Federal Communications Commission
Washington, D. C. 20554

Approved by OMB
3060-0627

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.

SECTION I - APPLICANT FEE INFORMATION

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

Byrnes, Brian - Receiver

MAILING ADDRESS (Line 1) (Maximum 35 characters)

46110 Whitewood Avenue

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
New Buffalo	MI	49117

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(312) 912-7908	WBGX(AM)	40147

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	$ 645	

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
	0 0 0 1	$	

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
$ 645	

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SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Brian Byrnes, Receiver		
MAILING ADDRESS 46110 Whitewood Avenue		
CITY New Buffalo	STATE MI	ZIP CODE 49117

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
WBGX(AM)	Harvey, IL	NA		

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

☐ Yes ☐ No

If No, explain in an Exhibit.

Exhibit No. NA

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. NA

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

☐ Yes ☐ No

If Yes, explain in an Exhibit.

Exhibit No. NA

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

☐ Yes ☐ No

☑ Does not apply

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☑ No

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

Exhibit No.

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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	
Brian Byrnes	Brian Byrnes	
Title	Date	Telephone Number
Receiver	02/17/2023	(312) 912-7908

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 REQUIRED BY 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 take from 4 to 20 hours 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. If you have any comments on this burden estimate, or how we can improve the collection and reduce the burden it causes you, please e-mail them to pra@fcc.gov or send to the Federal Communications Commission, AMD-PERM, Paperwork Reduction Project (3060-0627), Washington, DC 20554. Do NOT send completed forms to this address. Remember - you are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number or if we fail yo provide you with this notice. This collection has been assigned an OMB control number of 3060-0627.

THE FOREGOING NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, P.L. 104-13, OCTOBER 1, 1995, 44 U.S.C. 3507.

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SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
BRIAN BYRNES, RECEIVER

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
WBGX	N/A	1570	Unlimited	0.5	1.1

2. Station location

State	City or Town
ILLINOIS	HARVEY

3. Transmitter location

State	County	City or Town	Street address (or other identification)
IL	COOK	HARVEY	15700 Campbell Ave.

4. Main studio location

State	County	City or Town	Street address (or other identification)
IL	COOK	CHICAGO	5956 S. Michigan Ave.

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

State	County	City or Town	Street address (or other identification)
IL	COOK	CHICAGO	5956 S. Michigan Ave.

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. ENG.

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
3.29	4.87

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
50.0	50.0	-4.7	-4.7

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(N)	0.0		1.000			
2(C)	164.3	7.9	.826	.421		
3(S)	-45.6	142.5	.604	.754		
4(E)		0.0		.800		

Manufacturer and type of antenna monitor: Potomac Instruments AM-19(204)

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Guyed Tower	45.8	46.3	46.3	Exhibit No. N/A

Excitation ☑ Series ☐ Shunt

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

North Latitude						West Longitude					
41	o	36	'	14	"	87	o	40	'	45	"

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. ENG.

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

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

N/A

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

FM Installation and adjustment

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)
Kurt Gorman	
Address (include ZIP Code) Phasetek Inc. 550 California Rd., Unit 11 Quakertown, PA 18951	Date February 10, 2023 Telephone No. (Include Area Code) 215-536-6648

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☑ Technical Consultant

☐ Other (specify)

ENGINEERING STATEMENT CONCERNING

APPLICATION FOR LICENSE INFORMATION

EMPLOYING MOMENT METHOD MODELING

WBGX, 1570 KHZ, DA-2

HARVEY, ILLINOIS

FEBRUARY, 2023

PHASETEK INC.

ENGINEERING STATEMENT CONCERNING
APPLICATION FOR LICENSE INFORMATION
EMPLOYING MOMENT METHOD MODELING
WBGX, 1570 KHZ, DA-2
HARVEY, ILLINOIS
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HARVEY, ILLINOIS
FEBRUARY, 2023

SUMMARY

Adjustment of the Antenna System and a Proof of Performance employing Moment Method Modeling were performed on Radio Station WBGX, 1570 KHz, Harvey, Illinois, after installation of the FM antenna and associated line for FM translator W240EI. This FM translator is authorized in file Number: 0000163147. This report was prepared on behalf of Brian Byrnes, Receiver, licensee of Radio Station WBGX.

SITE MODIFICATIONS

The WBGX Transmitter site is that as currently licensed. The sampling system remains unchanged. All Towers remain unchanged except for the addition of the FM antenna with line. Towers #2, #3, and #4 are used for the Day pattern. Towers #1, #2, and #3 are used for the Night pattern. Unused towers are detuned. There are no changes to the presently licensed standard radiation patterns, therefore, a site survey is not included. A License Application employing Moment Method Modeling as set forth in Section 73.151(C) has been done to license Radio Station WBGX under the new rules.

REFERENCE POINTS

Reference Points were measured at pattern minima and maxima for the Directional modes of operation. These Points and their measured field intensity are shown in Figure 15.

PHASETEK INC.

ENGINEERING STATEMENT CONCERNING
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EMPLOYING MOMENT METHOD MODELING
WBGX, 1570 KHZ, DA-2
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METHOD OF MOMENTS DETAIL

All Moment Method Modeling was done with Expert MININEC Broadcast Professional, Version 23. One wire was used to represent each tower. Towers were driven individually to verify the Model compared to measured impedance data. Once the Model was verified, both the Day and Night Directional Antenna Systems were computed. For Directional modes, the complex voltage values for sources located at ground level were computed. These sources produce current moment sums for each Tower that, when normalized, equate to the Theoretical Field Parameters for each respective Tower. Figure's 16 and 17 show the computed current moments.

MEASURING EQUIPMENT AND PERSONNEL

All Tower Resistance and Reactance measurements were made with a HP8753ES Network Analyzer with a Tunwall directional coupler and a Delta Electronics OIB-3 operating impedance bridge. Before use, tests of known impedances were made to verify operation. All Field Intensity Measurements were made with a Potomac Instruments Field Intensity Meter, model PI 4100, Serial Number 249, calibrated on January 21, 2016. The meter was calibrated by Potomac Instruments, Frederick, Maryland. The meter was compared to a Potomac Instruments FIM-41, Serial Number 2181, calibrated on June 21, 2022, and agreed. All measurements were taken by Phasetek Inc. personnel supervised by Kurt Gorman of Phasetek Inc.

PHASETEK INC.

ENGINEERING STATEMENT CONCERNING
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WBGX, 1570 KHZ, DA-2
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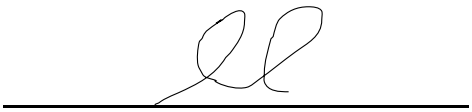
CONCLUSION

It is believed that the WBGX Antenna System has been constructed and adjusted in accordance with all applicable Commission rules and regulations. The foregoing was prepared on behalf of Brian Byrnes, Receiver, under the immediate supervision of Kurt Gorman, Phasetek Inc., Quakertown, Pennsylvania, whose qualifications are a matter of record with the Federal Communications Commission. The statements herein are true and correct of his knowledge, except such statements made on information and belief, and as to these statements he believes them to be true and correct.



