1.0 V/A.

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According to the manufacturer, *Phasetek Inc.,* Model P600-205 toroidal current transformers have a published absolute magnitude accuracy of ±2% and absolute phase accuracy of ±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 their impedance at 1580 kHz at their output connectors (not FCC required, but done for reference and future troubleshooting purposes) and also measuring the impedance of the sample lines with the TCT's connected to the distal ends of the lines (FCC required). The results of these tests are supplied below:

TCT Location (Tower No.)	TCT Serial Number	Measured Impedance at TCT Output Connector		Measured Impedance Of Sample Line with TCT Connected	
		Day Mode	Night Mode	Day Mode	Night Mode
1 (S) Night Ref	S1	50.11 +j0.43 Ω	49.57 +j1.88 Ω	50.93 -j1.79 Ω	50.39 -j3.12 Ω
2 (W) Day Ref	S2	50.12 +j0.46 Ω	49.58 +j1.97 Ω	51.06 -j1.79 Ω	50.45 -j3.15 Ω
3 (E)	S3	50.12 +j0.39 Ω	49.64 +j1.87 Ω	51.07 -j1.80 Ω	50.50 -j3.16 Ω
4 (N)	S4	50.13 +j0.38 Ω	49.59 +j1.77 Ω	51.13 -j1.77 Ω	50.62 -j3.06 Ω

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).

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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 bases. (The results of the impedance measurements of each of the sample lines, *with the TCT sampling devices connected*, has been reported on the previous page of this document.)

The sample lines were swept for length and characteristic impedance with their ends under "open-circuit" (unterminated) 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.

Line Length Tabulation

Tower	Sampling Line Open-Circuited Resonance Nearest to 1580 kHz	Sampling Line Ratio-Calculated Electrical Length (at 1580 kHz)
1 (S)	1489.60 kHz	286.4°
2 (W)	1489.10 kHz	286.5°
3 (E)	1489.10 kHz	286.5°
4 (N)	1489.60 kHz	286.4°

As shown, the maximum length difference between the sampling line lengths is 0.1°. Thus this system meet 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 $R_2 + j X_2$ are the measured impedances at the +45 and –45 degree offset frequencies, respectively:

$$Zo = \sqrt{\sqrt{R_1^2 + X_1^2} \circ \sqrt{R_2^2 + X_2^2}}$$

Characteristic Impedance Tabulation

Tower	-45 Degree Offset Frequency	-45 Degree Measured Impedance	+45 Degree Offset Frequency	+45 Degree Measured Impedance	Calculated Characteristic Impedance
1 (S)	1241.3 kHz	3.21 –j 50.5 Ω	1737.9 kHz	4.75 +j 50.4 Ω	50.61 Ω
2 (W)	1240.9 kHz	3.23 –j 50.5 Ω	1737.3 kHz	4.76 +j 50.4 Ω	50.61 Ω
3 (E)	1240.9 kHz	3.23 –j 50.7 Ω	1737.3 kHz	4.76 +j 50.4 Ω	50.71 Ω
4 (N)	1241.3 kHz	3.22 –j 50.6 Ω	1737.9 kHz	4.77 +j 50.6 Ω	50.76 Ω

As shown, the maximum difference in sampling line measured characteristic impedance between all 4 lines is 0.15 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, for MoM proofs of performance, "Reference field strength measurement locations shall be established in directions of pattern minima and maxima" as companion information for such proofs. Accordingly, such information is being provided herein.

As discussed earlier in this document, *CBS Radio* had previously conducted a MoM proof-of-performance for this array (see BMML-20130918AJO), therefore, for the purposes of this replacement MoM proof, the same measurement direction and locations that were established and accepted in the prior proof are carried forward for this proof. While no changes were made in the actual measurement locations used in the original MoM proof of performance, point descriptions, distances, and coordinate information have been updated where it was deemed appropriate by station staff. 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 PI-4100 field strength meter, Serial Number 214, was used for these measurements. This meter was factory calibrated within the last two years (on August 4, 2014); the calibration was field-verified using the published calibration procedure.

Mr. Roger DuFault, WJFK Station Engineer, collected the reference measurements for each pattern, as tabulated in the following pages.

Reference Field Strength Measurement Tables

Daytime Reference Field Strength Measurements – 14° (Minima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	1.8	35.6	38.884530° N 76.891279° W	Entrance to Central High School
2	2.5	19.2	38.889890° N 76.889505° W	In front of building 15 on Cindy Lane
3	3.3	10.2	38.897083° N 76.887946° W	6901 Valley Park Road

Daytime Reference Field Strength Measurements – 68° (Minima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	3.5	41.1	38.880833° N 76.859498° W	Southeast side parking, at 605 Ritchie Road
2	3.8	43.2	38.882721° N 76.856360° W	Near entrance to Coca Cola distributor
3	4.3	33.3	38.883751° N 76.851721° W	401 Hampton Park Blvd., parking lot

Daytime Reference Field Strength Measurements – 141° (Maxima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	1.7	852	38.857307° N 76.883392° W	7103 Kipling Street, in median
2	2.3	335	38.854442° N 76.877947° W	Mason Street at Kirkland Land Intersection
3	3.1	290	38.847136° N 76.873751° W	3101 Ritchie Road, old white building

Daytime Reference Field Strength Measurements – 277.5° (Maxima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	2.0	548	38.871887° N 76.919222° W	1229 Capital Heights Blvd, baseball field
2	2.8	285	38.872860° N 76.929255° W	4851 Marlboro Pike
3	3.2	138	38.873029° N 76.933584° W	4207C Pear Street

***Nighttime* Reference Field Strength Measurements – 41.5° (Minima)**

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	2.5	2.84	38.885417° N 76.877608° W	7434 Shady Glenn Terrace
2	3.4	3.45	38.891997° N 76.871309° W	109 Jonquil at dead end
3	4.2	1.79	38.897083° N 76.864305° W	End of Gibbs Way

