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WRITER'S EXTENSION: 202

2013 DEC 26 A 8
TAX COUNSEL
MARK B. WEINBERG
LOUIS SCHWARTZ
(1918 - 2004)
ROBERT A. WOODS
(1931-2011)

December 20, 2013

RECEIVED
ACCEPTED/FILED
DEC 20 2013

Federal Communications Commission
Office of the Secretary

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Room TW-A325
Washington, D.C. 20554

Re: Station WFNW(AM)
Naugatuck, Connecticut
FIN 8517
FCC File No. BP-20101012ABA
FRN: 0009905936

Dear Ms. Dortch:

On behalf of Candido Dias Carrelo, licensee of Station WFNW(AM), Naugatuck, Connecticut, we are filing herewith, in triplicate on FCC Form 302-AM, its application for license to cover the above-referenced construction permit for modification of facilities.

Simultaneously herewith, the licensee is paying the applicable filing fee of \$1,365.00.

Please address any questions concerning this matter to this office.

Very truly yours,

SCHWARTZ, WOODS & MILLER

By: 
Malcolm G. Stevenson

Attachment
MGS/nmc

ACCEPTED/FILED

Federal Communications Commission
Washington, D. C. 20554Approved by OMB
3060 0627
Expires 01/31/98FOR
FCC
USE
ONLY

DEC 20 2013

Federal Communications Commission
Office of the Secretary

FCC 302-AM

APPLICATION FOR AM
BROADCAST STATION LICENSE
(Please read instructions before filing out form.)

FOR COMMISSION USE ONLY

FILE NO. *BL-20131220 HUL*

SECTION I - APPLICANT FEE INFORMATION

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

SCHWARTZ WOODS & MILLER

MAILING ADDRESS (Line 1) (Maximum 35 characters)

1233 20TH STREET, NW

MAILING ADDRESS (Line 2) (Maximum 35 characters)

SUITE 610

CITY

WASHINGTON

STATE OR COUNTRY (if foreign address)

DC

ZIP CODE

20036-7322

TELEPHONE NUMBER (include area code)

202-833-1700

CALL LETTERS

WFNW

OTHER FCC IDENTIFIER (If applicable)

FACILITY ID: 8517

2. A. Is a fee submitted with this application?



Yes



No

B. If No, indicate reason for fee exemptions (see 47 C.F.R. Section 1.1 112).



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		
M	M	R

(B)

FEE MULTIPLE			
0	0	0	1

(C)

FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	
\$	\$635.00

FOR FCC USE ONLY

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

(A)

M	O	R
---	---	---

(B)

0	0	0	1
---	---	---	---

(C)

\$	\$730.00
----	----------

FOR FCC USE ONLY

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

\$ 1,365.00

FOR FCC USE ONLY

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT CANDIDO DIAS CARRELO		
MAILING ADDRESS PO BOX 178		
CITY NAUGATUCK	STATE CT	ZIP CODE 06770

2. This application is for:

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

Call letters WFNW	Community of License NAUGATUCK, CT	Construction Permit File No. BP-20101012ABA	Modification of Construction Permit File No(s). ---	Expiration Date of Last Construction Permit 12/22/2013
-----------------------------	--	---	--	--

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

☐ Yes ☒ No

If No, explain in an Exhibit.

NEW AM DIRECTIONAL ANTENNA SYSTEM -
SEE ENGINEERING NARRATIVE EE-1 -
PROGRAM TEST AUTHORITY IS REQUESTED.

Exhibit No.
EE-1

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

☒ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

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

☐ Yes ☒ No

If Yes, explain in an Exhibit.

Exhibit No.

6. Has the permittee filed its Ownership Report (FCC Form 323) or ownership certification in accordance with 47 C.F.R. Section 73.361 5(b)?

☒ Yes ☐ No

☐ Does not apply

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☒ No

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

Exhibit No.

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

☐ Yes ☒ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

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

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

CERTIFICATION

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

☒ Yes ☐ No

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

Name CANDIDO DIAS CARRELO	Signature <i>Candido Dias Carrelo</i>	
Title OWNER	Date 12/15/2013	Telephone Number 203-723-0678

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

CANDIDO DIAS CARRELO

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	
WFNW	BP-20101012ABA	1380	UNLIMITED	Night 0.350	Day 3.50

2. Station location

State CONNECTICUT	City or Town NAUGATUCK
-----------------------------	----------------------------------

3. Transmitter location

State CT	County NEW HAVEN	City or Town NAUGATUCK	Street address (or other identification) 46 MULLANE LANE
--------------------	----------------------------	----------------------------------	---

4. Main studio location

State CT	County NEW HAVEN	City or Town NAUGATUCK	Street address (or other identification) 199 CHURCH STREET
--------------------	----------------------------	----------------------------------	---

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

State CT	County NEW HAVEN	City or Town NAUGATUCK	Street address (or other identification) 199 CHURCH STREET
--------------------	----------------------------	----------------------------------	---

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

**SEE ENGINEERING EXHIBIT - THIS IS A
MOMENT-OF-METHODS ANTENNA PROOF AND
LICENSE APPLICATION**



Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed.

Exhibit No.

EE-1

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system 2.75	RF common point or antenna current (in amperes) without modulation for day system 8.69
Measured antenna or common point resistance (in ohms) at operating frequency Night 50.0 Day 50.0	Measured antenna or common point reactance (in ohms) at operating frequency Night 0.0 Day 0.0

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 (NW)	+167.7	-124.7	0.735	0.691	---	---
2 (C)	0.0	0.0	1.000	1.000	---	---
3 (SE)	-161.7	+106.5	0.596	0.750	---	---

Manufacturer and type of antenna monitor: **POTOMAC INSTRUMENTS AM-19 (204)**

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 UNIFORM CROSS-SECTION, GUYED, STEEL TOWER	Overall height in meters of radiator above base insulator, or above base, if grounded. #1 & #3 39.8 m #2 42.7 m	Overall height in meters above ground (without obstruction lighting) #1 & #3 40.3 m #2 43.2 m	Overall height in meters above ground (include obstruction lighting) #1 & #3 40.3 m #2 43.2 m	If antenna is either top loaded or sectionalized, describe fully in an Exhibit. Exhibit No. ---
---	--	---	---	--

Excitation



Series



Shunt

STANDARD BASE INSULATED - SERIES FED.

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

North Latitude	41 °	30 '	38 "	West Longitude	73 °	03 '	18 "
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If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits.

Exhibit No.

NONE

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

Exhibit No.