Kurt Gorman, President
Phasetek Inc.
Quakertown, Pennsylvania

FIGURE 1

ANTENNA SYSTEM AS ADJUSTED

APPLICATION FOR LICENSE INFORMATION
EMPLOYING MOMENT METHOD MODELING
WBGX, 1570 KHZ, DA-2
HARVEY, ILLINOIS
FEBRUARY, 2023

ANTENNA SYSTEM DESCRIPTION

1. The Antenna System consists of three (4), vertical steel transmitting Towers. All Towers are uniform cross section and guyed. All Towers stand 45.8M (86.5^{o}) above their Base Insulators. The Towers are arranged with Tower 2 as a reference; Tower 1 is spaced 90.0^{o} on a bearing of 5.0^{o}T. Tower 3 is spaced 90.0^{o} on a bearing of 185.0^{o}T. Tower 4 is spaced 70.5^{o} on a bearing of 132.1^{o}T. Tower 1 supports a (4) bay FM antenna. The feed for the FM antenna is isolated at the base with an isocoupler. There is no lighting or other antennas attached to the towers.

2. The Ground System for each Tower remains as currently licensed. Copper strap connects all Towers to the main Transmitter grounding point.

3. The Sampling System consists of four (4), Delta Electronics Inc. model TCT-1, 0.5 V/A Toroidal Current Transformers. All TCT's are at the Output of each Antenna Tuning Unit. These TCT's are connected to a Potomac Instruments AM-19(204) Antenna Monitor via three (4) equal lengths of RFS, FLC12-50J, 1/2" phase stabilized foam coaxial cable.

FIGURE 1
ANTENNA SYSTEM AS ADJUSTED

APPLICATION FOR LICENSE INFORMATION
EMPLOYING MOMENT METHOD MODELING
CONTINUED
WBGX, 1570 KHZ, DA-2
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ANTENNA SYSTEM DESCRIPTION – Continued

DIRECTIONAL OPERATION (DAY)

COMMON POINT

Impedance = 50.0 - j 4.7 Ohms
Current = 4.87 Amperes
Power = 1,190 Watts

DIRECTIONAL OPERATION (NIGHT)

COMMON POINT

Impedance = 50.0 - j 4.7 Ohms
Current = 3.29 Amperes
Power = 540 Watts

Directional Antenna Monitor indications are within ±5% and ±3° of the modeled TCT values.

FIGURE 2
WBGX SAMPLING SYSTEM DESCRIPTION/MEASUREMENTS

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WBGX, 1570 KHZ, DA-2
HARVEY, ILLINOIS
FEBRUARY, 2023

SAMPLING SYSTEM DESCRIPTION

The Sampling System consists of Delta Electronics Inc. model TCT-1 Toroidal Sampling Transformers (0.5 volt/amp) mounted at the base of each Tower. The sampling devices are connected to the Antenna Monitor with equal lengths of RFS FLC12-50J. The Antenna Monitor is a Potomac Instruments Model AM-19(204), Serial Number 1775.

SAMPLE LINE MEASUREMENTS

Impedance measurements were made of the Antenna Sampling Lines using an HP8753ES Network Analyzer and Tunwall directional coupler. Measurements were done with the lines open circuited and then connected to the TCT's.

The table below shows the frequencies above and below the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, was found. Frequencies of resonance occur at odd multiples of 90 degrees electrical length, the Sample Line length at the resonant frequency below the carrier frequency, which is the closest one to the carrier frequency, was found to be 270 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by ratioing the frequencies.

SAMPLE LINE MEASUREMENTS

	Resonant Frequency (KHz) below 1570 KHz	Resonant Frequency (KHz) above 1570 KHz	Calculated Electrical Length (deg) at 1570 KHz	Measured Impedance (ohms) Connected to TCT @ 1570 KHz
Tower 1	1285.62	2146.31	329.7	49.6 +j 0.1
Tower 2	1287.73	2151.35	329.2	49.7 +j 0.3
Tower 3	1286.37	2149.16	329.5	51.0 –j 0.4
Tower 4	1285.14	2145.43	329.8	49.8 –j 0.2

FIGURE 2
WBGX SAMPLING SYSTEM DESCRIPTION/MEASUREMENTS

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EMPLOYING MOMENT METHOD MODELING
WBGX, 1570 KHZ, DA-2
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SAMPLE LINE MEASUREMENTS (CONTINUED)

To determine the characteristic impedance values of the Sample Lines, open-circuited measurements were made with frequencies offset to produce ± 45 degrees of electrical length from resonance. The characteristic impedance was calculated using the following formula, where R1 +j X1 and R2 +j X2 are the measured impedances at the +45 and -45 degree offset frequencies, respectively:

$$Z_0 = ((R_1^2 + X_1^2)^{1/2} \bullet (R_2^2 + X_2^2)^{1/2})^{1/2}$$

Tower	+ 45 Degree Offset Frequency (kHz)	+ 45 Degree Measured Impedance (Ohms)	- 45 Degree Offset Frequency (kHz)	- 45 Degree Measured Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)
1	1499.9	4.9 +j 49.4	1071.3	3.2 –j 48.2	48.97
2	1502.4	4.8 +j 50.4	1073.1	3.1 –j 46.9	48.78
3	1500.8	4.9 +j 50.2	1071.9	3.1 –j 47.4	48.95
4	1499.4	4.8 +j 50.1	1070.9	3.0 –j 47.2	48.79

SAMPLING TCT MEASUREMENTS

Measurements of the Delta Electronics Inc. Model TCT-1, 0.5 V/A Toroidal Current Transformers were performed by a Hewlett Packard 8752A, Network Analyzer. Measurements are normalized to Tower #4 (Day reference) and are within the manufacturer's rating of ± 2.0% and ± 2.0°.

FIGURE 2
WBGX SAMPLING SYSTEM DESCRIPTION/MEASUREMENTS

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WBGX, 1570 KHZ, DA-2
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SAMPLING TCT MEASUREMENTS CONT'D