***Nighttime* Reference Field Strength Measurements – 115.5° (Minima)**

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	2.2	6.11	38.860474° N 76.873169° W	2117 Roslyn, by stop sign
2	2.5	3.95	38.859722° N 76.870246° W	2201 Oakglen Way, near 25 mph sign
3	3.1	2.95	38.857777° N 76.863999° W	2302 Timbercrest Drive, by 25 mph sign

***Nighttime* Reference Field Strength Measurements – 183.5° (Maxima)**

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	1.2	124	38.857471° N 76.897140° W	6401 Elmhurst Street, at side of house
2	2.3	51	38.848362° N 76.897612° W	6506 Laconia, in front of house
3	2.9	29.2	38.842667° N 76.898394° W	6307 Hilmar, in front of building

***Nighttime* Reference Field Strength Measurements – 254.5° (Maxima)**

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	1.9	102	38.864582° N 76.918335° W	Cramer Way & Gethsemane Way intersection
2	2.4	51	38.863945° N 76.923532° W	Rt. 4 Quarter Avenue, near intersection
3	2.8	35.7	38.862057° N 76.928053° W	2104 Lakewood Street, by 25 mph sign

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Nighttime Reference Field Strength Measurements – 320.5° (Minima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	2.1	2.35	38.883667° N 76.911111° W	Gateway Village, near hydrant
2	2.2	1.57	38.884304° N 76.912222° W	Capital Heights Fire Department parking lot
3	2.8	1.35	38.888526° N 76.915946° W	5878 Southern Avenue, in front of business office

Nighttime Reference Field Strength Measurements – 351.5° (Minima)

Point	Distance (km)	Field (mV/m)	Coordinates (WGS-84)	Description
1	2.2	1.28	38.888027° N 76.899414° W	69th St. Public Works building, behind fire station
2	2.5	1.70	38.890862° N 76.900582° W	6200 Addison Road
3	3.5	0.78	38.899808° N 76.902251° W	719 71th Avenue

Direct Measurement of Power – Daytime and Nighttime 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 operating power. The results are as follows:

Mode	Common Point Resistance	Common Point Reactance
Daytime Directional	50 Ω	-9.0 Ω
Nighttime Directional	50 Ω	-9.0 Ω

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 Watts / 50Ω Resistance)$^{1/2}$ is **32.45 Amperes.**

Similarly, the authorized common point input power of the **nominal 270 W (0.27 kW) nighttime** directional antenna system is **291.6 Watts**. This value is obtained by applying the provisions of §73.51(b)(1) of the Commission's Rules, i.e. 270 Watts x 1.08 = 291.6 Watts. Accordingly, the nighttime common point current, found by the following calculation (291.6 Watts / 50Ω Resistance)$^{1/2}$ is **2.41 Amperes.** These current values are maintained as required by §73.1560(a)(1), through the use of the station's common point ammeter, (a Delta TCA-10/40-EXR-HV, factory calibrated on August 12, 2014).

As-Constructed Certified Array Geometry

Per the FCC's Public Notice of October 29, 2009 (DA 09-2340), older licensed stations such as WJFK, that were originally licensed using the "conventional proof" provisions of Section 73.151(a)(1) of the FCC's Rules, and are not proposing a change in the authorized theoretical patterns, are exempt from the provisions of Section 73.151(c)(1)(ix) of the Commission's Rules and do not require a land survey to be conducted. Nevertheless, inasmuch as a survey was conducted by the "new" stations that proposed to use the existing WJFK site and tower array, a copy of that professional land surveyor's combined certification and survey plat is provided herewith (in the following page) to complete the station's record.

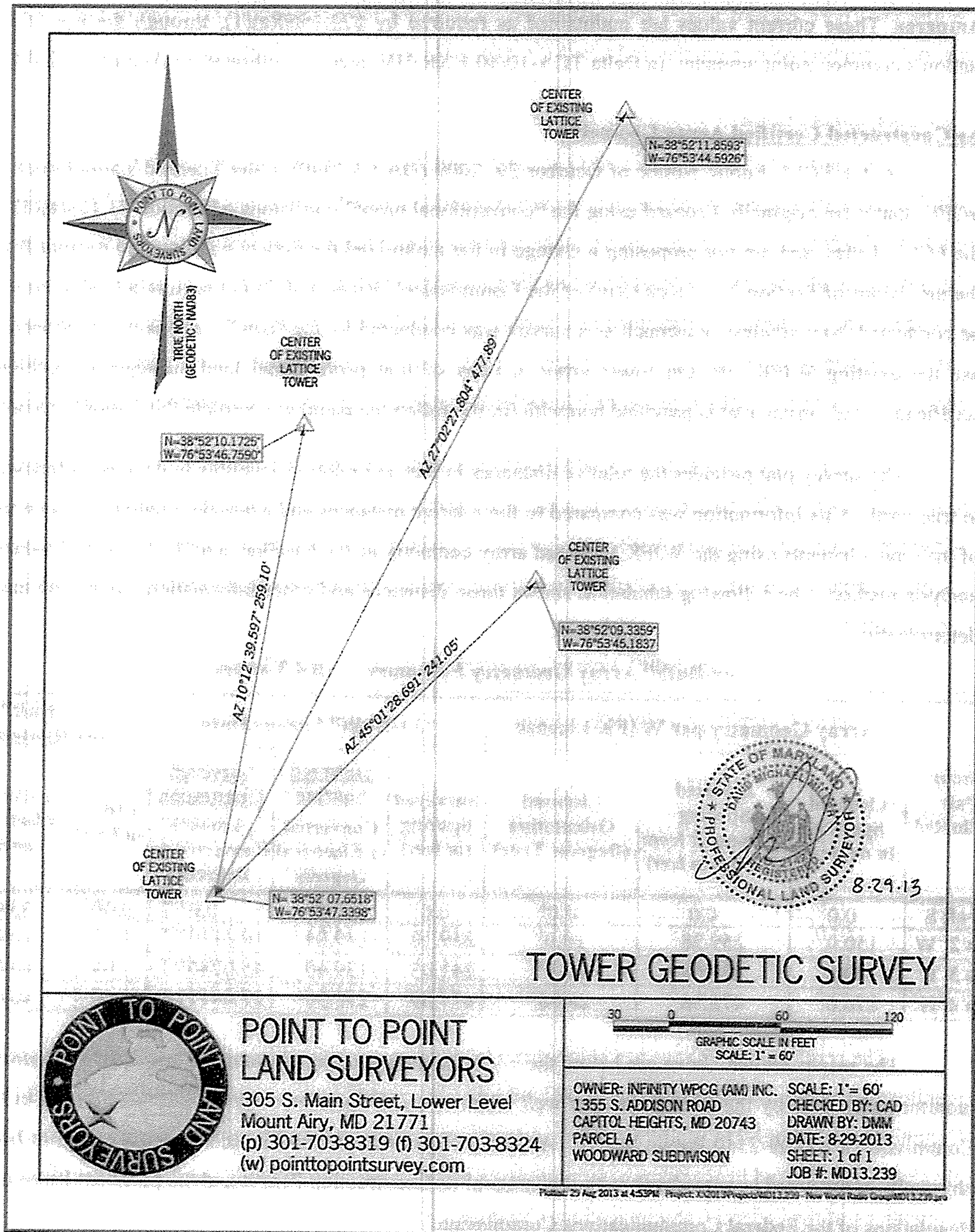
The survey plat provides the relative distances in feet and relative azimuths in degrees, referenced to true north. This information was compared to the relative distances and azimuths relative to true north of the array elements using the WJFK Licensed array geometry as the baseline, and the "Law of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