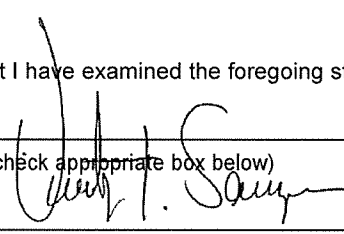
10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

**CHANGE FROM UNIPOLE ANTENNA SYSTEM (IN CP APP) TO STANDARD SERIES FED SYSTEM
WITH BASE INSULATORS INCREASED OVERALL HEIGHT OF ALL TOWERS BY 0.5 METERS.
(NO FAA REQUIRED/OR FCC REGISTRATION OF STRUCTURES).**

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

NEW ANTENNA SYSTEM

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) TIMOTHY Z. SAWYER	Signature (check appropriate box below) 
MULLANEY ENGINEERING, INC. 9049 SHADY GROVE COURT GAITHERSBURG, MD 20877	Date 12/15/2013
	Telephone No. (Include Area Code) (301) 921-0115



Technical Director



Registered Professional Engineer



Chief Operator



Technical Consultant

Other (specify) **CONSULTING ENGINEER**

JOHN J. MULLANEY
JOHN H. MULLANEY, P.E. (1994)
ALAN E. GEARING, P.E.
TIMOTHY Z. SAWYER

301 921-0115 Voice
301 590-9757 Fax
mullaney@mullengr.com E-mail

MULLANEY ENGINEERING, INC.
9049 SHADY GROVE COURT
GAITHERSBURG, MD 20877

ENGINEERING EXHIBIT EE-1:

**CANDIDO DIAS CARRELO
RADIO STATION WFNW (AM)
NAUGATUCK, CONNECTICUT**

**APPLICATION FOR STATION LICENSE
DECEMBER 2013**

FCC FACILITY NUMBER: 8517

**ENGINEERING EXHIBIT
IN SUPPORT OF
AN APPLICATION FOR STATION LICENSE
WFNW (AM) BROADCAST STATION
CLASS B AM STATION
NAUGATUCK, CONNECTICUT**

ENGINEERING EXHIBIT EE-1:

CANDIDO DIAS CARRELO

**RADIO STATION WFNW (AM)
NAUGATUCK, CONNECTICUT**

APPLICATION FOR STATION LICENSE

DECEMBER 2013

FCC FACILITY NUMBER: 8517

TABLE OF CONTENTS:

	Engineering Statement
I.	Description of Radiators
II.	Description of Sampling System
III.	Measured Matrix Impedances
IV.	Daytime Antenna System
	Operating Parameters Derived from Modeled Currents
	Calculated Impedances, Drive Voltages and Currents
V.	Nighttime Antenna System
	Operating Parameters Derived from Modeled Currents
	Calculated Impedances, Drive Voltages and Currents
VI.	Measured and Calculated Sampling Line Characteristics

ENGINEERING EXHIBIT EE-1:

TABLE OF CONTENTS (CONT'D):

VII.	Sampling System Transformer Calibration
VIII.	Reference Measurement Point Data
IX.	Direct Measurement of Power
X.	Environmental Statement
APPENDIX A.	Certified Array Geometry Survey

ENGINEERING EXHIBIT EE-1:

**CANDIDO DIAS CARRELO
RADIO STATION WFNW (AM)
NAUGATUCK, CONNECTICUT
APPLICATION FOR STATION LICENSE**

DECEMBER 2013

**FCC FACILITY NUMBER: 8517
1380 KHZ 3.5 KW DAY, 0.35 NIGHT, DA-2
CLASS B**

Narrative Statement

This engineering statement and license application is prepared on behalf of Candido Dias Carrelo, permittee of Standard Broadcast Station WFNW, Naugatuck, Connecticut, broadcast construction permit BP-20101012ABA.

This application is for a station license and covers the referenced construction permit of the directional antenna systems. A "Moment of Methods" computer modeling and sampling system verification of the antenna system and request for station license as authorized in 47 CFR §73.151(c) "Field Strength Measurements To Establish Performance of Directional Antennas."

I, Timothy Z. Sawyer, certify that each antenna system has been adjusted to the operating parameters determined as a result of the computer modeling of the antenna system and that the station is ready for the issuance of a station license that specifies operation using "computer modeling and sampling system verification" methods.

All construction has been completed, prior to the expiration of the underlying permit, and all "special operating conditions or restrictions of the permit have been met.

Program Test Authority Is Requested.

As this is a directional AM station, automatic program test authority was not granted. However, as this is a licensed facility operating with modification of facilities (as authorized in the construction permit), the station is currently operating under the provisions of 47 CFR §73.1615(b)(6) and §73.1615 (c), "Operation During Modification Of Facilities."

In order to cover continual operation while this application is pending, issuance of Program Test Authority, utilizing the operating parameters provided within this application is requested.

Computer Modeling - Array Analysis - Antenna Performance Verification

Analysis of the antenna systems (daytime and nighttime) were performed using the computer program "Expert Mininec Broadcast Professional" Version 12.7 by EM Scientific, Inc.

The antenna model was adjusted to produce the same matrix impedances as those measured at the base of the tower(s) by varying the electrical height of the radiators and adding lumped inductive loads in series with the radiators (utilizing the "lumped load" capabilities of the software program.)

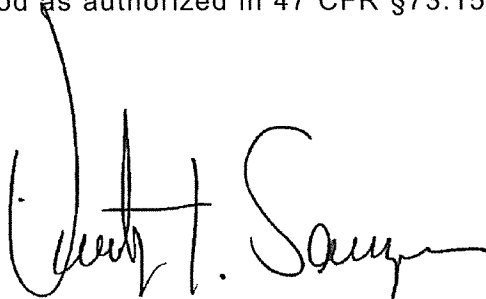
Once the computer model was adjusted to match the measured matrix impedances, the array synthesis module of the computer program was used to calculate the proper base drive voltages to generate the fields necessary to form the required pattern for both daytime and nighttime operation.

The current distributions was calculated for each radiator and given that the sampling system utilizes base current sampling devices, the operating parameters were calculated from the resulting currents at each base node.

Summary

As demonstrated in the following tables/figures/exhibits contained within this application, WFNW (AM) has fully met the conditions of its underlying authorization and is ready for station licensing using the computer modeling and sampling system verification method as authorized in 47 CFR §73.151(c).

December 15, 2013

A handwritten signature in black ink, appearing to read "Timothy Z. Sawyer". The signature is fluid and cursive, with a large initial "T" and "S".

Timothy Z. Sawyer, Consulting Engineer

Mullaney Engineering, Inc.
9049 Shady Grove Court
Gaithersburg, MD 20877
E-mail to : tzsawyer@mullengr.com
Direct Telephone Number: 202-642-2130
General Office Telephone: 301-921-0115

SECTION I

DESCRIPTION OF RADIATORS

WFNW (AM) employs THREE uniform cross-section, guyed steel, series fed towers to form its broadcast directional antenna systems. All three towers are in use by the daytime and nighttime directional antenna systems. There are no unused towers in the system.