TOWER	TCT SERIAL #	MAGNITUDE	PHASE
1	132	.998	-0.4°
2	143	.999	0.1°
3	6659	1.001	-0.1°
4	1665	1.000	0.0°

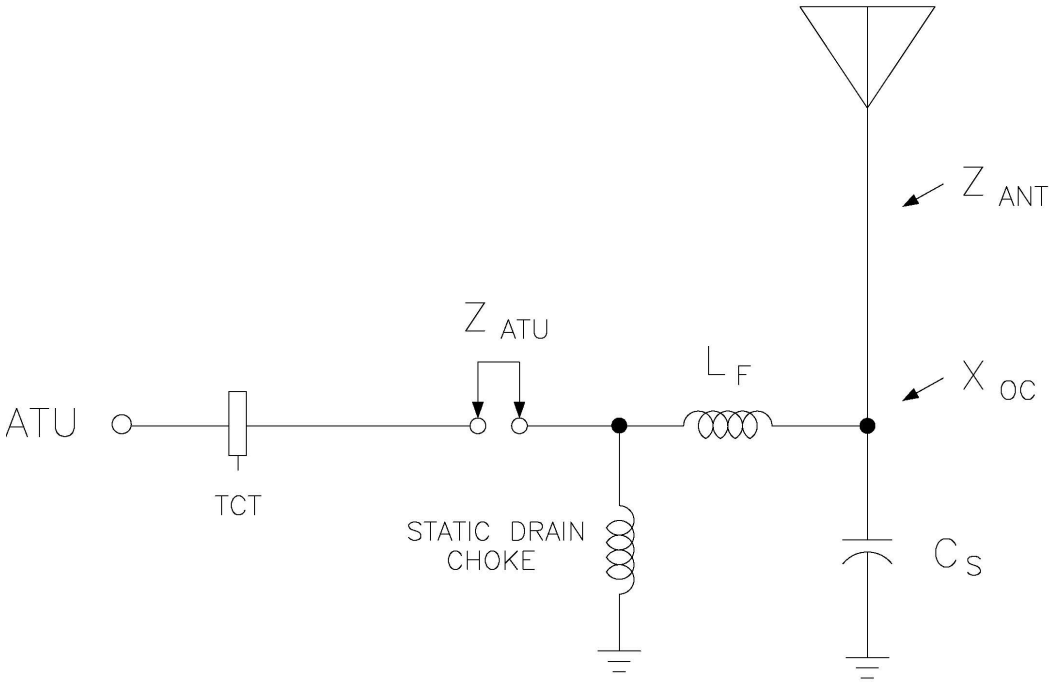
ANTENNA MONITOR MEASUREMENT

Measurement of the Potomac Instruments Model AM-19(204) Antenna Monitor was performed to verify calibration. A single RF Voltage was applied to both the Day/Night Reference Input (Tower #4/#1) and each other Input by use of a "T" divider and equal electrical length coaxial cables. This yields the following:

Tower	D Ratio	D Phase	N Ratio	N Phase
1	1.001	0.0°	1.000	0.0°
2	1.001	0.2°	1.000	0.2°
3	1.000	-0.2°	.998	-0.2°
4	1.000	0.0°	.999	0.0°

The above is within the manufacturer's rating of ± 1.0% and ± 1.0°.

FIGURE 3
WBGX TOWER IMPEDANCE MEASUREMENTS COMPARED TO METHOD OF MOMENTS MODEL



TOWER	Specified Cs (pf)	Measured L_F (µH)	Measured X_F (Ω)	Modeled Z_{ANT} (Ω)	Modeled Z_{ATU} (Ω)	Measured Z_{ATU} (Ω)
1	35	2.03	+j20.0	46.79 +j 41.68	48.75 +j 61.64	48.8 +j 61.8
2	15	2.74	+j27.0	40.33 +j 30.16	41.16 +j 57.21	40.9 +j 57.4
3	15	3.14	+j31.0	42.19 +j 28.18	43.05 +j 59.20	42.9 +j 59.7
4	15	2.53	+j25.0	37.21 +j 14.20	37.66 +j 39.04	36.9 +j 39.5

Tower	Calculated X_{OC} (Ω)
1	-j 2,244.9
2	-j 4,028.4
3	-j 4,027.7
4	-j 4,028.7

FIGURE 4
WBGX MOMENT MODEL PARAMETERS

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Tower #	Wire #	# of Segments	Base Node
1	1	18	1
2	2	18	19
3	3	18	37
4	4	18	55

Tower #	Physical Height Degrees	Modeled Height Degrees	Modeled Radius Meters	% of Equivalent Radius
1	86.5	93.5	.1455	100.0
2	86.5	92.0	.1759	100.0
3	86.5	91.5	.1759	100.0
4	86.5	89.0	.1455	100.0

Towers are uniform cross section, guyed with Base Insulator. Towers #1 and #4 are three (3) sided with a 12" face width. Towers #2 and #3 are three (3) sided with a 14.5" face width.

All Base Insulators are manufactured by Lapp, with an assumed capacity of 15pf (-j6,758.2 ohms @ 1570 kHz). Tower #1 has a Phasetek Inc. P600-408 FM isocoupler with a measured capacity of 20pf.

All Towers have a Phasetek Inc. static drain choke. These measure –j10,000.0 ohms @ 1570 kHz.

FIGURE 5
WBGX MOMENT SUMMARY FOR INDIVIDUAL TOWERS

WBGX TOWER 1 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	90.	5.	0	.1455	18
		90.	5.	93.5		
2	none	0	0	0	.1759	18
		0	0	92.		
3	none	90.	185.	0	.1759	18
		90.	185.	91.5		
4	none	70.5	132.1	0	.1455	18
		70.5	132.1	89.		

Number of wires = 4
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	4.94445	1	5.19445
radius	1	.1455	2	.1759

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.57	0	1	.0137346	.014429

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	19	0	-4,028.4	0	0	0
2	37	0	-4,027.7	0	0	0
3	55	0	-4,028.7	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							
1.57	46.79	41.68	62.662	41.7	2.315	-8.0312	-.74356

FIGURE 5
WBGX MOMENT SUMMARY FOR INDIVIDUAL TOWERS

WBGX TOWER 2 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	90.	5.	0	.1455	18
		90.	5.	93.5		
2	none	0	0	0	.1759	18
		0	0	92.		
3	none	90.	185.	0	.1759	18
		90.	185.	91.5		
4	none	70.5	132.1	0	.1455	18
		70.5	132.1	89.		

Number of wires = 4
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	4.94445	1	5.19445
radius	1	.1455	2	.1759

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.57	0	1	.0137346	.014429

Sources

source	node	sector	magnitude	phase	type
1	19	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-2,244.9	0	0	0
2	37	0	-4,027.7	0	0	0
3	55	0	-4,028.7	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 19, sector 1							
1.57	40.325	30.162	50.358	36.8	1.9969	-9.5607	-.50925

FIGURE 5
WBGX MOMENT SUMMARY FOR INDIVIDUAL TOWERS

WBGX TOWER 3 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	90.	5.	0	.1455	18
		90.	5.	93.5		
2	none	0	0	0	.1759	18
		0	0	92.		
3	none	90.	185.	0	.1759	18
		90.	185.	91.5		
4	none	70.5	132.1	0	.1455	18
		70.5	132.1	89.		

Number of wires = 4
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	4.94445	1	5.19445
radius	1	.1455	2	.1759

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.57	0	1	.0137346	.014429

Sources

source	node	sector	magnitude	phase	type
1	37	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-2,244.9	0	0	0
2	19	0	-4,028.4	0	0	0
3	55	0	-4,028.7	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 37, sector 1							
1.57	42.19	28.177	50.734	33.7	1.8707	-10.362	-.41913

FIGURE 5
WBGX MOMENT SUMMARY FOR INDIVIDUAL TOWERS

WBGX TOWER 4 (OTHERS OPEN)

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	90.	5.	0	.1455	18
		90.	5.	93.5		
2	none	0	0	0	.1759	18
		0	0	92.		
3	none	90.	185.	0	.1759	18
		90.	185.	91.5		
4	none	70.5	132.1	0	.1455	18
		70.5	132.1	89.		

Number of wires = 4
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	4.94445	1	5.19445
radius	1	.1455	2	.1759

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.57	0	1	.0137346	.014429

Sources

source	node	sector	magnitude	phase	type
1	55	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-2,244.9	0	0	0
2	19	0	-4,028.4	0	0	0
3	37	0	-4,027.7	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 55, sector 1							
1.57	37.212	14.195	39.828	20.9	1.5517	-13.302	-.20794

FIGURE 6
WBGX MOMENT MODEL ARRAY SYNTHESIS
(DIRECTIONAL – DAY)

WBGX DAY

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.57 MHz

tower	field ratio magnitude	phase (deg)
1	0	0
2	.6	214.
3	1.	0
4	1.05	212.