"As-Built" Array Geometry Summary – All 4 Towers

Tower Pair Evaluated	Array Geometry per WJFK License			"As-Built" Survey Data			"As-Built" Error/Deviation	
	Licensed Spacing (in degrees)	Licensed Spacing (converted from degrees to feet)	Licensed Orientation (Degrees True)	Surveyed Spacing (in feet)	Surveyed Spacing Converted to Electrical Degrees	Surveyed Orientation (Azimuth Converted to Degrees)	Error In Feet	Error In Electrical Degrees
1 (ref) S	0.0	0.0	0.0°	0.0	0.0	0.0° T	0.00	**0.00**
1 to 2 W	150.0	259.38	10.0°	259.10	149.84	10.2110° T	1.00	**0.58**
1 to 3 E	140.0	242.09	45.0°	241.05	139.40	45.0246° T	1.04	**0.60**
1 to 4 N	276.6	478.30	26.88°	477.89	276.36	27.0411° T	1.40	**0.81**

The results shown above are below 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.

Survey Certification – "As Built" Survey



RF Exposure Evaluation

The operation of the 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 FCC Rule Section 1.1310.

An evaluation of the site with all three stations operating at maximum power levels was conducted by the proponents of the two stations (WUST and WZHF) when they initially proposed to utilize this site and discussed in their separate underlying applications for Construction Permits[6]. Upon grant of the Construction Permits for these two facilities, construction was initiated, which included erection of tall fences around each of the tower bases spaced no closer than 25 feet (7.62 meters) from any energized surface. These fences restrict access to distances that exceed those necessary to prevent electric and magnetic field exposure above the levels described in the Commission's Rules, even when assuming the combined worst case power level is being radiated from any one tower individually. Further, a tall chain link fence, topped with barbed wire, already encloses the entire site. Two locked gates are placed across the entry driveway prevent casual site access. Based upon the above, 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 have been posted with RF exposure warning signs on all fence sides, and all fence gates are securely locked.

With respect to worker safety, no work activity is permitted that will endanger employees or subcontractors. Access to high exposure or shock/burn areas are controlled and supervised by knowledgeable station engineering personnel. If it is necessary for workers to be inside the tower base fence enclosures for extended periods of time, the stations 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.

Special Considerations Pertaining to the Triplexed Operation

The Construction Permits issued to triplex partners WUST and WZHF have had "conditions" placed upon them to assure that the combined operations will meet pertinent FCC Rules, and will not adversely impact WJFK or each other. Each station must address these conditions to the satisfaction of

[6] For WUST, please see BP-20130926BCX and BMML-20141218AFW; for WZHF, please see BP-20131223AFI.

the FCC within their respective "Applications for License to Cover" before receiving Program Test Authority and Licenses[7]. Since WJFK is the "host station", this proof of performance will demonstrate from WJFK's standpoint that the as-constructed, shared facilities, has not adversely impacted the WJFK operation. As discussed in the preceding text, common point resistance measurements have been completed for WJFK with all stations operating and the results are documented herein. FCC Form 302-AM is attached to this proof requesting direct measurement of power for WJFK. Similar measurements have been completed for WUST and WZHF, and are addressed in their separate Applications for License.

Filters, traps and other equipment have been installed and adjusted to prevent any undesired interaction, intermodulation and/or generation of spurious radiation products which may be caused by common usage of the same antenna system by Stations WUST, WZHF, and WJFK. In particular, filters and traps were installed at each tuning unit of each station's RF system, and at locations within each station's phasors. 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. NRSC measurements and tests for out of band emissions (harmonics and "intermod") were then conducted following these adjustments with favorable results.

A copy of the harmonic and intermod test results (for all stations) is attached to this Statement as Appendix I and is also provided with the Applications for License for the other collocated stations. A copy of the NRSC measurements for each station is supplied within the respective Statement E documents.

A firm agreement has been entered into by the involved stations clearly fixing the responsibility of each with regard to the installation and maintenance of such equipment, a copy of which is included with the WZHF and WUST Applications for License. The agreement between the co-located stations, WUST and WJFK is included with those stations' Application for License filings as "Attachment I". As shown in their individual filings, the licensees of WUST and WZHF affirmed their responsibilities to properly maintain and adjust all filters and traps as necessary to assure the elimination of undesired, spurious emissions from the combined facilities.

[7] WUST has already filed their Application for License (prior to completion of construction of the other collated facilities) – see BMML-20141218AFW. An amendment to that application is being prepared to update the spurious emissions report and other necessary data now that all of the site construction has been completed. The WZHF application for license to cover has also been completed. Both sets of materials will be filed following the submission of WJFK's Application for Direct Measurement when a file number becomes known.

