WOMBLE
CARLYLE
SANDRIDGE
& RICE

A PROFESSIONAL LIMITED
LIABILITY COMPANY

Seventh Floor
1401 Eye Street, N.W.
Washington, DC 20005

Telephone: (202) 467-6900
Fax: (202) 467-6910
Web site: www.wcsr.com

Gregg P. Skall
Direct Dial: (202) 857-4441
Direct Fax: (202) 261-0041
E-mail: gskall@wcsr.com

December 7, 2009

FILED/ACCEPTED

DEC - 7 2009

Federal Communications Commission
Office of the Secretary

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
Washington, DC 20554

Re: File No. BMML 20090527AIB
        KYES(AM), Rockville, MN (Facility ID No. 136921)
        Amendment to License Application (License to Cover BMP-20080715ADM)

Dear Ms. Dortch:

Transmitted herewith on behalf of Throw Fire Project is its further amendment to the above-referenced license application filed with the FCC on May 26, 2009.

Should any question arise concerning this material, please communicate directly with this office or, with respect to technical matters, with B. Benjamin Evans, 216 N. Green Bay Road, Suite 205, Thiensville, WI 53092; telephone: (262) 242-6000; email: ben@evansassoc.com.

Sincerely,

Gregg P. Skall

Enclosures
cc: Benjamin Evans
        Ann Gallagher, FCC

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)

THROW FIRE PROJECT

FILED/ACCEPTED

MAILING ADDRESS (Line 1) (Maximum 35 characters)
1310 SECOND STREET

DEC - 7 2009

MAILING ADDRESS (Line 2) (Maximum 35 characters)

Federal Communications Commission
Office of the Secretary

CITY Sauk Rapids	STATE OR COUNTRY (if foreign address) MN	ZIP CODE 56379-2532
TELEPHONE NUMBER (include area code) 3202511780	CALL LETTERS KYES	OTHER FCC IDENTIFIER (If applicable)

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): **Amendment**

   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
	0 0 0 1	$	

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

FCC 302-AM
August 1995

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT		
Throw Fire Project		
MAILING ADDRESS		
P. O. Box 547, 1310 Second Street North		
CITY **Sauk Rapids**	STATE **MN**	ZIP CODE **56379**

2. This application is for:

       ☒Commercial   ☐Noncommercial

       ☒AM Directional   ☐AM Non-Directional

Call letters **KYES**	Community of License **Rockville, MN**	Construction Permit File No. **BNP-20020508AAN**	Modification of Construction Permit File No(s). **BMP-20080715ADM** **BMP-20080220ABE**	Expiration Date of Last Construction Permit **01/25/2009**

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. **Eng. Stmt.**

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

☒ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

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

☐ Yes ☒ No

Exhibit No.

If Yes, explain in an Exhibit.

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.

FCC 302-AM
August 1995

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

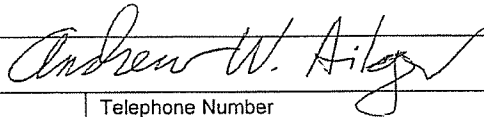If Yes, provide particulars as an Exhibit.

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	Andrew W. Hilger	Signature	*Andrew W. Hilger*	
Title	President	Date 12/07/2009	Telephone Number (320) 257-1625	

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
Throw Fire Project

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☒ Station License   ☐ Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign **KYES**	File No. of Construction Permit (if applicable) **BMP-20080715ADM**	Frequency (kHz) **1180**	Hours of Operation **Unlimited**	Power in kilowatts	
				Night **5.0**	Day **50.0**

2. Station location

State **Minnesota**	City or Town **Rockville**

3. Transmitter location

State **MN**	County **Stearns**	City or Town **Maine Prairie Township**	Street address (or other identification) **County Rd. 147 & 93rd Ave.**

4. Main studio location

State **MN**	County **Benton**	City or Town **Sauk Rapids**	Street address (or other identification) **1310 2nd Street N**

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

State **MN**	County **Benton**	City or Town **Sauk Rapids**	Street address (or other identification) **1310 2nd Street N**

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
However, see Engineering Statement.