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	157.854	180.1	.298739	270.3
19	230.948	251.8	2.24313	223.2
37	108.273	105.3	3.9938	359.3
55	230.112	254.6	4.2448	216.1

Sum of square of source currents = 78.1793
Total power = 1,100. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00887348	-.00880974
Y(1, 2)	.00331053	.00644572
Y(1, 3)	-.000372836	-.000602314
Y(1, 4)	.00180663	.00119831
Y(2, 1)	.00331052	.00644581
Y(2, 2)	.00389058	-.0125956
Y(2, 3)	.00148357	.00375633
Y(2, 4)	-.000120523	.0106243
Y(3, 1)	-.000372812	-.000602321
Y(3, 2)	.00148355	.00375633
Y(3, 3)	.00847835	-.0128284
Y(3, 4)	.000901203	.00980467
Y(4, 1)	.00180655	.00119828
Y(4, 2)	-.000120714	.0106244
Y(4, 3)	.000901001	.0098047
Y(4, 4)	.0109126	-.0169826

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	46.8642	41.5483
Z(1, 2)	21.4473	-19.9661
Z(1, 3)	-13.5193	-16.9094
Z(1, 4)	-1.75287	-22.3109
Z(2, 1)	21.4469	-19.9663
Z(2, 2)	41.1093	30.2924
Z(2, 3)	20.5034	-20.7705
Z(2, 4)	26.3409	-14.4524
Z(3, 1)	-13.5194	-16.9092
Z(3, 2)	20.5033	-20.7705
Z(3, 3)	42.3924	28.2412
Z(3, 4)	26.2779	-15.4333
Z(4, 1)	-1.75331	-22.3107
Z(4, 2)	26.3403	-14.453
Z(4, 3)	26.2775	-15.4337
Z(4, 4)	37.5615	14.2008

FIGURE 7
WBGX MOMENT MODEL SUMMARY FOR DIRECTIONAL DAY MODE

```
WBGX DAY

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 90.          5.           0            .1455        18
           90.          5.           93.5
 2    none 0            0            0            .1759        18
           0            0            92.
 3    none 90.          185.         0            .1759        18
           90.          185.         91.5
 4    none 70.5         132.1        0            .1455        18
           70.5         132.1        89.

Number of wires          =  4
          current nodes  =  72

                         minimum                  maximum
Individual wires      wire    value             wire  value
segment length         4      4.94445            1    5.19445
radius                 1      .1455              2    .1759


ELECTRICAL DESCRIPTION
Frequencies (MHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   1.57         0             1      .0137346       .014429

Sources
source node    sector  magnitude      phase          type
 1      19      1       326.61         251.8          voltage
 2      37      1       153.121        105.3          voltage
 3      55      1       325.427        254.6          voltage

Lumped loads
            resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1     0             528.4         0           0            0



IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(MHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 19, sector 1
1.57     90.365   49.145   102.86   28.5     2.4942  -7.3787  -.87707

source =  2; node 37, sector 1
1.57     -7.4698  26.062   27.111   106.     ****    ****     ****

source =  3; node 55, sector 1
1.57     42.429   33.774   54.23    38.5     2.0851  -9.0759  -.57352
```

CURRENT rms
Frequency = 1.57 MHz
Input power = 1,100. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	89.6575	-7.844	0	.298767	270.1	5.91E-04	-.298767
2	89.6575	-7.844	5.19445	.211557	270.1	4.01E-04	-.211556
3	89.6575	-7.844	10.3889	.154146	270.1	2.37E-04	-.154146
4	89.6575	-7.844	15.5833	.105828	270.	5.99E-05	-.105828
5	89.6575	-7.844	20.7778	.0640929	269.9	-1.32E-04	-.0640928
6	89.6575	-7.844	25.9722	.0279613	269.3	-3.37E-04	-.0279593
7	89.6575	-7.844	31.1667	3.05E-03	100.3	-5.47E-04	3.E-03
8	89.6575	-7.844	36.3611	.0290168	91.5	-7.56E-04	.029007
9	89.6575	-7.844	41.5556	.0501728	91.1	-9.55E-04	.0501637
10	89.6575	-7.844	46.75	.066554	91.	-1.13E-03	.0665444
11	89.6575	-7.844	51.9444	.0782138	90.9	-1.28E-03	.0782034
12	89.6575	-7.844	57.1389	.0852033	90.9	-1.38E-03	.0851921
13	89.6575	-7.844	62.3333	.0875736	90.9	-1.42E-03	.087562
14	89.6575	-7.844	67.5278	.0853755	90.9	-1.4E-03	.0853639
15	89.6575	-7.844	72.7222	.0786469	91.	-1.31E-03	.0786361
16	89.6575	-7.844	77.9167	.0673824	91.	-1.13E-03	.067373
17	89.6575	-7.844	83.1111	.0514576	91.	-8.64E-04	.0514503
18	89.6575	-7.844	88.3056	.0304053	91.	-5.08E-04	.0304011
END	89.6575	-7.844	93.5	0	0	0	0
GND	0	0	0	2.24486	223.3	-1.6348	-1.53844
20	0	0	5.11111	2.30439	220.3	-1.75692	-1.49112
21	0	0	10.2222	2.32516	218.6	-1.81802	-1.44955
22	0	0	15.3333	2.32304	217.1	-1.85165	-1.40283
23	0	0	20.4444	2.29962	215.9	-1.86175	-1.34987
24	0	0	25.5556	2.25568	214.9	-1.85013	-1.29039
25	0	0	30.6667	2.19172	214.	-1.81784	-1.22438
26	0	0	35.7778	2.10826	213.1	-1.76566	-1.15204
27	0	0	40.8889	2.00582	212.4	-1.6943	-1.07363
28	0	0	46.	1.88502	211.7	-1.60442	-.989512
29	0	0	51.1111	1.74648	211.	-1.49671	-.900033
30	0	0	56.2222	1.59092	210.4	-1.37188	-.805591
31	0	0	61.3333	1.419	209.9	-1.23057	-.706572
32	0	0	66.4444	1.23136	209.3	-1.07343	-.603327
33	0	0	71.5556	1.02843	208.8	-.90086	-.496108
34	0	0	76.6667	.810165	208.4	-.712867	-.38495
35	0	0	81.7778	.57535	207.9	-.508402	-.26936
36	0	0	86.8889	.319648	207.5	-.283604	-.147458
END	0	0	92.	0	0	0	0
GND	-89.6575	7.84401	0	3.99313	359.3	3.99284	-.0483235
38	-89.6575	7.84401	5.08333	4.03944	359.6	4.03932	-.0317145
39	-89.6575	7.84401	10.1667	4.03404	359.7	4.03398	-.0215148
40	-89.6575	7.84401	15.25	3.99303	359.8	3.99301	-.013359
41	-89.6575	7.84401	20.3333	3.91868	359.9	3.91867	-6.73E-03
42	-89.6575	7.84401	25.4167	3.81239	360.	3.81239	-1.39E-03
43	-89.6575	7.84401	30.5	3.67534	0.0	3.67534	2.82E-03
44	-89.6575	7.84401	35.5833	3.50872	.1	3.50872	5.99E-03
45	-89.6575	7.84401	40.6667	3.31383	.1	3.31382	8.22E-03
46	-89.6575	7.84401	45.75	3.09203	.2	3.09201	9.62E-03
47	-89.6575	7.84401	50.8333	2.84479	.2	2.84477	.0102729
48	-89.6575	7.84401	55.9167	2.57362	.2	2.5736	.0102852
49	-89.6575	7.84401	61.	2.28	.2	2.27998	9.76E-03
50	-89.6575	7.84401	66.0833	1.96533	.3	1.96531	8.78E-03
51	-89.6575	7.84401	71.1667	1.63062	.3	1.6306	7.46E-03
52	-89.6575	7.84401	76.25	1.27619	.3	1.27618	5.89E-03
53	-89.6575	7.84401	81.3333	.900453	.3	.900443	4.13E-03
54	-89.6575	7.84401	86.4167	.497068	.3	.497063	2.24E-03
END	-89.6575	7.84401	91.5	0	0	0	0
GND	-47.2651	-52.3093	0	4.24262	216.1	-3.42887	-2.49855
56	-47.2651	-52.3093	4.94445	4.30472	214.8	-3.53426	-2.45755
57	-47.2651	-52.3093	9.88889	4.30954	214.	-3.57172	-2.41142
58	-47.2651	-52.3093	14.8333	4.27561	213.4	-3.57032	-2.35237
59	-47.2651	-52.3093	19.7778	4.20544	212.8	-3.53395	-2.27967
60	-47.2651	-52.3093	24.7222	4.10047	212.3	-3.46457	-2.1933
61	-47.2651	-52.3093	29.6667	3.96182	211.9	-3.36352	-2.09351