Spectrum Analyzer Check for Undesired Emissions and NRSC Compliance

While not normally required to be conducted when a MoM proof-of-performance is being conducted, given the complexity of the described triplexed operation, equipment performance measurements were nevertheless made on WJFK pursuant to Section 73.1590(a)(6) of the FCC's Rules.

Equipment Performance Measurement Requirements

Section 73.1590(b) states that spurious and harmonic emission measurements should be made to show compliance with Section 73.44 and that AM station emissions are attenuated in accordance with the following requirements:

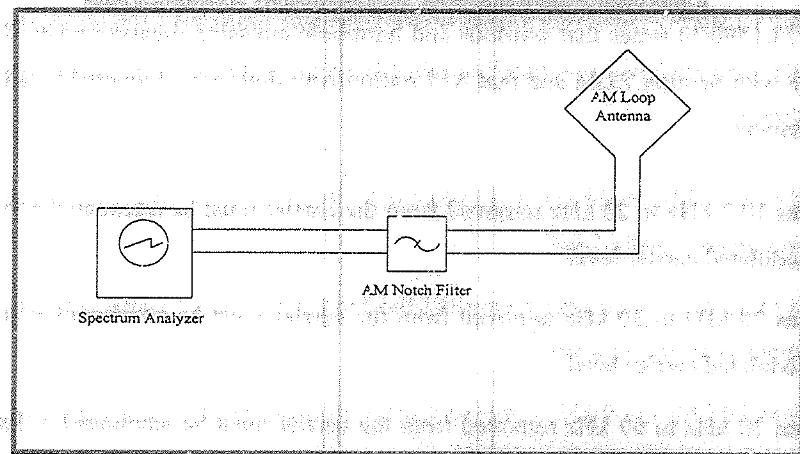
- Emissions 10.2 kHz to 20 kHz removed from the carrier must be attenuated at least 25 dB below the unmodulated carrier level,
- Emissions 20 kHz to 30 kHz removed from the carrier must be attenuated at least 35 dB below the unmodulated carrier level,
- Emissions 30 kHz to 60 kHz removed from the carrier must be attenuated at least *5 + 1 dB/kHz* below the unmodulated carrier level,
- Emissions between 60 kHz and 75 kHz of the carrier frequency must be attenuated at least 65 dB below the unmodulated carrier level, and
- Emissions removed by more than 75 kHz must be attenuated at least *43 + 10 Log Pw (Power in watts)* or 80 dB below the unmodulated carrier level, whichever is the lesser attenuation. Accordingly, for WJFK(AM), with a licensed daytime power of 50,000 Watts and nighttime power of 270 Watts, station emissions occurring at more than +/-75 kHz of the carrier frequency must be attenuated at least 80 dB (Day) or 67.3 dB (Night) below the unmodulated carrier in order to satisfy the provisions of this Rule Section.

Measurement Methodology and Equipment

The Commission's Rules require that when emission measurements are being made for operating stations,[8] the measurements must be made at ground level, approximately one kilometer from the center of the antenna system. The Commission recommends that observations be made with a suitable swept-

[8] As opposed to instances where the transmitter type acceptance measurements are being made, where samples are taken at the output terminals of the transmitter (when operating into an artificial antenna of substantially zero reactance.)

frequency RF spectrum analyzer[9] using a peak-hold duration of 10 minutes, no video filtering, and a 300 Hz resolution bandwidth. (Wider resolution bandwidth may be employed above 11.5 kHz to detect transient emissions.) For the case at hand, a *Rohde & Schwarz* FSH4.14 Spectrum Analyzer was employed in conjunction with a *Chris Scott & Associates* LP-3 Standard H-Field loop antenna, as shown below. This antenna was elevated approximately 6 feet above the ground.