Towers 1 and 3 are identical in physical characteristics 66.0 electrical degrees in length at 1380 kilohertz. The center tower, tower 2 is slightly longer at 70.8 electrical degrees in length at 1380 kilohertz.

All towers/radiators are triangular, uniform cross-section with an effective face width of 203.2 centimeters (80 inches).

The radiator length (above base insulator) is 39.8 meters for towers 1 and 3, and 42.7 meters for tower 2.

The physical overall tower heights above ground (including base insulator and pier) are 40.3 meters for towers 1 and 3, and 43.2 meters for tower 2. No lighting or marking of the structures is required (i.e., no top light).

The equivalent radius calculated for the towers for use in the computer model of the antenna system is 0.97 meters using the following formula:

$$R = \frac{1}{2} \times \frac{3F}{\pi}$$

where: R= Equivalent radius = 0.97 meters

F= Tower face width = 203.2 cm (80 inches).

The equivalent radius calculated above is employed in the model for all towers without any adjustments.

SECTION II

DESCRIPTION OF SAMPLING SYSTEM

The installed sampling system uses identical Delta TCT-3 precision toroidal current transformers at the base of each tower connected to equal lengths of phase stabilized 3/8-inch foam dielectric, solid outer jacket, coaxial cable connected to a Potomac Instruments AM-19 (204), Serial number: 395, antenna monitor.

The toroidal current sampling transformers produce 1V per 1 ampere of radio frequency current.

All sampling lines are buried and exposed to similar environmental conditions.

The sampling lines were verified to be of equal electrical length by frequency resonating the open circuit transmission line using a signal generator and an R.F. impedance bridge. The system meets the Commission's standards and rules for an "approved" sampling system.

The complete details of the verification and electrical characteristics of the sampling system are contained in Section VI.

SECTION III

MEASURED AND MODELED MATRIX IMPEDANCES

Measurements were made by Timothy Z. Sawyer of Mullaney Engineering Inc., using a Delta OIB-3 operating R.F. Impedance bridge in conjunction with a Potomac Instruments RX/SD-31 signal generator and detector. Each tower was driven while all other towers were floated (open circuit).

Measurements were made at the output of each antenna tuning unit immediately adjacent to the base sampling system transformers.

Measured Impedance Values

TOWER	RESISTANCE (OHMS)	REACTANCE (OHMS)
1 DAY 1 NIGHT	22.1	5.8
2 DAY 2 NIGHT	26.0	11.7
3 DAY 3 NIGHT	22.0	1.4

Modeled Impedance Values

TOWER	RESISTANCE (OHMS)	REACTANCE (OHMS)
1 DAY 1 NIGHT	21.9	5.7
2 DAY 2 NIGHT	25.6	11.5
3 DAY 3 NIGHT	21.9	1.4

Modeled values are within FCC limits of +/- 2 ohms and +/- 4% of measured values.

Modeled Tower Height and Radius

TOWER	ACTUAL HEIGHT (DEG)	MODELED HEIGHT (DEG)	TOWER HEIGHT (%)	ACTUAL RADIUS (m)	MODELED RADIUS (m)	TOWER RADIUS (%)
1 D 1N	66.0	73.6	111.5	0.97	0.97	100.0
2 D 2N	70.8	78.0	110.2	0.97	0.97	100.0
3 D 3N	66.0	73.6	111.5	0.97	0.97	100.0

Modeled height is within FCC limits of 75% to 125% of actual value.

Modeled radius is within FCC limits of 80% to 150% of actual value.

WFNW TOWER 1 DRIVEN - ALL OTHERS "FLOATING"

\Dropbox\M-O-M Data\WFNW\NON DA TOWERS\tower 1 measured

IMPEDANCE

normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1,380.	21.927	5.7293	22.663	14.6	2.3172	-8.0222	-.74524

INPUT FILE

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	71.6	340.	0	.97	10
		71.6	340.	73.6		
2	none	0	0	0	.97	10
		0	0	78.		
3	none	74.8	160.	0	.97	10
		74.8	160.	73.6		

Number of wires = 3
current nodes = 30

	minimum	maximum
Individual wires	wire value	wire value
segment length	1 7.36	2 7.8
radius	1 .97	1 .97

ELECTRICAL DESCRIPTION

Frequencies (KHz)

no.	frequency	step	no. of steps	segment length (wavelengths)
	lowest			minimum maximum
1	1,380.	0	1	.0204444 .0216667

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	42.6	0	0	0
2	11	0	-10,000.	0	0	0
3	21	0	-10,000.	0	0	0

PROBLEM DEFINITION EVALUATION

maximum frequency = 1,380. KHz
shortest wavelength = 217.246 meters
number of wires = 3

INDIVIDUAL WIRES

segment length to wavelength ratio: No detected violations!
segment length to radius ratio: No detected violations!
radius to wavelength ratio: No detected violations!
checking for wires in ground plane: No detected violations!

WIRE JUNCTIONS

junction segment length ratio: No detected violations!
junction radius ratio: No detected violations!
ELECTRICAL DESCRIPTION: No detected violations!

WFNW TOWER 2 DRIVEN - ALL OTHERS "FLOATING"

\Dropbox\M-O-M Data\WFNW\NON DA TOWERS\tower 2 measured

IMPEDANCE

normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 11, sector 1							
1,380.	25.559	11.545	28.045	24.3	2.0943	-9.0287	-.58023

INPUT FILE

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	71.6	340.	0	.97	10
		71.6	340.	73.6		
2	none	0	0	0	.97	10
		0	0	78.		
3	none	74.8	160.	0	.97	10
		74.8	160.	73.6		

Number of wires = 3
current nodes = 30

	minimum	maximum
Individual wires	wire	value
segment length	1	7.36
radius	1	.97

ELECTRICAL DESCRIPTION

Frequencies (KHz)

no.	frequency	step	no. of steps	segment length (wavelengths)
	lowest			minimum maximum
1	1,380.	0	1	.0204444 .0216667

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	-10,000.	0	0	0
2	11	0	35.	0	0	0
3	21	0	-10,000.	0	0	0

PROBLEM DEFINITION EVALUATION

maximum frequency = 1,380. KHz

shortest wavelength = 217.246 meters

number of wires = 3

INDIVIDUAL WIRES

segment length to wavelength ratio: No detected violations!
segment length to radius ratio: No detected violations!
radius to wavelength ratio: No detected violations!
checking for wires in ground plane: No detected violations!

WIRE JUNCTIONS

junction segment length ratio: No detected violations!
junction radius ratio: No detected violations!

ELECTRICAL DESCRIPTION: No detected violations!