62	-47.2651	-52.3093	34.6111	3.79065	211.5	-3.23199	-1.98073
63	-47.2651	-52.3093	39.5556	3.58813	211.1	-3.07113	-1.8555
64	-47.2651	-52.3093	44.5	3.35556	210.8	-2.88215	-1.71844
65	-47.2651	-52.3093	49.4444	3.09429	210.5	-2.66628	-1.57022
66	-47.2651	-52.3093	54.3889	2.80574	210.2	-2.42481	-1.41155
67	-47.2651	-52.3093	59.3333	2.4913	209.9	-2.15899	-1.24312
68	-47.2651	-52.3093	64.2778	2.15222	209.7	-1.86993	-1.06556
69	-47.2651	-52.3093	69.2222	1.78939	209.4	-1.55845	-.879297
70	-47.2651	-52.3093	74.1667	1.40291	209.2	-1.22464	-.684408
71	-47.2651	-52.3093	79.1111	.990865	209.	-.866839	-.480004
72	-47.2651	-52.3093	84.0556	.546002	208.8	-.478671	-.262664
END	-47.2651	-52.3093	89.	0	0	0	0

FIGURE 8
WBGX MOMENT MODEL ARRAY SYNTHESIS
(DIRECTIONAL – NIGHT)

WBGX NIGHT

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.57 MHz

tower	field ratio magnitude	phase (deg)
1	1.	0
2	.82	166.6
3	.52	-44.2
4	0	0

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	275.857	72.7	4.36824	2.1
19	244.746	254.6	3.56545	166.9
37	25.9862	327.2	2.56967	316.9
55	115.224	242.5	.212798	332.8

Sum of square of source currents = 76.8848
Total power = 500. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00887348	-.00880974
Y(1, 2)	.00331053	.00644572
Y(1, 3)	-.000372836	-.000602314
Y(1, 4)	.00180663	.00119831
Y(2, 1)	.00331052	.00644581
Y(2, 2)	.00389058	-.0125956
Y(2, 3)	.00148357	.00375633
Y(2, 4)	-.000120523	.0106243
Y(3, 1)	-.000372812	-.000602321
Y(3, 2)	.00148355	.00375633
Y(3, 3)	.00847835	-.0128284
Y(3, 4)	.000901203	.00980467
Y(4, 1)	.00180655	.00119828
Y(4, 2)	-.000120714	.0106244
Y(4, 3)	.000901001	.0098047
Y(4, 4)	.0109126	-.0169826

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	46.8642	41.5483
Z(1, 2)	21.4473	-19.9661
Z(1, 3)	-13.5193	-16.9094
Z(1, 4)	-1.75287	-22.3109
Z(2, 1)	21.4469	-19.9663
Z(2, 2)	41.1093	30.2924
Z(2, 3)	20.5034	-20.7705
Z(2, 4)	26.3409	-14.4524
Z(3, 1)	-13.5194	-16.9092
Z(3, 2)	20.5033	-20.7705
Z(3, 3)	42.3924	28.2412
Z(3, 4)	26.2779	-15.4333
Z(4, 1)	-1.75331	-22.3107
Z(4, 2)	26.3403	-14.453
Z(4, 3)	26.2775	-15.4337
Z(4, 4)	37.5615	14.2008

FIGURE 9
WBGX MOMENT MODEL SUMMARY FOR DIRECTIONAL NIGHT MODE

WBGX NIGHT

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	90.	5.	0	.1455	18
		90.	5.	93.5		
2	none	0	0	0	.1759	18
		0	0	92.		
3	none	90.	185.	0	.1759	18
		90.	185.	91.5		
4	none	70.5	132.1	0	.1455	18
		70.5	132.1	89.		

Number of wires = 4
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	4.94445	1	5.19445
radius	1	.1455	2	.1759

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.57	0	1	.0137346	.014429

Sources

source	node	sector	magnitude	phase	type
1	1	1	390.121	72.7	voltage
2	19	1	346.124	254.6	voltage
3	37	1	36.7501	327.2	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	55	0	541.5	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.57	20.957	59.598	63.175	70.6	6.0289	-2.9083	-3.1147
source = 2; node 19, sector 1							
1.57	2.7307	68.569	68.623	87.7	52.781	-.32917	-11.367
source = 3; node 37, sector 1							
1.57	9.9508	1.8051	10.113	10.3	5.0315	-3.4991	-2.571