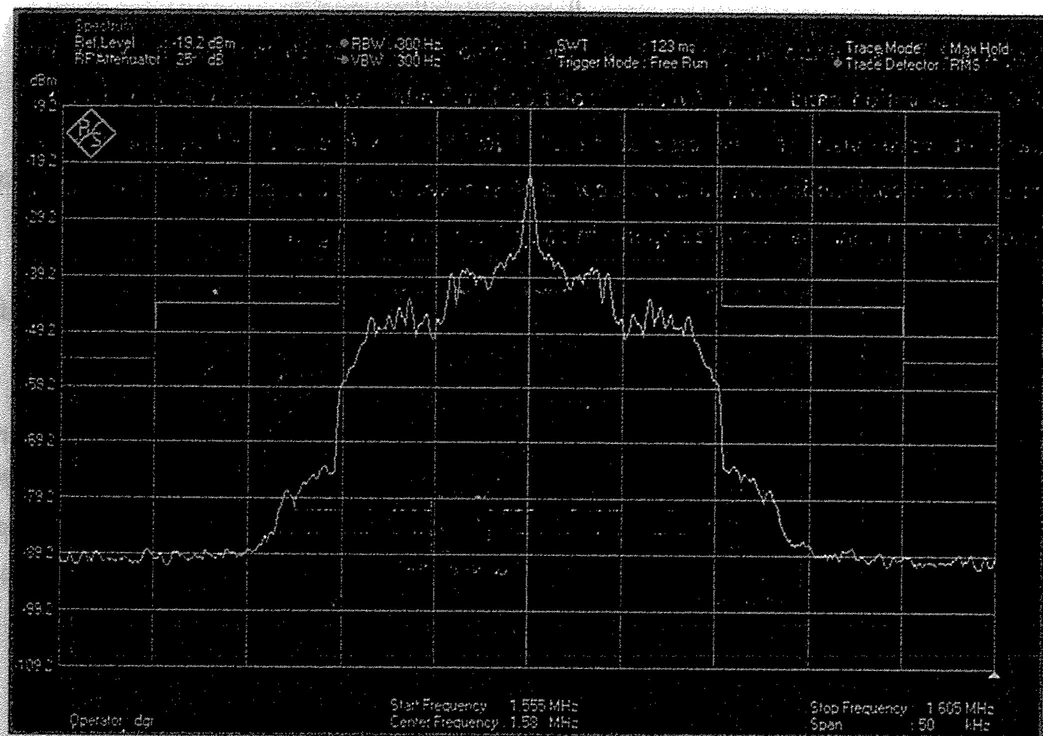


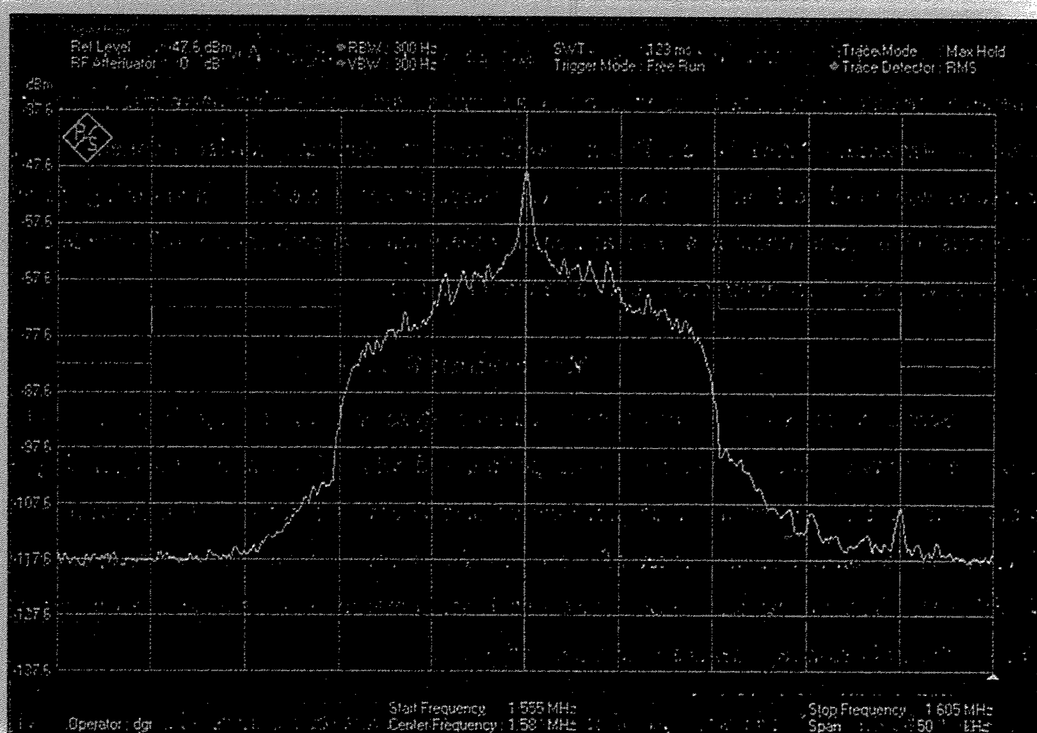
The WJFK transmitter site is now shared with two other AM radio stations. Accordingly, whenever needed to eliminate analyzer overload errors when measuring harmonics, one or more *Chris Scott & Associates* "AM Notch Filters" were used to attenuate carrier frequencies which allows measurements to -80 dBc at +/- 75 kHz. These measurements were conducted during the midday hours of August 13th. Observations and measurements were made approximately 0.7 kilometers west of the WJFK(AM) transmitter in the directional antenna main lobe.

Measurement Results

Screen captures were made of the spectrum analyzer system, starting about 11:00 AM local time, after the mandatory ten minute peak hold period, and while the station was operating with normal program material. The first archived plot (shown below) covers a span of 50 kHz with the WJFK(AM) daytime carrier placed at the center of the plot. The second image is a similar spectrum plot of the WJFK(AM) nighttime carrier. In both cases, each horizontal division represents an increment of 5 kHz. Each vertical division represents an increment of 10 dB.

[9] Alternatively, the FCC permits the use of other specialized receivers (or monitors with appropriate characteristics) for this purpose, provided that any disputes over measurement accuracy are resolved in favor of measurements obtained by using a calibrated spectrum analyzer, adjusted as described above.


Ref Level : -19.2 dBm
RF Attenuator : 25 dB
RBW : 300 Hz
VBW : 300 Hz
SWT : 123 ms
Trigger Mode : Free Run
Trace Mode : Max Hold
Trace Detector : RMS
Operator : dgr
Start Frequency : 1.555 MHz
Center Frequency : 1.58 MHz
Stop Frequency : 1.605 MHz
Span : 50 kHz


Ref Level : -47.6 dBm
RF Attenuator : 0 dB
RBW : 300 Hz
VBW : 300 Hz
SWT : 123 ms
Trigger Mode : Free Run
Trace Mode : Max Hold
Trace Detector : RMS
Operator : dgr
Start Frequency : 1.555 MHz
Center Frequency : 1.58 MHz
Stop Frequency : 1.605 MHz
Span : 50 kHz

NRSC Measurement Summary

The above discussed field observations demonstrate that the emissions for this radio station at this time and location meet the required compliance specifications of FCC Rule Section 73.44. Completion of this equipment performance measurement establishes the 2015 annual benchmark for this radio station as required under FCC Rule Section 73.1590(a)(6). A separate full report on this measurement series has been provided to Station personnel for insertion into the WJFK Pubic File.

"Statement E" Preparer's Certification

These **Statement E** documents and application materials, which are attached to FCC Form 302-AM, Section III, have been prepared on behalf of *CBS Radio* 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 October 2, 2015
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Appendix I

Field Strength Survey for Undesired Emissions

WJFK Morningside, Maryland
Facility ID 28638
1580 kHz 50 kW-D 0.27 kW-N DA-2
CBS Radio WPGC(AM), Inc.

Field observations have been made for the as-constructed WJFK-WUST-WZHF combined operation to determine the existence of any out of band emissions or intermodulation products, whether any occur at levels in excess of those allowed under the FCC Rules, and that objectionable problems resulting therefrom do not exist or have been eliminated. As shown in the following tables, it is believed that, following the adjustment of the various filter and trap systems, no significant spurious emissions, harmonics, or intermodulation products exist.