☐ Not Applicable

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

Exhibit No. **On File**

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system **10.4**	RF common point or antenna current (in amperes) without modulation for day system **32.4**
Measured antenna or common point resistance (in ohms) at operating frequency Night **50** Day **50**	Measured antenna or common point reactance (in ohms) at operating frequency Night **0** Day **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	-5.5	0.0	.474	1.000	2.79	27.7
2 – Night / 7 – Day	0.0	+105.9	1.000	.939	7.60	26.3
3	+15.9	-	.536	-	4.05	-
4	+59.4	-	.441	-	3.37	-
5	+94.5	-	1.028	-	7.82	-
6	+116.2	-	.568	-	4.32	-

Manufacturer and type of antenna monitor: **Potomac 1901**

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

Type Radiator **Uniform cross-section steel towers**	Overall height in meters of radiator above base insulator, or above base, if grounded. **59.7**	Overall height in meters above ground (without obstruction lighting) **60.7**	Overall height in meters above ground (include obstruction lighting) **60.7**	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
				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 **45 o** **21'** **43"**	West Longitude **94 o** **17'** **57"**

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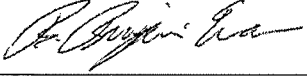
> Exhibit No.

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?

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

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) **B. Benjamin Evans, P. E.**	Signature (check appropriate box below)
Address (include ZIP Code) **216 N. Green Bay Road, Suite 205, Thiensville, WI 53092**	Date **12/04/2009**
	Telephone No. (Include Area Code) **(262) 242-6000**

☐ Technical Director   ☒ Registered Professional Engineer

☐ Chief Operator   ☐ Technical Consultant

☐ Other (specify)

Engineering Statement
Amendment to Application for License
KYES(AM), 1180 KHz, Rockville, MN

This Engineering Statement and attached exhibits are in support of the pending application for license to cover construction permit of KYES, 1180 KHz, Rockville, MN (BMP-20080715ADM), and are in response to a letter from FCC Audio Division staff dated October 7, 2009, regarding the engineering exhibits currently on file for that application. The license application was filed in accordance with the requirements for an antenna proof of performance using the Method of Moments.

The FCC letter has asked Throw Fire, the permittee, to address the following:

1. Tower current distributions for the nighttime antenna, given the drive voltages listed in the Form 302 exhibit, and normalized to the reference tower, do not agree with the theoretical parameters.

2. The FCC 302 form must list the antenna parameters derived by the Method of Moments, not the actual parameters as read on the antenna monitor.

3. Slightly different heights for Tower 2 were used in the nighttime array model and in the individual tower impedance calculations.

4. Measurements of the sampling system at or near carrier frequency, with the sample devices connected, were not included in the Form 302 exhibit.

The information contained in this amendment to address the above is as follows:

1. MoM night array model calculations with corrected Tower 2 height.
2. Revised FCC 302-AM form.
3. Sample line measurements and calculations with requested impedance measurements of the sample system at carrier included.
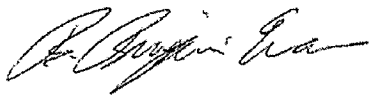
It is believed that the discrepancy between the Audio Division's moment of methods calculations and the information in the exhibits on file was caused in part by this engineer's use of inconsistent heights for Tower 2 in the MoM night antenna model. It has also been discovered that the inclusion of Tower 7 (the unused daytime-only tower) in the nighttime array modeling can cause anomalies in the calculations.

The MoM night model has been rerun using the same Tower 2 height as was used in the individual tower impedance calculations. Also, Tower 7 has been removed from the model, which is believed to be acceptable since this tower is sufficiently detuned in the night mode according to industry standards and is therefore not a significant radiator in the array. However, it should be noted that the MiniNec Broadcast Professional program (Version 14.5), the most widely-used computer program for AM Method of Moments

proofs (and used in the KYES proof), does not necessarily give identical numbers when run on another computer or under a different operating system.

The new Method of Moments night antenna parameters derived from the corrected Tower 2 model height and with Tower 7 removed are ever so slightly different from those currently on file. The KYES nighttime array is operating within the maximum tolerances from the revised MoM antenna parameters.