CURRENT rms
Frequency = 1.57 MHz
Input power = 500. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	89.6575	-7.844	0	4.3665	2.1	4.36364	.157992
2	89.6575	-7.844	5.19445	4.49327	1.4	4.49186	.112644
3	89.6575	-7.844	10.3889	4.5367	1.	4.53594	.0827189
4	89.6575	-7.844	15.5833	4.53115	.7	4.53078	.057461
5	89.6575	-7.844	20.7778	4.48129	.5	4.48115	.0355701
6	89.6575	-7.844	25.9722	4.38952	.2	4.38949	.0165447
7	89.6575	-7.844	31.1667	4.25754	0.0	4.25754	1.7E-04
8	89.6575	-7.844	36.3611	4.08688	359.8	4.08685	-.0136527
9	89.6575	-7.844	41.5556	3.8791	359.6	3.87902	-.024971
10	89.6575	-7.844	46.75	3.63587	359.5	3.63571	-.033809
11	89.6575	-7.844	51.9444	3.35891	359.3	3.35867	-.040182
12	89.6575	-7.844	57.1389	3.05004	359.2	3.04972	-.0441037
13	89.6575	-7.844	62.3333	2.71106	359.	2.71067	-.0455881
14	89.6575	-7.844	67.5278	2.34364	358.9	2.34322	-.0446485
15	89.6575	-7.844	72.7222	1.94911	358.8	1.94867	-.0412915
16	89.6575	-7.844	77.9167	1.52793	358.7	1.52752	-.0355009
17	89.6575	-7.844	83.1111	1.07845	358.6	1.07811	-.0271978
18	89.6575	-7.844	88.3056	.593194	358.4	.592975	-.0161195
END	89.6575	-7.844	93.5	0	0	0	0
GND	0	0	0	3.56649	166.9	-3.47341	.809526
20	0	0	5.11111	3.69628	166.8	-3.59851	.844527
21	0	0	10.2222	3.74544	166.7	-3.64558	.859108
22	0	0	15.3333	3.75148	166.7	-3.65081	.86323
23	0	0	20.4444	3.71903	166.7	-3.61869	.858097
24	0	0	25.5556	3.65047	166.6	-3.55148	.844322
25	0	0	30.6667	3.54737	166.6	-3.45075	.822289
26	0	0	35.7778	3.41112	166.6	-3.31783	.792315
27	0	0	40.8889	3.24307	166.5	-3.15403	.754726
28	0	0	46.	3.04462	166.5	-2.96072	.709833
29	0	0	51.1111	2.81723	166.5	-2.73931	.657969
30	0	0	56.2222	2.56239	166.5	-2.49128	.599469
31	0	0	61.3333	2.28159	166.4	-2.21806	.534664
32	0	0	66.4444	1.97617	166.4	-1.92096	.463855
33	0	0	71.5556	1.64715	166.4	-1.60098	.387262
34	0	0	76.6667	1.29479	166.4	-1.25838	.304921
35	0	0	81.7778	.91744	166.4	-.891549	.216417
36	0	0	86.8889	.508493	166.3	-.494092	.120158
END	0	0	92.	0	0	0	0
GND	-89.6575	7.84401	0	2.5695	316.9	1.8767	-1.75508
38	-89.6575	7.84401	5.08333	2.56316	316.6	1.8619	-1.76158
39	-89.6575	7.84401	10.1667	2.53772	316.4	1.83704	-1.7508
40	-89.6575	7.84401	15.25	2.49405	316.2	1.80015	-1.72619
41	-89.6575	7.84401	20.3333	2.4325	316.	1.75117	-1.68834
42	-89.6575	7.84401	25.4167	2.35355	315.9	1.69033	-1.63768
43	-89.6575	7.84401	30.5	2.25772	315.8	1.61796	-1.57465
44	-89.6575	7.84401	35.5833	2.14564	315.7	1.5345	-1.49969
45	-89.6575	7.84401	40.6667	2.01803	315.5	1.44045	-1.41334
46	-89.6575	7.84401	45.75	1.8757	315.4	1.3364	-1.31616
47	-89.6575	7.84401	50.8333	1.7195	315.3	1.22297	-1.20874
48	-89.6575	7.84401	55.9167	1.55033	315.2	1.10078	-1.0917
49	-89.6575	7.84401	61.	1.36907	315.1	.970489	-.96566
50	-89.6575	7.84401	66.0833	1.17653	315.1	.832684	-.831185
51	-89.6575	7.84401	71.1667	.973325	315.	.687801	-.688688
52	-89.6575	7.84401	76.25	.759626	314.9	.535979	-.538292
53	-89.6575	7.84401	81.3333	.534517	314.8	.376586	-.37933
54	-89.6575	7.84401	86.4167	.294264	314.7	.207012	-.209134
END	-89.6575	7.84401	91.5	0	0	0	0
GND	-47.2651	-52.3093	0	.212784	332.5	.188743	-.0982503
56	-47.2651	-52.3093	4.94445	.151036	332.5	.133963	-.0697548
57	-47.2651	-52.3093	9.88889	.110619	332.5	.0980877	-.0511413
58	-47.2651	-52.3093	14.8333	.0765611	332.4	.0678363	-.0354942
59	-47.2651	-52.3093	19.7778	.0470654	332.2	.0416169	-.0219816
60	-47.2651	-52.3093	24.7222	.0214252	331.4	.0188021	-.0102722
61	-47.2651	-52.3093	29.6667	9.08E-04	193.9	-8.81E-04	-2.17E-04

62	-47.2651	-52.3093	34.6111	.0194044	154.8	-.0175597	8.26E-03
63	-47.2651	-52.3093	39.5556	.0347828	154.1	-.0312897	.015192
64	-47.2651	-52.3093	44.5	.0468668	153.9	-.042092	.0206098
65	-47.2651	-52.3093	49.4444	.0556629	153.9	-.0499682	.0245264
66	-47.2651	-52.3093	54.3889	.0611685	153.9	-.0549098	.0269536
67	-47.2651	-52.3093	59.3333	.0633735	153.9	-.0569013	.0279005
68	-47.2651	-52.3093	64.2778	.0622593	153.9	-.0559191	.0273728
69	-47.2651	-52.3093	69.2222	.057791	154.	-.0519253	.0253687
70	-47.2651	-52.3093	74.1667	.049897	154.	-.0448494	.0218686
71	-47.2651	-52.3093	79.1111	.0384104	154.	-.034537	.0168094
72	-47.2651	-52.3093	84.0556	.0229009	154.1	-.0205977	.0100094
END	-47.2651	-52.3093	89.	0	0	0	0

FIGURE 10
DERIVED DIRECTIONAL PARAMETERS

APPLICATION FOR LICENSE INFORMATION
EMPLOYING MOMENT METHOD MODELING
WBGX, 1570 KHZ, DA-2
HARVEY, ILLINOIS
FEBRUARY, 2023

DAY:

	Theoretical		Base Network Input Current		Normalized TCT	
Tower	**Field**	**Phase**	**Amplitude**	**Phase**	**Amplitude**	**Phase**
2 (C)	.600	214.0°	2.21	-135.44°	.526	7.9°
3 (S)	1.000	0.0°	3.96	-0.80°	.943	142.5°
4 (E)	1.050	212.0°	4.20	-143.31°	1.000	0.0°

NIGHT:

	Theoretical		Base Network Input Current		Normalized TCT	
Tower	**Field**	**Phase**	**Amplitude**	**Phase**	**Amplitude**	**Phase**
1 (N)	1.000	0.0°	4.24	2.63°	1.000	0.0°
2 (C)	.820	166.6°	3.50	166.92°	.826	164.3°
3 (S)	.520	-44.2°	2.56	-42.97°	.604	-45.6°

Note: for Day operation, antenna monitor reference set to 80% due to sample voltage.

FIGURE 11
WBGX TOWER BASE CIRCUIT ANALYSIS DESCRIPTION

APPLICATION FOR LICENSE INFORMATION
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FEBRUARY, 2023

CIRCUIT ANALYSIS

Circuit Analysis was performed on each Tower of the WBGX model. "Phasetek" nodal Circuit Analysis program was used to compute base model Input/Output voltages and currents. For the Directional modes, the calculated Mininec Tower Base Drive Voltage was used to determine the Base Network Input Current. This point is the location of the Sampling TCT. "Z_1" represents the ATU Shunt impedance, "Z_2" represents the Tower Feed impedance, and "Z_3" represents the Tower Base Shunt impedance.