All stations were operated for the purposes of these tests using their MoM proof parameter adjusted authorized facilities in various modes of operation. In particular, observations were made with:

- all stations operating in their daytime modes of operation in the daytime main lobe side ("west side") of the array,
- with WJFK and WZHF stations operating in their nighttime modes of operation (and WUST in its non-directional "critical hours" mode of operation) in the WJFK nighttime main lobe side ("west side") of the array,
- with WJFK and WZHF stations operating in their nighttime modes of operation (and WUST in its non-directional "critical hours" mode of operation) in the WZHF nighttime main lobe side ("east side") of the array.

The following tabulations are provided "per mode" as described above ("Daytime Mode Measurements", "Nighttime Mode Measurements – West Side" and "Nighttime Mode Measurements – East Side"), with signal level measurements of all pertinent possible frequency combinations tabulated per mode, with achieved suppression levels listed in separate station columns within each table.

Due to the differing power levels in the various modes, the required suppressions for each are provided below.

Power Level	Station and Mode	Required Suppression
50 kW	WUST DA- Day WJFK DA-Day	-80.0 dB
9 kW	WZHF DA-Day	-80.0 dB
3 kW	WUST Critical Hours	-77.8 dB
1 kW	WZHF DA-Night	-73.0 dB
0.27 kW	WJFK DA-Night	-67.3 dB

Appendix I (Continued)

Daytime Mode Measurements

Station 1 ("F1"):	WUST, 1120 kHz, Washington, DC	Note: "N/A" either indicates that the Signal Parameter combination is not pertinent for that station/column, or some other (off-site) station's carrier is dominant on that frequency.
Station 2 ("F2"):	WZHF, 1390 kHz, Capitol Heights, MD	
Station 3 ("F3"):	WJFK, 1580 kHz, Morningside, MD	
Measurement Mode:	All Stations in DAY Mode (West Test Site - Day Main Lobes)	
Device Used:	*Potomac Instruments Field Intensity Meters*: #1 - Model # PI-4100, Serial #214, Last Calibrated March 31 2014; and #2 - Model FIM-41, Serial #2152, Last calibrated December 18 2014	
Measurement Date:	13-Aug-15	Personnel: Daniel Ryson, Kurt Gorman, Bill Smith, Roger DuFault

Signal Parameter (Harmonic in Green)	Frequency (kHz)	Field Strength (V, mV, µV)	Field Strength (dBµ)	Signal Relative to "F3" WJFK (dB) (-80 dB Required)	Signal Relative to "F2" WZHF (dB) (-80 dB Required)	Signal Relative to "F1" WUST (dB) (-80 dB Required)	Observed Audio
3F1 - 2F3	200	27 µV	28.63	-97.81	N/A	-104.3	Noise
4F1-3F2	310	12.5 µV	21.94	N/A	-104.5	-111.0	Noise
3F1 - 2F2	580	100 µV	40	N/A	-86.44	-92.93	Noise
2F1 - F3	660	290 µV	49.25	N/A - WFAN Carrier	N/A - WFAN Carrier	N/A - WFAN Carrier	WFAN
2F1 - F2	850	43 µV	32.67	N/A	-93.77	-100.26	WUST + WZHF
F1+F2-F3	930	680 µV	56.65	N/A - WFMD Carrier	N/A - WFMD Carrier	N/A - WFMD Carrier	WFMD
3F2 - 2F3	1010	75 µV	37.5	-95.56	-88.94	N/A	WINS
F1 (WUST)	1120	4.43 V	132.93	N/A - WINS Carrier	N/A - WINS Carrier	N/A - WINS Carrier	WUST
2F2 - F3	1200	102 µV	40.17	-92.89	-86.27	N/A	Spanish?
F1-F2+F3	1310	1.1 mV	60.83	N/A - WDCT Carrier	N/A - WDCT Carrier	N/A - WDCT Carrier	WDCT
F2 (WZHF)	1390	2.1 V	126.44	N/A	0 (Self)	N/A	WZHF
F3 (WJFK)	1580	4.5 V	133.06	0 (Self)	N/A	N/A	WJFK
2F2-F1	1660	120 µV	41.58	N/A	-84.86	-91.35	Noise + Spanish
2F3-F2	1770	28 µV	28.94	-104.1	-97.50	N/A	Sports + Spanish
3F1 - F3	1780	16 µV	24.08	-109.0	N/A	-108.9	Noise
2F1-3F2	1950	11 µV	20.83	N/A	-105.6	-112.1	Noise
3F3-2F2	1960	10 µV	20	-113.1	-106.4	N/A	Faint Programming
3F1 - F2	1970	10 µV	20	N/A	-106.4	-112.9	Noise
2F3-F1	2040	340 µV	50.63	-82.43	N/A	-82.30	Sports + Spanish
4F3-3F2	2150	9.7 µV	19.74	-113.3	-106.7	N/A	Noise
4F2-3F1	2200	10 µV	20	N/A	-106.4	-112.9	Quiet Carrier
2F1 (WUST)	2240	50 µV	33.98	N/A	N/A	-98.95	Power Line Hum
3F3-2F1	2500	60 µV	35.56	-97.5	N/A	-97.37	Quiet Carrier
F1 + F2	2510	70 µV	36.9	N/A	-89.54	-96.03	Noise
3F2 - F3	2590	8.5 µV	18.59	-114.5	-107.9	N/A	Noise
F1 + F3	2700	135 µV	42.61	-90.45	N/A	-90.32	Faint Programming
2F2 (WZHF)	2780	15 µV	23.52	N/A	-102.9	N/A	Noise
4F3-3F1	2960	8.8 µV	18.89	-114.2	N/A	-114.0	Noise
F2 + F3	2970	88 µV	38.89	-94.17	-87.55	N/A	Chatter
2F3 (WJFK)	3160	105 µV	40.42	-92.64	N/A	N/A	Sports
3F1 (WUST)	3360	108 µV	40.67	N/A	N/A	-92.26	Spanish
2F1 + F2	3630	200 µV	46.02	N/A	-80.42	-86.91	WZHF + WUST
2F1 + F3	3820	321 µV	50.13	-82.93	N/A	-82.80	Spanish + Sports
F1 + 2F2	3900	107 µV	40.59	N/A	-85.85	-92.34	WZHF
3F2 (WZHF)	4170	21 µV	26.44	N/A	-100.0	N/A	Noise
F1 + 2F3	4280	330 µV	50.37	-82.69	N/A	-82.56	Sports + WUST?
2F2 + F3	4360	102 µV	40.17	-92.89	-86.27	N/A	WZHF?
4F1 (WUST)	4480	10 µV	20	N/A	N/A	-112.9	Noise
F2 + 2F3	4550	90 µV	39.08	-93.98	-87.36	N/A	WZHF + Sports?
3F3 (WJFK)	4740	170 µV	44.61	-88.45	N/A	N/A	Sports
3F1 + F2	4750	111 µV	40.91	N/A	-85.53	-92.02	Remains with F1,F2,F3 Off