The information in this statement and the information attached are true and accurate to the best of my knowledge and belief.

B. Benjamin Evans, P.E.
Consulting Engineer for Throw Fire Project

December 4, 2009

Derivation of Operating Parameters for Nighttime Directional Antenna

The Method of Moments model was used to calculate the nighttime operating parameters. Calculations were made to determine the complex voltage source values to be applied at ground level for each tower of the array to produce the current moment sums for the towers which, when normalized to the reference tower, provide equality to the theoretical parameters of the night directional pattern. These voltage sources were then applied in the model and the tower currents were calculated.

The Tower 2 model height was corrected to the 88.5 electrical degrees used for this tower in the tower self-impedance calculations.

Tower 7, the unused Tower at night, was left out of the calculations, since the tower is sufficiently detuned according to industry standards so that it is not a significant radiator in the night array. The predicted operating base impedances produced by the model were then examined.

The calculations of the antenna parameters are as follows:

Twr	Theo. Field	Theo. Phase	Calc. R (Ω)	Calc. X (Ω)	Current Mag (A)	Current Phase (°)	Ant. Mon. Ratio	Ant. Mon. Phase (°)
1	0.438	-6.9	59.25	-29.99	3.702	0.1	0.474	-5.5
2	1	0	52.36	12.26	7.811	5.6	1	0
3	0.523	16.7	44.03	1.49	4.189	21.5	0.536	+15.9
4	0.418	64.9	0.796	-10.98	3.445	65.0	0.441	+59.4
5	0.990	99.5	4.08	-5.63	8.032	100.1	1.028	+94.5
6	0.549	122.0	-2.63	-1.40	4.436	121.8	0.568	+116.2

C:\Documents and Settings\Owner\Desktop\Newest KYES\KYES 6 Twr Geometry 12-04-
2009   15:54:39

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.29	10
		0	0	88.8		
2	none	181.2	120.2	0	.29	10
		181.2	120.2	88.5		
3	none	366.4	116.6	0	.29	10
		366.4	116.6	88.2		
4	none	123.8	213.6	0	.29	10
		123.8	213.6	88.		
5	none	201.7	144.9	0	.29	10
		201.7	144.9	88.6		
6	none	375.6	130.1	0	.29	10
		375.6	130.1	88.2		

Number of wires   = 6
          current nodes = 60

		minimum			maximum	
Individual wires		wire	value		wire	value
segment length		4	8.8		1	8.88
radius		1	.29		1	.29

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1,180.	0	1	.0244444	.0246667

Sources

source	node	sector	magnitude	phase	type
1	1	1	347.651	333.2	voltage
2	11	1	593.984	18.8	voltage
3	21	1	261.003	23.5	voltage
4	31	1	53.6213	339.2	voltage
5	41	1	79.0447	46.	voltage
6	51	1	18.6786	329.9	voltage

IMPEDANCE
   normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1,180.	59.252	-29.991	66.41	333.2	1.7664	-11.149	-.34679
source = 2; node 11, sector 1							
1,180.	52.356	12.262	53.772	13.2	1.2756	-18.336	-6.4E-02
source = 3; node 21, sector 1							
1,180.	44.034	1.4919	44.06	1.9	1.1399	-23.69	-1.9E-02
source = 4; node 31, sector 1							
1,180.	.79575	-10.976	11.005	274.1	65.862	-.26378	-12.297
source = 5; node 41, sector 1							
1,180.	4.0843	-5.634	6.9587	305.9	12.399	-1.4042	-5.5868
source = 6; node 51, sector 1							
1,180.	-2.6256	-1.4041	2.9775	208.1	****	****	****