WFNW TOWER 3 DRIVEN - ALL OTHERS "FLOATING"

\Dropbox\M-O-M Data\WFNW\NON DA TOWERS\tower 3 measured

IMPEDANCE

normalization = 50.
freq resist react impd phase VSWR S11 S12
(KHz) (ohms) (ohms) (ohms) (deg) dB dB
source = 1; node 21, sector 1
1,380. 21.916 1.408 21.961 3.7 2.2837 -8.1581 -.72026

INPUT FILE

GEOMETRY

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	71.6	340.	0	.97	10
		71.6	340.	73.6		
2	none	0	0	0	.97	10
		0	0	78.		
3	none	74.8	160.	0	.97	10
		74.8	160.	73.6		

Number of wires = 3
current nodes = 30

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	1	7.36	2	7.8
radius	1	.97	1	.97

ELECTRICAL DESCRIPTION

Frequencies (KHz)

frequency		step	no. of steps	segment length (wavelengths)	
no.	lowest			minimum	maximum
1	1,380.	0	1	.0204444	.0216667

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	-10,000.	0	0	0
2	11	0	-10,000.	0	0	0
3	21	0	38.2	0	0	0

PROBLEM DEFINITION EVALUATION

maximum frequency = 1,380. KHz
shortest wavelength = 217.246 meters
number of wires = 3

INDIVIDUAL WIRES

segment length to wavelength ratio: No detected violations!
segment length to radius ratio: No detected violations!
radius to wavelength ratio: No detected violations!
checking for wires in ground plane: No detected violations!

WIRE JUNCTIONS

junction segment length ratio: No detected violations!
junction radius ratio: No detected violations!
ELECTRICAL DESCRIPTION: No detected violations!

SECTION IV
DAYTIME ANTENNA SYSTEM
OPERATING PARAMETERS DERIVED FROM MODELED CURRENTS

TOWER NUMBER SITE	BASE CURRENT	BASE CURRENT PHASE	RATIO	PHASE
1 DAY	7.30568	238.6	0.691	-124.7
2 DAY (ref)	10.5737	3.3	1.000	0.0
3 DAY	7.9299	109.8	0.750	+106.5

DAYTIME CALCULATED DRIVE VOLTAGES AND CURRENTS AND IMPEDANCES

\Dropbox\M-O-M Data\WFWN\DAY\WFWNWDAY
MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1380 KHz

	field ratio	
tower	magnitude	phase (deg)
1	.685	-123.
2	1.	0
3	.685	107.

VOLTAGES AND CURRENTS - rms

source	voltage		current	
node	magnitude	phase (deg)	magnitude	phase (deg)
1	316.646	315.2	7.30568	238.6
11	286.748	51.1	10.5737	3.3
21	144.279	74.2	7.9299	109.8

Sum of square of source currents = 456.12

Total power = 3,500. watts

INPUT FILE

\Dropbox\M-O-M Data\WFWN\DAY\WFWNWDAY
WFWN DAYTIME

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	71.6	340.	0	.97	10
		71.6	340.	73.6		
2	none	0	0	0	.97	10
		0	0	78.		
3	none	74.8	160.	0	.97	10
		74.8	160.	73.6		

Number of wires = 3
current nodes = 30

	minimum	maximum
Individual wires	wire value	wire value
segment length	1 7.36	2 7.8
radius	1 .97	1 .97

PROBLEM DEFINITION EVALUATION

maximum frequency = 1,380. KHz

shortest wavelength = 217.246 meters

number of wires = 3

INDIVIDUAL WIRES

segment length to wavelength ratio: No detected violations!

segment length to radius ratio: No detected violations!

radius to wavelength ratio: No detected violations!

checking for wires in ground plane: No detected violations!

WIRE JUNCTIONS

junction segment length ratio: No detected violations!

junction radius ratio: No detected violations!

ELECTRICAL DESCRIPTION: No detected violations!

ELECTRICAL DESCRIPTION

Frequencies (KHz)

no.	frequency lowest	step	no. of steps	segment length minimum	(wavelengths) maximum
1	1,380.	0	1	.0204444	.0216667

Sources

source	node	sector	magnitude	phase	type
1	1	1	446.799	315.2	voltage
2	11	1	405.523	51.1	voltage
3	21	1	204.043	74.2	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	42.6	0	0	0
2	11	0	35.	0	0	0
3	22	0	38.2	0	0	0

\Dropbox\M-O-M Data\WFWN\DAY\WFWNWDAY

IMPEDANCE

normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1,380.	9.8008	42.387	43.505	77.	8.851	-1.9711	-4.3791
source = 2; node 11, sector 1							
1,380.	18.268	20.297	27.307	48.	3.2453	-5.5327	-1.425
source = 3; node 21, sector 1							
1,380.	14.925	-10.561	18.283	324.7	3.5135	-5.0847	-1.6123

\Dropbox\M-O-M Data\WFWN\DAY\WFWNWDAY
 CURRENT rms
 Frequency = 1380 KHz
 Input power = 3,500. watts
 Efficiency = 100. %
 coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	67.282	24.4886	0	7.30568	238.6	-3.84984	-6.2225
2	67.282	24.4886	7.36	7.18418	237.4	-3.86603	-6.05527
3	67.282	24.4886	14.72	6.97665	237.1	-3.79355	-5.85514
4	67.282	24.4886	22.08	6.61665	236.8	-3.625	-5.5353
5	67.282	24.4886	29.44	6.11908	236.6	-3.37138	-5.10656
6	67.282	24.4886	36.8	5.48869	236.4	-3.0371	-4.57184
7	67.282	24.4886	44.16	4.73097	236.3	-2.6264	-3.93499
8	67.282	24.4886	51.52	3.84993	236.2	-2.14253	-3.19868
9	67.282	24.4886	58.88	2.8418	236.1	-1.58431	-2.35919
10	67.282	24.4886	66.24	1.70817	236.1	-.953538	-1.41725
END	67.282	24.4886	73.6	0	0	0	0
GND	0	0	0	10.5737	3.3	10.5411	.574989
12	0	0	7.8	10.1606	1.5	10.157	.271185
13	0	0	15.6	9.75165	.7	9.75091	.11961
14	0	0	23.4	9.16075	0.0	9.16074	6.71E-03
15	0	0	31.2	8.3993	359.5	8.39896	-.0755217
16	0	0	39.	7.47256	359.	7.47141	-.130954
17	0	0	46.8	6.38879	358.6	6.38676	-.161086
18	0	0	54.6	5.15537	358.1	5.15268	-.166504
19	0	0	62.4	3.77059	357.8	3.76773	-.146902
20	0	0	70.2	2.23667	357.4	2.23435	-.101943
END	0	0	78.	0	0	0	0
GND	-70.289	-25.5831	0	7.9299	109.8	-2.64952	7.47788
22	-70.289	-25.5831	7.36	7.8832	108.2	-2.46821	7.48684
23	-70.289	-25.5831	14.72	7.27759	107.6	-2.19672	6.93814
24	-70.289	-25.5831	22.08	6.71033	107.	-1.95976	6.41778
25	-70.289	-25.5831	29.44	6.05836	106.4	-1.7148	5.81061
26	-70.289	-25.5831	36.8	5.3227	105.9	-1.46084	5.11831
27	-70.289	-25.5831	44.16	4.50399	105.4	-1.19833	4.34165
28	-70.289	-25.5831	51.52	3.60423	104.9	-.928842	3.48249
29	-70.289	-25.5831	58.88	2.61936	104.4	-.652948	2.53667
30	-70.289	-25.5831	66.24	1.55062	103.9	-.37263	1.50518
END	-70.289	-25.5831	73.6	0	0	0	0