Appendix I (Continued)

Nighttime Mode Measurements - West Side

Station 1 ("F1"):	WUST, 1120 kHz, Washington, DC
Station 2 ("F2"):	WZHF, 1390 kHz, Capitol Heights, MD
Station 3 ("F3"):	WJFK, 1580 kHz, Morningside, MD
Measurement Mode:	All Stations in Night Mode except WUST, which is in Critical Hours Mode (West Test Site)
Device Used:	*Potomac Instruments Field Intensity Meters*: #1 - Model # PI-4100, Serial #214, Last Calibrated March 31 2014; and #2 - Model FIM-41, Serial #2152, Last calibrated December 18 2014
Measurement Date:	13-Aug-15 **Personnel:** Daniel Ryson, Kurt Gorman, Bill Smith, Roger DuFault

Note: "N/A" either indicates that the Signal Parameter combination is not pertinent for that station column, or some other (offsite) station's carrier is dominant on that frequency.

Signal Parameter (Harmonic in Green)	Frequency (kHz)	Field Strength (V, mV, µV)	Field Strength (dBµ)	Signal Relative to "F3" WJFK (dB) (-67.3 dB Required)	Signal Relative to "F2" WZHF (dB) (-73.0 dB Required)	Signal Relative to "F1" WUST (dB) (-77.8 dB Required)	Observed Audio
3F1 - 2F3	200	19 µV	25.58	-75.86	N/A	-90.94	Noise
4F1-3F2	310	22 µV	26.85	N/A	-74.59	-89.67	Noise
3F1 - 2F2	580	24 µV	27.6	N/A	-73.84	-88.92	Noise
2F1 - F3	660	40 µV	32.04	N/A - WFAN Carrier	N/A - WFAN Carrier	N/A - WFAN Carrier	WFAN
2F1 - F2	850	23 µV	27.23	N/A	-74.21	-89.29	WUST + WZHF
F1+F2-F3	930	100 µV	40	N/A - WFMD Carrier	N/A - WFMD Carrier	N/A - WFMD Carrier	WFMD
3F2 - 2F3	1010	107 µV	40.59	N/A - WINS Carrier	N/A - WINS Carrier	N/A - WINS Carrier	WINS
F1 (WUST)	1120	670 mV	116.52	N/A	N/A	0 (Self)	WUST
2F2 - F3	1200	25 µV	27.96	-78.89	-73.48	N/A	Spanish?
F1-F2+F3	1310	340 µV	50.63	N/A - WDCT Carrier	N/A - WDCT Carrier	N/A - WDCT Carrier	WDCT
F2 (WZHF)	1390	118 mV	101.44	N/A	0 (Self)	N/A	WZHF
F3 (WJFK)	1580	220 mV	106.85	0 (Self)	N/A	N/A	WJFK
2F2-F1	1660	17 µV	24.61	N/A	-76.83	-91.91	Noise + Spanish
2F3-F2	1770	23 µV	27.23	-79.62	-74.21	N/A	Sports + Spanish
3F1 - F3	1780	10 µV	20	-86.85	N/A	-96.52	Noise
2F1-3F2	1930	10 µV	20	N/A	-81.44	-96.52	Noise
3F3-2F2	1960	9.7 µV	19.74	-87.11	-81.70	N/A	Faint Programming
3F1 - F2	1970	9.4 µV	19.46	N/A	-81.98	-97.06	Noise
2F3-F1	2040	9 µV	19.08	-87.77	N/A	-97.44	Sports + Spanish
4F3-3F2	2150	9.2 µV	19.28	-87.57	-82.16	N/A	Noise
4F2-3F1	2200	8.8 µV	18.89	N/A	-82.55	-97.63	Quiet Carrier
2F1 (WUST)	2240	17 µV	24.61	N/A	N/A	-91.91	Power Line Hum
3F3-2F1	2500	60 µV	35.56	-71.29	N/A	-80.96	Quiet Carrier
F1 + F2	2510	14 µV	22.92	N/A	-78.52	-93.60	Noise
3F2 - F3	2590	8.4 µV	18.49	-88.36	-82.95	N/A	Noise
F1 + F3	2700	9 µV	19.08	-87.77	N/A	-97.44	Faint Programming
2F2 (WZHF)	2780	8.2 µV	18.28	N/A	-83.16	N/A	Noise
4F3-3F1	2960	8.2 µV	18.28	-88.57	N/A	-98.24	Noise
F2 + F3	2970	8.8 µV	18.89	-87.96	-82.55	N/A	Chatter
2F3 (WJFK)	3160	8 µV	18.06	-88.79	N/A	N/A	Sports
3F1 (WUST)	3360	12 µV	21.58	N/A	N/A	-94.94	Spanish
2F1 + F2	3630	9.7 µV	19.74	N/A	-81.70	-96.78	WZHF + WUST
2F1 + F3	3820	9 µV	19.08	-87.77	N/A	-97.44	Spanish + Sports
F1 + 2F2	3900	9 µV	19.08	N/A	-82.36	-97.44	WZHF
3F2 (WZHF)	4170	8.6 µV	18.69	N/A	-82.75	N/A	Noise
F1 + 2F3	4280	7.8 µV	17.84	-89.01	N/A	-98.68	Sports + WUST?
2F2 + F3	4360	8.8 µV	18.89	-87.96	-82.55	N/A	WZHF?
4F1 (WUST)	4480	7.8 µV	17.84	N/A	N/A	-98.68	Noise
F2 + 2F3	4550	7.8 µV	17.84	-89.01	-83.60	N/A	WZHF + Sports?
3F3 (WJFK)	4740	7.9 µV	17.95	-88.90	N/A	N/A	Sports
3F1 + F2	4750	116 µV	41.29	N/A	N/A	N/A	Remains with F1,F2,F3 Off