CURRENT rms
Frequency   = 1180 KHz
Input power = 5,000. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	3.70166	.1	3.70165	5.76E-03
2	0	0	8.88	3.5691	357.	3.56436	-.184059
3	0	0	17.76	3.39834	355.1	3.38573	-.292495
4	0	0	26.64	3.16731	353.4	3.14648	-.36272
5	0	0	35.52	2.8759	352.	2.84796	-.39985
6	0	0	44.4	2.52717	350.8	2.49433	-.406125
7	0	0	53.28	2.12578	349.6	2.09099	-.38306
8	0	0	62.16	1.67687	348.6	1.64368	-.332008
9	0	0	71.04	1.18447	347.6	1.15691	-.254032
10	0	0	79.92	.64737	346.7	.630007	-.148929
END	0	0	88.8	0	0	0	0
GND	-91.1472	-156.607	0	7.8109	5.6	7.77315	.766928
12	-91.1472	-156.607	8.85	7.81399	3.	7.80292	.415695
13	-91.1472	-156.607	17.7	7.61267	1.5	7.61016	.19537
14	-91.1472	-156.607	26.55	7.22647	.2	7.22642	.0281684
15	-91.1472	-156.607	35.4	6.66364	359.2	6.66297	-.0945868
16	-91.1472	-156.607	44.25	5.93462	358.3	5.932	-.176159
17	-91.1472	-156.607	53.1	5.05176	357.5	5.04704	-.218348
18	-91.1472	-156.607	61.95	4.02809	356.8	4.02194	-.222606
19	-91.1472	-156.607	70.8	2.87371	356.2	2.86741	-.190114
20	-91.1472	-156.607	79.65	1.58555	355.6	1.58093	-.120908
END	-91.1472	-156.607	88.5	0	0	0	0
GND	-164.059	-327.618	0	4.1888	21.5	3.89691	1.53627
22	-164.059	-327.618	8.82	4.15037	19.3	3.9165	1.37354
23	-164.059	-327.618	17.64	4.0185	18.	3.82247	1.23977
24	-164.059	-327.618	26.46	3.79547	16.9	3.63178	1.10261
25	-164.059	-327.618	35.28	3.48494	16.	3.35023	.959579
26	-164.059	-327.618	44.1	3.09216	15.2	2.98394	.810903

27	-164.059	-327.618	52.92	2.62355	14.5	2.53976	.657711
28	-164.059	-327.618	61.74	2.08582	13.9	2.02467	.501339
29	-164.059	-327.618	70.56	1.48416	13.4	1.44404	.342772
30	-164.059	-327.618	79.38	.816943	12.8	.79652	.181526
END	-164.059	-327.618	88.2	0	0	0	0
GND	-103.116	68.5099	0	3.44527	65.	1.45559	3.12268
32	-103.116	68.5099	8.8	3.37449	65.	1.42787	3.05751
33	-103.116	68.5099	17.6	3.24185	64.9	1.3732	2.93665
34	-103.116	68.5099	26.4	3.04204	64.9	1.28979	2.75507
35	-103.116	68.5099	35.2	2.77757	64.9	1.17873	2.51505
36	-103.116	68.5099	44.	2.45259	64.9	1.04175	2.22036
37	-103.116	68.5099	52.8	2.07213	64.8	.880921	1.87555
38	-103.116	68.5099	61.6	1.64136	64.8	.698397	1.48536
39	-103.116	68.5099	70.4	1.16416	64.8	.495781	1.05331
40	-103.116	68.5099	79.2	.639027	64.8	.272376	.578071
END	-103.116	68.5099	88.	0	0	0	0
GND	-165.021	-115.979	0	8.03209	100.1	-1.40366	7.90849
42	-165.021	-115.979	8.86	7.90325	99.9	-1.35252	7.78666
43	-165.021	-115.979	17.72	7.61341	99.7	-1.28382	7.50438
44	-165.021	-115.979	26.58	7.15865	99.6	-1.19087	7.0589
45	-165.021	-115.979	35.44	6.54629	99.4	-1.07468	6.45748
46	-165.021	-115.979	44.3	5.7868	99.3	-.937397	5.71037
47	-165.021	-115.979	53.16	4.89278	99.2	-.781791	4.82992
48	-165.021	-115.979	62.02	3.87727	99.1	-.610792	3.82886
49	-165.021	-115.979	70.88	2.75029	98.9	-.426894	2.71696
50	-165.021	-115.979	79.74	1.50924	98.8	-.230642	1.49151
END	-165.021	-115.979	88.6	0	0	0	0
GND	-241.933	-287.305	0	4.43592	121.8	-2.33831	3.76958
52	-241.933	-287.305	8.82	4.38105	121.9	-2.31755	3.71788
53	-241.933	-287.305	17.64	4.23039	122.	-2.24197	3.58745
54	-241.933	-287.305	26.46	3.98552	122.	-2.1145	3.37835
55	-241.933	-287.305	35.28	3.65082	122.1	-1.93792	3.09402
56	-241.933	-287.305	44.1	3.23224	122.1	-1.71579	2.73925
57	-241.933	-287.305	52.92	2.73681	122.	-1.45222	2.31973
58	-241.933	-287.305	61.74	2.17174	122.	-1.1515	1.84133
59	-241.933	-287.305	70.56	1.54257	122.	-.817005	1.30844
60	-241.933	-287.305	79.38	.847684	121.9	-.448337	.719417
END	-241.933	-287.305	88.2	0	0	0	0