SECTION V

NIGHTTIME ANTENNA SYSTEM

OPERATING PARAMETERS DERIVED FROM MODELED CURRENTS

TOWER NUMBER SITE	BASE CURRENT	BASE CURRENT PHASE	RATIO	PHASE
1 NIGHT	6.38514	168.6	0.735	+167.7
2 NIGHT(ref)	8.68749	0.9	1.000	0
3 NIGHT	5.17905	199.2	0.596	-161.7

NIGHTTIME CALCULATED DRIVE VOLTAGES AND CURRENTS AND IMPEDANCES

\Dropbox\M-O-M Data\WFWN\NIGHT\WFWNNIGHT

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1380 KHz

	field ratio	
tower	magnitude	phase (deg)
1	.64	168.
2	1.	0
3	.575	-160.

VOLTAGES AND CURRENTS - rms

source	voltage		current	
node	magnitude	phase (deg)	magnitude	phase (deg)
1	33.1016	225.9	6.38514	168.6
11	212.458	79.8	8.68749	.9
21	62.667	310.7	5.17905	199.2

Sum of square of source currents = 286.13

Total power = 350. watts

INPUT FILE

\Dropbox\M-O-M Data\WFWN\NIGHT\WFWNNIGHT
WFWN NIGHTTIME

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	71.6	340.	0	.97	10
		71.6	340.	73.6		
2	none	0	0	0	.97	10
		0	0	78.		
3	none	74.8	160.	0	.97	10
		74.8	160.	73.6		

Number of wires = 3
current nodes = 30

	minimum	maximum
Individual wires	wire	wire
segment length	1	2
radius	1	1
	value	value
	7.36	7.8
	.97	.97

PROBLEM DEFINITION EVALUATION

maximum frequency = 1,380. KHz

shortest wavelength = 217.246 meters

number of wires = 3

INDIVIDUAL WIRES

segment length to wavelength ratio: No detected violations!

segment length to radius ratio: No detected violations!

radius to wavelength ratio: No detected violations!

checking for wires in ground plane: No detected violations!

WIRE JUNCTIONS

junction segment length ratio: No detected violations!

junction radius ratio: No detected violations!

ELECTRICAL DESCRIPTION: No detected violations!

ELECTRICAL DESCRIPTION

Frequencies (KHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1,380.	0	1	.0204444	.0216667

Sources

source	node	sector	magnitude	phase	type
1	1	1	46.8128	225.9	voltage
2	11	1	300.461	79.8	voltage
3	21	1	88.6246	310.7	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	42.6	0	0	0
2	11	0	35.	0	0	0
3	22	0	38.2	0	0	0

\\Dropbox\\M-O-M Data\\WFWN\\NIGHT\\WFWNNIGHT

IMPEDANCE

normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1,380.	2.8076	4.4047	5.2234	57.5	17.947	-.96894	-6.9903
source = 2; node 11, sector 1							
1,380.	4.7395	24.075	24.537	78.9	13.013	-1.3375	-5.7664
source = 3; node 21, sector 1							
1,380.	-4.4209	11.315	12.148	111.3	****	****	****

\Dropbox\M-O-M Data\WFWN\NIGHT\WFWNNIGHT
 CURRENT rms
 Frequency = 1380 KHz
 Input power = 350. watts
 Efficiency = 100. %
 coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	67.282	24.4886	0	6.38514	168.6	-6.20361	1.27387
2	67.282	24.4886	7.36	5.87272	168.1	-5.74748	1.20639
3	67.282	24.4886	14.72	5.53635	168.	-5.41549	1.15049
4	67.282	24.4886	22.08	5.12573	167.9	-5.01158	1.07573
5	67.282	24.4886	29.44	4.64367	167.8	-4.53837	.983286
6	67.282	24.4886	36.8	4.08955	167.7	-3.99523	.873254
7	67.282	24.4886	44.16	3.46628	167.6	-3.38501	.746192
8	67.282	24.4886	51.52	2.77679	167.5	-2.71062	.602546
9	67.282	24.4886	58.88	2.01915	167.4	-1.97025	.441637
10	67.282	24.4886	66.24	1.19543	167.3	-1.16599	.263657
END	67.282	24.4886	73.6	0	0	0	0
GND	0	0	0	8.68749	.9	8.65199	.139005
12	0	0	7.8	8.37234	.5	8.37201	.0743175
13	0	0	15.6	8.05271	.3	8.05261	.041356
14	0	0	23.4	7.5745	.1	7.57449	.0160136
15	0	0	31.2	6.94972	360.	6.94972	-3.28E-03
16	0	0	39.	6.18439	359.8	6.18437	-.0172292
17	0	0	46.8	5.28679	359.7	5.28673	-.0259914
18	0	0	54.6	4.26431	359.6	4.26421	-.0295326
19	0	0	62.4	3.1168	359.5	3.11668	-.0276222
20	0	0	70.2	1.84718	359.4	1.84707	-.0200174
END	0	0	78.	0	0	0	0
GND	-70.289	-25.5831	0	5.17905	199.2	-4.86331	-1.71027
22	-70.289	-25.5831	7.36	5.28542	199.7	-4.97486	-1.78505
23	-70.289	-25.5831	14.72	4.95511	199.9	-4.65844	-1.68878
24	-70.289	-25.5831	22.08	4.62514	200.1	-4.34379	-1.58852
25	-70.289	-25.5831	29.44	4.21841	200.2	-3.95808	-1.45897
26	-70.289	-25.5831	36.8	3.73849	200.4	-3.50461	-1.30154
27	-70.289	-25.5831	44.16	3.18743	200.5	-2.98537	-1.11683
28	-70.289	-25.5831	51.52	2.56774	200.6	-2.40281	-.905442
29	-70.289	-25.5831	58.88	1.87729	200.8	-1.75509	-.666223
30	-70.289	-25.5831	66.24	1.11763	200.9	-1.04385	-.399335
END	-70.289	-25.5831	73.6	0	0	0	0

SECTION VI

MEASURED AND CALCULATED SAMPLING LINE CHARACTERISTICS

Impedance measurements were made of the antenna monitor sampling system using a Delta Electronics OIB-3 R.F. Impedance bridge and a Potomac Instruments RX/SD-31 signal generator and detector.