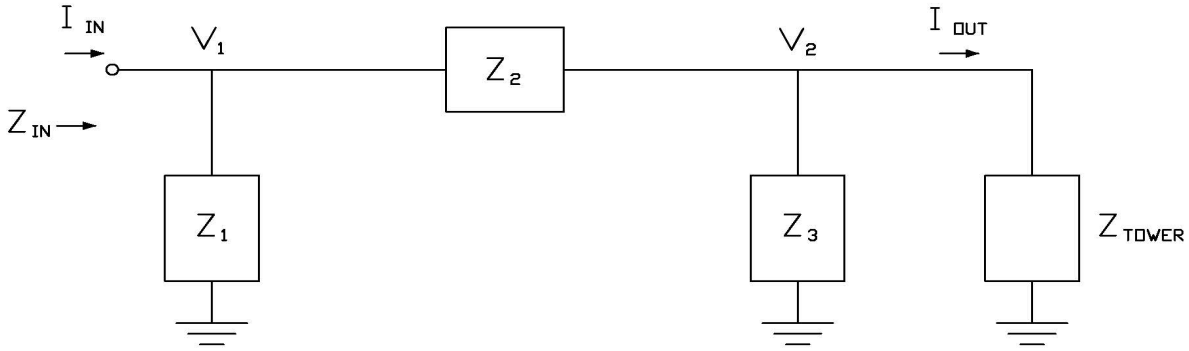

FIGURE 12
WBGX CIRCUIT ANALYSIS FOR INDIVIDUAL TOWERS

CUSTOMER : WBGX
NETWORK ID : TOWER 1 (OTHERS OPEN)

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 20.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -2896.40 OHMS
TOWER IMPEDANCE (R,X) : 46.79, 41.68 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	48.15	41.50
1		2	0.00	20.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	100.00	0.00
2	81.38	-11.18

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	48.75	61.64	78.59	51.66
INPUT CURRENT (AMPS) :	0.79	-1.00	1.27	-51.66
OUTPUT CURRENT (AMPS) :	0.78	-1.04	1.30	-52.88

INPUT/OUTPUT CURRENT RATIO = 0.9797
INPUT/OUTPUT PHASE = 1.22 DEGREES

FIGURE 12
WBGX CIRCUIT ANALYSIS FOR INDIVIDUAL TOWERS

CUSTOMER : WBGX
NETWORK ID : TOWER 2 (OTHERS OPEN)

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 27.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 40.33, 30.16 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	40.69	30.05
1		2	0.00	27.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	100.00	0.00
2	72.19	-18.06

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	41.16	57.21	70.48	54.27
INPUT CURRENT (AMPS) :	0.83	-1.15	1.42	-54.27
OUTPUT CURRENT (AMPS) :	0.83	-1.17	1.43	-54.85

INPUT/OUTPUT CURRENT RATIO = 0.9899
INPUT/OUTPUT PHASE = 0.58 DEGREES

FIGURE 12
WBGX CIRCUIT ANALYSIS FOR INDIVIDUAL TOWERS

CUSTOMER : WBGX
NETWORK ID : TOWER 3 (OTHERS OPEN)

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 31.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 42.19, 28.18 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	42.54	28.03
1		2	0.00	31.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	100.00	0.00
2	70.02	-20.84

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	43.05	59.20	73.20	53.98
INPUT CURRENT (AMPS) :	0.80	-1.10	1.37	-53.98
OUTPUT CURRENT (AMPS) :	0.80	-1.12	1.38	-54.58

INPUT/OUTPUT CURRENT RATIO = 0.9900
INPUT/OUTPUT PHASE = 0.60 DEGREES

FIGURE 12
WBGX CIRCUIT ANALYSIS FOR INDIVIDUAL TOWERS

CUSTOMER : WBGX
NETWORK ID : TOWER 4 (OTHERS OPEN)

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 25.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 37.21, 14.20 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	-10000.00
2	GROUND	37.37	14.02
1	2	0.00	25.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	100.00	0.00
2	73.87	-25.67

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	37.66	39.04	54.24	46.03
INPUT CURRENT (AMPS) :	1.28	-1.33	1.84	-46.03
OUTPUT CURRENT (AMPS) :	1.28	-1.35	1.85	-46.56

INPUT/OUTPUT CURRENT RATIO = 0.9940
INPUT/OUTPUT PHASE = 0.53 DEGREES

FIGURE 13
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL DAY MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 2 DAY

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 27.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 90.37, 49.15 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	91.68	48.28
1		2	0.00	27.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	264.41	-96.58
2	230.95	251.80

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	93.07	74.99	119.52	38.86
INPUT CURRENT (AMPS) :	-1.58	-1.55	2.21	-135.44
OUTPUT CURRENT (AMPS) :	-1.63	-1.54	2.25	-136.74

INPUT/OUTPUT CURRENT RATIO = 0.9854
INPUT/OUTPUT PHASE = 1.30 DEGREES

FIGURE 13
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL DAY MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 3 DAY

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 31.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : -7.47, 26.06 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	-7.53	26.15
1		2	0.00	31.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	229.34	96.75
2	108.27	105.30

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	-7.61	57.48	57.98	97.55
INPUT CURRENT (AMPS) :	3.96	-0.06	3.96	-0.80
OUTPUT CURRENT (AMPS) :	3.99	-0.05	3.99	-0.69

INPUT/OUTPUT CURRENT RATIO = 0.9905
INPUT/OUTPUT PHASE = -0.11 DEGREES

FIGURE 13
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL DAY MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 4 DAY

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 25.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 42.43, 33.77 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	-10000.00
2	GROUND	42.86	33.67
1	2	0.00	25.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	306.76	-89.70
2	230.11	254.60

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	43.36	58.83	73.08	53.61
INPUT CURRENT (AMPS) :	-3.37	-2.51	4.20	-143.31
OUTPUT CURRENT (AMPS) :	-3.43	-2.50	4.24	-143.92

INPUT/OUTPUT CURRENT RATIO = 0.9892
INPUT/OUTPUT PHASE = 0.61 DEGREES

FIGURE 14
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL NIGHT MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 1 NIGHT

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 20.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -2896.40 OHMS
TOWER IMPEDANCE (R,X) : 20.96, 59.60 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	21.85	60.69
1		2	0.00	20.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	357.51	77.35
2	275.86	72.70

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	22.21	81.30	84.28	74.72
INPUT CURRENT (AMPS) :	4.24	0.19	4.24	2.63
OUTPUT CURRENT (AMPS) :	4.36	0.16	4.37	2.08

INPUT/OUTPUT CURRENT RATIO = 0.9715
INPUT/OUTPUT PHASE = 0.55 DEGREES

FIGURE 14
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL NIGHT MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 2 NIGHT

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 27.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 2.73, 68.57 OHMS

NODE	TO NODE	IMPEDANCE (OHMS) R	X
1	GROUND	0.00	-10000.00
2	GROUND	2.79	69.27
1	2	0.00	27.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	340.01	-104.75
2	244.75	254.60