Sample Line Measurements & Calculations
KYES(AM), 1180 KHz, Rockville, MN

The sampling system for KYES consists of Delta TCT current transformers installed at the output of each antenna tuning unit, immediately adjacent to the final J-plug. Samples from the current transformers are fed to the antenna monitor via equal lengths of 1/2-inch phase-stabilized foam-dielectric coaxial transmission lines. The antenna monitor is a Potomac Instruments 1901.

Impedance measurements of the sample lines were made using a General Radio 916-AL impedance bridge. The measurements were made looking into the antenna monitor ends of the sample lines with the tower ends of the sample lines open-circuited (OC).

The table below shows the frequencies above and below the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, was found. As the length of distortionless transmission line is 180 electrical degrees at the difference frequency between adjacent frequencies of resonance, and frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sample line length at the resonant frequency below the carrier frequency of 1180 Khz, which is the closest to 1180 Khz, is 270 electrical degrees. The electrical length at 1180 Khz of each sample line was calculated by ratioing 1180 to the lower resonant frequency and multiplying that ratio by 270 electrical degrees. To determine the characteristic impedances of the sample lines, open-circuit measurements were made with frequency offsets of 45 electrical degrees above and below the resonant frequency nearest to 1180 KHz.

Twr	OC resonance below carrier (KHz)	OC resonance above carrier (KHz)	Sample line calc. length @carrier (deg)	+45° offset from nearest OC freq (KHz)	-45° offset from nearest OC freq (KHz)	Meas R @+45° (Ω)	Meas X @+45° (Ω)	Meas R @-45° (Ω)	Meas X @-45° (Ω)	Calc. Char. Impedance (Z₀) (Ω)	R @carrier w/Delta TCT connected (Ω)	X @carrier w/Delta TCT connected (Ω)
1	961.0	1609.3	331.5	1121.2	800.8	5.6	48.1	4.4	-50.6	49.6	49.2	1.3
2	961.2	1609.6	331.5	1121.4	801.0	5.6	48.1	4.3	-50.6	49.6	48.6	1.7
3	961.2	1609.5	331.5	1121.4	801.0	5.7	48.1	4.3	-50.6	49.6	48.9	1.3
4	961.1	1609.6	331.5	1121.3	800.9	5.6	48.1	4.3	-50.6	49.6	48.7	1.3
5	961.1	1609.5	331.5	1121.3	800.9	5.7	48.1	4.3	-50.6	49.6	48.8	1.7
6	961.3	1609.9	331.4	1121.5	801.1	5.6	48.1	4.3	-50.6	49.6	48.6	1.3
7	961.1	1609.6	331.5	1121.3	800.9	5.7	48.1	4.4	-50.6	49.6	48.8	1.3

Sample Line Measurements & Calculations
KYES(AM), 1180 KHz, Rockville, MN
(Continued)

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:

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

Finally, the Delta TCT transformers were reconnected, and impedance measurements at the antenna monitor ends of the sample lines were taken at 1180 KHz. These measurements are shown in the last two columns in the previous table.

As can be seen in the table, the sample lines are of equal length to within one electrical degree, and both the calculated characteristic impedances and the measured impedances at 1180 KHz with the sample devices connected are well within 2 ohms as required by FCC rules.