The measurements were made looking into the antenna monitor ends of the sampling lines outbound to the towers in the follow modes:

1. Open circuited at the respective tower ends (not connected to the sampling devices) to determine then antenna sampling line length, and; 2. With the sampling lines connected to the sampling devices at the tower bases to determine the sampling system impedance at carrier frequency.

The table below shows the frequencies above and below the carrier frequency where resonance (zero reactance with low resistance) occurred.

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 90 electrical degrees.

The electrical lengths of the sampling lines at carrier frequency were calculated by ratio of the resonance frequency with the carrier frequency and multiplying the result by 90 degrees.

TOWER	RESONANCE BELOW 1380 KHZ 90 degrees (KHZ)	ELECTRICAL LENGTH AT 1380 KHZ (DEGREES)	MEASURED IMPEDANCE WITH SAMPLING DEVICES CONNECTED * (OHMS AT CARRIER)
1	1137.5	109.19	50.5 -j 0.1
2	1133.0	109.62	50.0 -j0.8
3	1138.0	109.14	50.5 -j0.5

* Measured Sampling System Impedance at 1380 KHZ.

The sampling line lengths meet the requirement that they be equal in length within 1 electrical degree, maximum deviation as measured is 0.48 degrees. (109.14 to 109.62 degrees)

The measured impedance of the sampling system fully connected at carrier frequency is within the allowable tolerance of +/- 2 ohms (48 to 52 ohms) as indicated in the table above.

The characteristic impedance of the sampling line (by itself) was also measured at -45 degrees and + 45 degrees from the nearest resonate frequency to the carrier (90 degrees).

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

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

TOWER (SAMPLING LINE)	-45 DEGREE OFFSET FREQUENCY (KHZ)	-45 DEGREE MEASURED IMPEDANCE (OHMS)	+45 DEGREE OFFSET FREQUENCY (KHZ)	+45 DEGREE MEASURED IMPEDANCE (OHMS)	CALCULATED IMPEDANCE ANTENNA SAMPLING LINE ONLY (OHMS)
1	947.9	5.5 +j50.24	1327.1	3.5 -j50.43	50.55
2	944.2	4.8 +j50.03	1321.8	3.5 -j50.24	50.31
3	948.3	5.8 +j50.24	1327.7	3.4 -j49.80	50.25

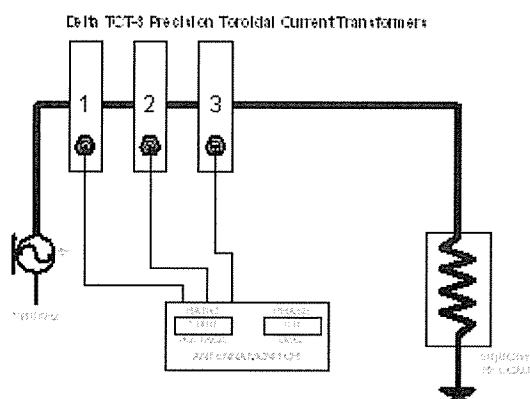
The measured characteristic impedance of the sampling line is within +/- 2 ohms. Maximum measured deviation is 0.30 ohm (50.25 to 50.55 ohms)

SECTION VII

SAMPLING SYSTEM TRANSFORMER CALIBRATION

The toroidal current transformers were set up adjacent to each other on a common conductor as shown below. The transmitter was adjusted to supply approximately 0.25 kilowatt at 1380 kilohertz to the 50 ohm load. The sampling output from the tower #1 transformer was fed into the reference channel of the Potomac Instruments antenna monitor. The sampling output from the other transformers was alternately fed into channel two of the antenna monitor. The coaxial interconnection cables used from the transformers to the antenna monitor were of equal length and characteristics.

Prior to this test, the antenna monitor was checked using the internal self-check, and calibration procedures as specified by the manufacturer and found to be operating correctly.



ALL SAMPLING DEVICES (TRANSFORMERS) ARE DELTA ELECTRONICS TCT-3

ANTENNA MONITOR		
TOWER	INDICATED LOOP /RATIO	INDICATED PHASE
1 TCT-3 SN #2018	100 / 1.000	0.0
2 TCT-3 SN #2479	99.8 / 0.998	-0.2
3 TCT-3 SN #2481	99.9 / 0.999	-0.6

The manufacturer's specifications for the Delta Electronics TCT-3 sampling transformers is 2% magnitude accuracy and +/- 2.0 absolute degrees. The units as measured, are well within the manufacturer's specifications, and are operating correctly.

SECTION VIII
REFERENCE FIELD STRENGTH MEASUREMENTS - WFNW

Reference field strength measurements were made using Potomac Instruments field strength meters FIM-41 of known calibration at three (locations) along each of the azimuths as required by the Commission's rules.

The measured field strengths and descriptions and GPS coordinates for the reference MEASUREMENTS points (locations) are tabulated on the following pages.

All measurements were made during normal daylight hours, within the period of 2-hours after sunrise and 2-hours before sunset. Measurements were made by Timothy Z. Sawyer of Mullaney Engineering Inc., Gaithersburg, Maryland.

Reference Field Strength Measurements

WFNW - DAY

Radial: 87.1 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.28	8.8	41.512098 -73.015273	CLARK HILL ROAD
2	5.82	3.8	41.513257 -72.984797	WATERBURY ROAD
3	10.68	1.0	41.515427 -72926498	STATE ROAD 70/ WATERBURY ROAD (900 BLOCK)

Radial: 132.0 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.14	18.0	41.491762 -73.026568	MAY STREET NORTH OF CURVE
2	6.18	4.5	41.473482 -72.999466	STRAITSVILLE ROAD (200 BLOCK)
3	9.68	2.5	41.452328 -72.968289	STATE ROAD 69/CARRINGTON ROAD, NORTH OF WOODCUTTERS DRIVE

Measurements Made on December 12, 2013

T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - DAY

Radial: 160.0 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.77	12.0	41.470348 -73.034995	NEW HAVEN ROAD, EAST OF HAZEL AVENUE
2	7.07	5.00	41.450912 -73.025569	STATE ROAD 42 LASKY ROAD, WEST OF CURVE
3	9.01	3.10	41.434510 -73.017567	FALLS ROAD, EAST OF TAWNEY DRIVE

Radial: 188.0 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.24	21.0	41.481779 -73.059970	LEWIS STREET, SOUTH OF OLIVE STREET
2	7.21	4.00	41.446450 -73.066586	CHURCH ST & N. MAIN STREET (NEAR POLICE STATION)
3	9.39	2.50	41.427052 -73.070170	PINESBRIDGE ROAD, WEST OF INTERSECTION