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	2.84	97.21	97.25	88.33
INPUT CURRENT (AMPS) :	-3.41	0.79	3.50	166.92
OUTPUT CURRENT (AMPS) :	-3.47	0.81	3.57	166.88

INPUT/OUTPUT CURRENT RATIO = 0.9803
INPUT/OUTPUT PHASE = 0.04 DEGREES

FIGURE 14
WBGX CIRCUIT ANALYSIS FOR DIRECTIONAL NIGHT MODE

CUSTOMER : WBGX
NETWORK ID : TOWER 3 NIGHT

FREQUENCY : 1570.00 kHz
ATU SHUNT IMPEDANCE (R,X) : 0.00,-10000.00 OHMS
TOWER FEED IMPEDANCE (R,X) : 0.00, 31.00 OHMS
TOWER SHUNT IMPEDANCE (R,X) : 0.00, -6758.20 OHMS
TOWER IMPEDANCE (R,X) : 9.95, 1.81 OHMS

NODE	TO	NODE	IMPEDANCE (OHMS) R	X
1		GROUND	0.00	-10000.00
2		GROUND	9.96	1.80
1		2	0.00	31.00

NODE	VOLTAGE MAGNITUDE	PHASE
1	88.06	30.09
2	25.99	327.20

	REAL	IMAGINARY	MAGNITUDE	PHASE
INPUT IMPEDANCE (OHMS) :	10.02	32.89	34.39	73.06
INPUT CURRENT (AMPS) :	1.87	-1.75	2.56	-42.97
OUTPUT CURRENT (AMPS) :	1.88	-1.76	2.57	-43.11

INPUT/OUTPUT CURRENT RATIO = 0.9965
INPUT/OUTPUT PHASE = 0.14 DEGREES

FIGURE 15
WBGX REFERENCE FIELD INTENSITY MEASUREMENTS
FEBRUARY, 2023

WBGX DAY REFERENCE POINT MEASUREMENTS – JANUARY 17, 2023

CO-ORD NAD27

Radial		Dist km	mV/m	Time		Deg	Min	Sec	Description
38°	1	1.05	428	1310	N	41	36	40.4	Dixie Hwy. at Police entrance
					W	87	40	16.4	
	2	1.89	124	1315	N	41	37	01.8	Opposite #147 150th St.
					W	87	39	53.9	
	3	2.31	149	1319	N	41	37	12.9	Honore St.
					W	87	39	43.0	
150.5°	1	2.35	16.4	1338	N	41	35	07.8	#16721 Dixie Hwy./Robey St.
					W	87	39	55.1	
	2	2.70	10.3	1414	N	41	34	58.0	NE corner, intersection of Lincoln St.
					W	87	39	47.2	and 169th St.
	3	2.98	9.1	1332	N	41	34	50.4	South side of 170th St. at entrance to
					W	87	39	40.7	commuter parking lot.
282°	1	1.32	55.0	1428	N	41	36	22.9	Kedzie Ave. at drive for Midwestern
					W	87	41	41.1	Electric.
	2	1.73	48.5	1437	N	41	36	25.6	#15531 Homan Ave.
					W	87	41	58.1	
	3	3.21	19.0	1448	N	41	36	35.1	East Side of Pulaski Ave. at drive #15425
					W	87	43	01.0	for Tom's Collision Clinic

FIGURE 15

WBGX REFERENCE FIELD INTENSITY MEASUREMENTS

CONTINUED

WBGX NIGHT REFERENCE POINT MEASUREMENTS – JANUARY 17, 2023

						CO-ORD NAD27			
Radial		**Dist km**	**mV/m**	**Time**		**Deg**	**Min**	**Sec**	**Description**
5°	1	1.49	138	1514	N	41	37	02.1	#369 150th St.
					W	87	40	39.2	
	2	1.68	99.2	1518	N	41	37	08.1	149th St. at building
					W	87	40	38.9	
	3	1.89	92.7	1525	N	41	37	15.1	148th St. by trees
					W	87	40	38.2	
73.5°	1	0.92	20.0	1532	N	41	36	22.3	#212 156th St.
					W	87	40	07.1	
	2	1.38	15.2	1538	N	41	36	26.6	#15517 Lincoln St.
					W	87	39	47.4	
	3	1.58	12.1	1545	N	41	36	28.9	SW corner, intersection of Wood St.
					W	87	39	39.6	and 155th St.
150.5°	1	2.35	17.9	1605	N	41	35	07.8	#16721 Dixie Hwy./Robey St.
					W	87	39	55.1	
	2	2.70	9.6	1602	N	41	34	58.0	NE corner, intersection of Lincoln St.
					W	87	39	47.2	and 169th St.
	3	2.98	12.6	1558	N	41	34	50.4	South side of 170th St. at entrance to
					W	87	39	40.7	commuter parking lot.

FIGURE 15

WBGX REFERENCE FIELD INTENSITY MEASUREMENTS

CONTINUED

WBGX NIGHT REFERENCE POINT MEASUREMENTS – JANUARY 17, 2023

						CO-ORD NAD27			
Radial		**Dist km**	**mV/m**	**Time**		**Deg**	**Min**	**Sec**	**Description**
219.5°	1	2.03	34.3	1620	N	41	35	23.4	SW corner, intersection of Kedzie Ave.
					W	87	41	40.9	and 165th St.
	2	2.28	28.5	1616	N	41	35	17.2	#16549 Spaulding/166th St.
					W	87	41	47.9	
	3	3.35	18.0	1633	N	41	34	50.2	#17003 Central Park Ave.
					W	87	42	17.4	
296.5°	1	2.92	13.0	1655	N	41	36	56.3	#15222 Ridgeway Ave.
					W	87	42	38.5	
	2	3.19	16.2	1650	N	41	37	00.5	#15153 Avers Ave.
					W	87	42	48.8	
	3	4.01	15.6	1704	N	41	37	11.6	Intersection, 150th St./Keeler Ave.
					W	87	43	20.8	

FIGURE 16
WBGX CURRENT MOMENTS FOR DAY MODE

WBGX DAY

CURRENT MOMENTS(amp-degrees) rms

Frequency = 1.57 MHz
Input power = 1,100. watts

			vertical current moment	
wire	magnitude	phase (deg)	magnitude	phase (deg)
1	.0473741	180.3	.0473741	180.3
2	112.998	214.1	112.998	214.1
3	188.189	360.	188.189	360.
4	197.537	212.	197.537	212.

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	.0473741	180.3
2	112.998	214.1
3	188.189	360.
4	197.537	212.

FIGURE 17
WBGX CURRENT MOMENTS FOR NIGHT MODE

WBGX NIGHT

CURRENT MOMENTS(amp-degrees) rms

Frequency = 1.57 MHz
Input power = 500. watts

			vertical current moment	
wire	magnitude	phase (deg)	magnitude	phase (deg)
1	222.416	0.0	222.416	0.0
2	182.491	166.6	182.491	166.6
3	115.688	315.8	115.688	315.8
4	.0547232	242.8	.0547232	242.8

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	222.416	0.0
2	182.491	166.6
3	115.688	315.8
4	.0547232	242.8