Appendix I (Continued)

Nighttime Mode Measurements - East Side

Station 1 ("F1"):	WUST, 1120 kHz, Washington, DC	Note: "N/A" either indicates that the Signal Parameter combination is not pertinent for that station/column, or some other (off-site) station's carrier is dominant on that frequency.
Station 2 ("F2"):	WZHF, 1390 kHz, Capitol Heights, MD	
Station 3 ("F3"):	WJFK, 1580 kHz, Morningside, MD	
Measurement Mode:	All Stations in Night Mode except WUST, which is in Critical Hours Mode (East Test Site)	
Device Used:	*Potomac Instruments Field Intensity Meters*: #1 - Model # PI-4100, Serial #214, Last Calibrated March 31 2014; and #2 - Model FIM-41, Serial #2152, Last calibrated December 18 2014	
Measurement Date:	13-Aug-15	Personnel: Daniel Ryson, Kurt Gorman, Bill Smith, Roger DuFault

Signal Parameter (Harmonic in Green)	Frequency (kHz)	Field Strength (V, mV, µV)	Field Strength (dBµ)	Signal Relative to "F3" WJFK (dB) (-67.3 dB Required)	Signal Relative to "F2" WZHF (dB) (-73.0 dB Required)	Signal Relative to "F1" WUST (dB) ([illegible] dB Required)	Observed Audio
3F1 - 2F3	200	66 µV	36.39	-81.23	N/A	-80.04	Noise
4F1-3F2	310	21 µV	26.44	N/A	-91.18	-89.99	Noise
3F1 - 2F2	580	37 µV	31.36	N/A	-86.26	-85.07	Noise
2F1 - F3	660	74 µV	37.38	N/A - WFAN Carrier	N/A - WFAN Carrier	N/A - WFAN Carrier	WFAN
2F1 - F2	850	39 µV	31.82	N/A	-85.8	-84.61	WUST + WZHF
F1+F2-F3	930	72 µV	37.15	N/A - WFMD Carrier	N/A - WFMD Carrier	N/A - WFMD Carrier	WFMD
3F2 - 2F3	1010	178 µV	45.01	N/A - WINS Carrier	N/A - WINS Carrier	N/A - WINS Carrier	WINS
F1 (WUST)	1120	663 mV	116.43	N/A	N/A	0 (Self)	WUST
2F2 - F3	1200	33 µV	30.37	-68.12	-87.25	N/A	Spanish?
F1-F2+F3	1310	420 µV	52.46	N/A - WDCT Carrier	N/A - WDCT Carrier	N/A - WDCT Carrier	WDCT
F2 (WZHF)	1390	760 mV	117.62	N/A	0 (Self)	N/A	WZHF
F3 (WJFK)	1580	84 mV	98.49	0 (Self)	N/A	N/A	WJFK
2F2-F1	1660	19 µV	25.58	N/A	-92.04	-90.85	Noise + Spanish
2F3-F2	1770	33 µV	30.37	-68.12	-87.25	N/A	Sports + Spanish
3F1 - F3	1780	12 µV	21.58	-76.91	N/A	-94.85	Noise
2F1-3F2	1930	24 µV	27.6	N/A	-90.02	-88.83	Noise
3F3-2F2	1960	10 µV	20	-78.49	-97.62	N/A	Faint Programming
3F1 - F2	1970	29 µV	29.25	N/A	-88.37	-87.18	Noise
2F3-F1	2040	9.5 µV	19.55	-78.94	N/A	-96.88	Sports + Spanish
4F3-3F2	2150	9.5 µV	19.55	-78.94	-98.07	N/A	Noise
4F2-3F1	2200	10 µV	20	N/A	-97.62	-96.43	Quiet Carrier
2F1 (WUST)	2240	30 µV	29.54	N/A	N/A	-86.89	Power Line Hum
3F3-2F1	2500	29 µV	29.25	-69.24	N/A	-87.18	Quiet Carrier
F1 + F2	2510	48 µV	33.62	N/A	-84.00	-82.81	Noise
3F2 - F3	2590	9 µV	19.08	-79.41	-98.54	N/A	Noise
F1 + F3	2700	10 µV	20	-78.49	N/A	-96.43	Faint Programming
2F2 (WZHF)	2780	30 µV	29.54	N/A	-88.08	N/A	Noise
4F3-3F1	2960	9 µV	19.08	-79.41	N/A	-97.35	Noise
F2 + F3	2970	17 µV	24.61	-73.88	-93.01	N/A	Chatter
2F3 (WJFK)	3160	8 µV	18.06	-80.43	N/A	N/A	Sports
3F1 (WUST)	3360	13 µV	22.28	N/A	N/A	-94.15	Spanish
2F1 + F2	3630	48 µV	33.62	N/A	-84.00	-82.81	WZHF + WUST
2F1 + F3	3820	9.3 µV	19.37	-79.12	N/A	-97.06	Spanish + Sports
F1 + 2F2	3900	30 µV	29.54	N/A	-88.08	-86.89	WZHF
3F2 (WZHF)	4170	20 µV	26.02	N/A	-91.60	N/A	Noise
F1 + 2F3	4280	8 µV	18.06	-80.43	N/A	-98.37	Sports + WUST?
2F2 + F3	4360	10 µV	20	-78.49	-97.62	N/A	WZHF?
4F1 (WUST)	4480	8.6 µV	18.69	N/A	N/A	-97.74	Noise
F2 + 2F3	4550	8 µV	18.06	-80.43	-99.56	N/A	WZHF + Sports?
3F3 (WJFK)	4740	8.8 µV	18.89	-79.60	N/A	N/A	Sports
3F1 + F2	4750	119 µV	41.51	N/A	N/A	N/A	Remains with F1,F2,F3 Off