Measurements Made on December 12, 2013

T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - DAY

Radial: 232.9 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.08	8.9	41.493945 -73.084009	RUBBER AVENUE AT FIELD STREET
2	5.14	5.6	41.482729 -73.103788	GRISWOLD ROAD, NORTH OF GUNNTOWN ROAD
3	10.01	2.0	41.4563.16 -73.150284	OXFORD ROAD, NORTH OF TOWNER LANE

Radial: 340.0 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.31	50.0	41.547037 -73.072262	CHASE PARKWAY AT UTILITY (AT&T?) BUILDING NORTH
2	6.68	24.5	41.567045 -73.081987	227 FOREST HILL ROAD
3	9.37	9.50	41.589776 -73.093069	670 MAIN STREET (STATE ROAD 73)

Measurements Made on December 12, 2013
T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - NIGHT

Radial: 26.5 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.11	3.8	41.543716 -73.032552	WASHINGTON STREET AT FAIRMOUNT STREET
2	6.39	2.2	41.562052 -73.020308	LONG HILL ROAD, WEST OF TRAVERS STREET
3	11.79	0.5	41.605528 -72.991278	BEACH ROAD, EAST OF CHASSE ROAD, PASSED CURVE

Radial: 56.9 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.43	4.50	41.532391 -73.009989	PROSPECT ROAD, 150 FEET NORTH OF INTERSECTION WITH HAMILTON AVENUE
2	7.24	1.00	41.546184 -72.981650	E MAIN STREET, 250 FEET EAST OF NORRIS STREET
3	10.64	0.28	41.562830 -72.947410	EAST STREET, 180 FEET NORTH OF ALMA AVENUE

Measurements Made on December 14, 2013
T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - NIGHT

Radial: 85.0 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	5.68	1.50	41.515081 -72.986570	WATERBURY ROAD (SR69), 120 FEET SOUTHEAST OF KNAPP DRIVE
2	10.37	0.25	41.518725 -72.930538	WATERBURY ROAD (SR70) AT CURVE NORTH OF WOODBRIDGE CIRCLE
3	13.17	0.10	41.520861 -72.897067	HIGHLAND AVENUE - 550 FEET SOUTH OF STONY HILL ROAD

Radial: 160.0 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.77	16.8	41.470348 -73.034995	NEW HAVEN ROAD, EAST OF HAZEL AVENUE
2	7.07	9.20	41.450912 -73.025569	STATE ROAD 42 LASKY ROAD, WEST OF CURVE
3	9.01	4.50	41.434510 -73.017567	FALLS ROAD, EAST OF TAWNEY DRIVE

Measurements Made on December 14, 2013
T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - NIGHT

Radial: 235.0 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.14	3.80	41.494424 -73.085482	RUBBER AVENUE, 420 FEET WEST OF FIELD STREET
2	5.08	1.8	41.484442 -73.104493	GUNNTOWN ROAD, 50 FEET SOUTH OF TOWANTIC HILL ROAD
3	10.00	0.15	41.459009 -73.152869	OXFORD ROAD, 200 FEET NORTHWEST OF OLD INTERSECTION (OLD STATE ROAD)

Radial: 263.1 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	3.47	8.50	41.506899 -73.095905	KRODEL ROAD, 200 FEET NORTH OF BOSCO DRIVE
2	4.77	3.20	41.505460 -73.111381	SOUTH STREET AT CURVE
3	8.34	0.55	41.501585 -73.153921	SOUTHFORD ROAD, 650 FEET SOUTHWEST OF BENSON ROAD

Measurements Made on December 14, 2013

T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

Reference Field Strength Measurements

WFNW - NIGHT

Radial: 293.5 degrees True (Construction Permit Radial)

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.50	2.50	41.526791 -73.104113	WITTMORE ROAD, 225 FEET EAST OF ALGIN DRIVE
2	6.31	1.5	41.533256 -73.124113	MIDDLEBURY ROAD (SR64), 50 FEET SOUTH OF CEMETERY ROAD
3	13.12	0.55	41.557610 -73.199180	MAIN STREET (US HWY 6) 230 FEET SOUTH OF FLANDERS ROAD

Radial: 340.0 degrees True

Point	Distance (km)	Field (mV/m)	Geographical Coordinates (NAD 83)	Description
1	4.31	6.80	41.547037 -73.072262	CHASE PARKWAY AT UTILITY (AT&T?) BUILDING NORTH
2	6.68	2.50	41.567045 -73.081987	227 FOREST HILL ROAD
3	9.37	0.75	41.589776 -73.093069	670 MAIN STREET (STATE ROAD 73)

Measurements Made on December 14, 2013

T.Z. Sawyer, Mullaney Engineering, Inc.

Reference field strength measurement locations shall be established in directions of pattern minima and maxima. On each radial corresponding to a pattern minimum or maximum, there shall be at least three measurement locations. The license application shall include the measured field strength values at each reference point, along with a description of each measurement location, including GPS coordinates and datum reference.

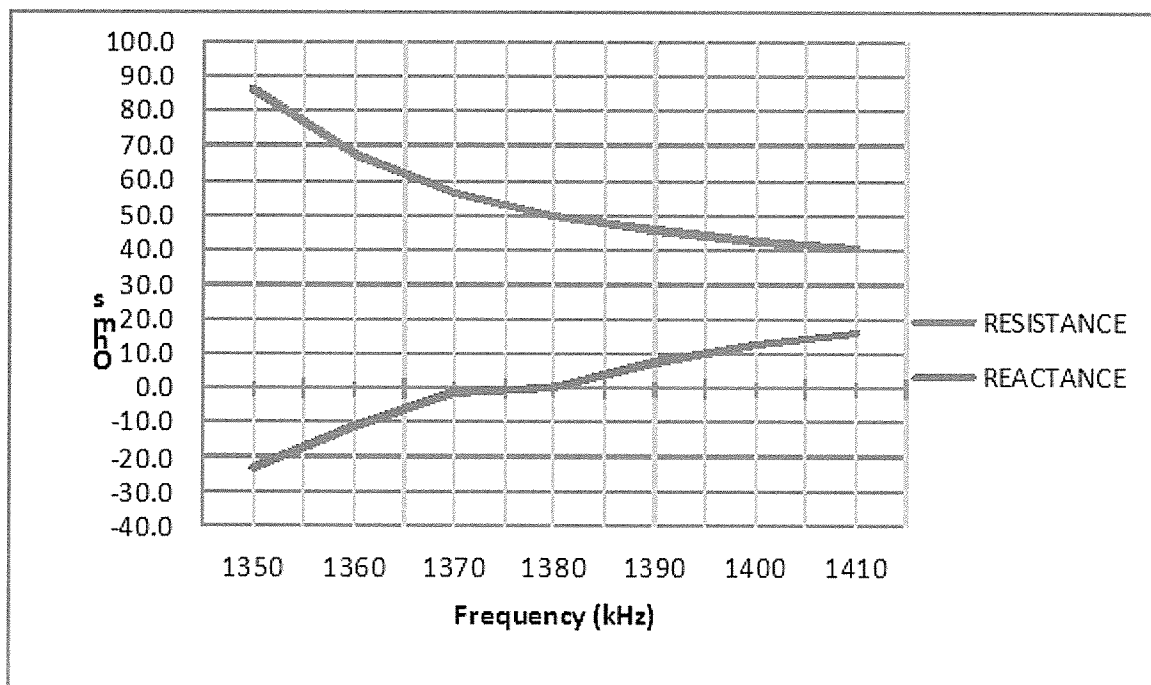
SECTION IX

DIRECT MEASUREMENT OF POWER

Following adjustment of the directional antenna arrays, the common point impedance (day and night) was measured by this office and set to 50 ohms $j0$ utilizing an in-line Delta Electronics RF operating impedance bridge. Prior to the measurement and adjustment the operating impedance bridge was checked and found to be operating correctly and within the manufacturers specifications.

DAYTIME COMMON POINT IMPEDANCE MEASUREMENTS

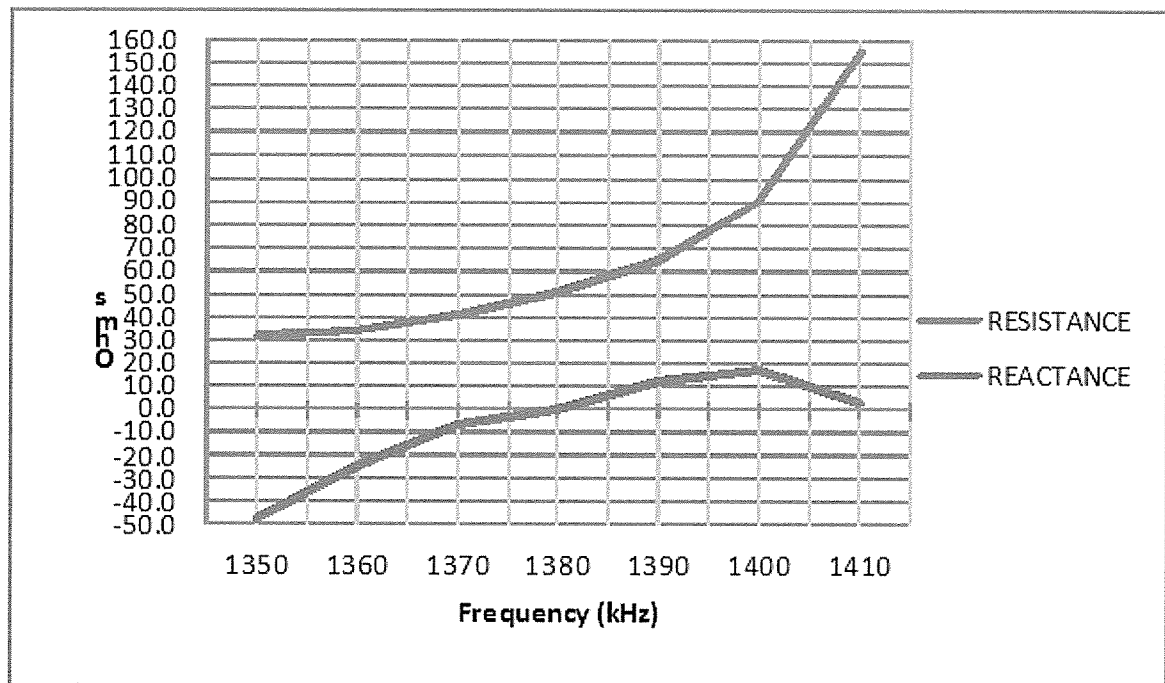
FREQUENCY (KHZ)	RESISTANCE (OHMS)	REACTANCE (OHMS)
1350	86.5	-23.0
1360	67.5	-11.6
1370	56.5	-1.4
1380	50.0	0.0
1390	45.5	7.6
1400	42.5	12.6
1410	40.5	16.2



DIRECT MEASUREMENT OF POWER

NIGHTTIME COMMON POINT IMPEDANCE MEASUREMENTS

FREQUENCY (KHZ)	RESISTANCE (OHMS)	REACTANCE (OHMS)
1350	31.0	-47.9
1360	33.0	-25.2
1370	40.0	-6.9
1380	50.0	0.0
1390	64.0	11.8
1400	90.0	17.5
1410	155.0	3.5



SECTION X

ENVIRONMENTAL STATEMENT

The station has suitable fences installed about the base of each tower/radiator as required by the Commission's rules and regulations, and is on full compliance with the guidelines contained within OET Bulletin Number 65 concerning exposure to non-ionizing radiation to workers or the general public.

The towers do not require FCC tower registration. Suitable warning signs have been installed on each of the fences warning of the possible danger to exposure to non-ionizing radiation.

APPENDIX A

CERTIFIED POST CONSTRUCTION ARRAY GEOMETRY SURVEY

A certification (stamped/sealed letter) of the array geometry is included herein as well as a general plat of the site.

There are no errors in the array geometry that would require modification of the underlying permit.

Measurements are reference to the center tower of the array - Tower 2.

TOWER	CP DISTANCE (FT)	AS BUILT DISTANCE (FT)	CP BEARING (DEGREES)	AS BUILT BEARING (DEGREES)
1 NW	141' 9"	142' 0 " (+3" error)	340.0 T.	340.0 T.
2 CENTER	0	0	0	0
3 SE	148' 1"	148' 0" (-1" error)	160.0 T.	160.0 T.

(See next two pages for certification letter of array geometry and general site plat.)



December 19, 2013

Mr. Candido Dias Carrelo
Spring Street,
Naugatuck, CT 06770

RE: Relocation of Radio Towers
Mallane Lane
Naugatuck, CT 06770

Dear Mr. Carrelo,

A review of the post-construction tower location(s) used by WFNW indicates the following:

The tower locations on the property with respect to each other are as follows:

With Tower 2 (the center tower) as reference, Tower 1 is located 142 feet distant on a true bearing of 340 degrees true.

With Tower 2 (the center tower) as reference, Tower 3 is located 148 feet distant on a true bearing of 160 degrees true.

Sincerely

A handwritten signature in black ink, appearing to read "T. Grajewski", followed by a long, horizontal, wavy line.

Tomek Grajewski, P.E.
V-President



cc: Peter D'Amico, Esq. - Rockwell
cc: John J. D'Amico, Esq. - Rockwell
cc: [illegible]

