

**Engineering Exhibit For  
Herbert M. Hoppe Revocable Trust  
Tri-County Broadcasting, Inc.  
Sauk Rapids, Minnesota  
March 2020**

This engineering exhibit was prepared in response to FM translator construction permit BNPFT-20181018ABJ (K232GA, FCC Facility ID 202576), BNPFT-20180509ACH (W239CU, FCC Facility ID 202610), BNPFT-20180509ACT (W266DT, FCC Facility ID 202589) and BNPFT-20180509ACG (W272EG, FCC Facility ID 202611) special operating conditions which require that measurements be taken to verify that the installation of the equipment related to these construction permits meets the spurious and harmonic emission requirements of 47 C.F.R. Sections 73.317(b) through 73.317(d).

3 BEFORE PROGRAM TESTS COMMENCE, sufficient measurements shall be made to establish that the operation authorized in this construction permit is in compliance with the spurious emissions requirements of 47 C.F.R. Sections 73.317(b) through 73.317(d). All measurements must be made with all stations simultaneously utilizing the shared antenna. These measurements shall be submitted to the Commission along with the FCC Form 350-FM application for license.

The implementation of the facilities authorized in these four construction permits was achieved via a combined antenna system which involves a shared two bay antenna and associated transmission line with the four Nautel VS-1 transmitters combined into that antenna via a custom-built Kintronic Labs FMC4X700W3C four port, three cavity-per-port combiner. Proper tuning of this combiner was verified prior to energizing the antenna, and measurements were taken using an Anritsu MS2721B spectrum analyzer and a calibrated whip antenna. These measurements were taken approximately 800 feet (244 meters) west of the tower and the results are attached. The minimum required attenuation for 250 watts ERP is -67 dBc while the maximum mix product attributable to this facility was at least -77 dBc, indicating full compliance with 73.317. Emissions from 120 through 600 KHz removed from the carrier frequency were also measured and verified to be within the allowable mask.

Specific potential mix product and harmonic frequencies were checked while scanning the frequency range of 50 through 700 MHz and any found above +10 dBu are noted. These were:

**Intermod Study: Transmit Frequencies and Fc Field Intensity**

94.3MHz : 91.13 dBu (This reference was used as it is the most restrictive.)  
95.7MHz : 95.23 dBu  
101.1MHz: 93.97 dBu  
102.3MHz: 95.68 dBu

**HIT WINDOW LIMITS**

LOWER LIMIT: 50MHz :      UPPER LIMIT: 700MHz :

**SECOND ORDER HITS:**

94.3 + 94.3 = 188.6	17.80 dBu	-73.33 dBc
95.7 + 94.3 = 190.0		
95.7 + 95.7 = 191.4		
101.1 + 94.3 = 195.4		
102.3 + 94.3 = 196.6		
101.1 + 95.7 = 196.8		
102.3 + 95.7 = 198.0		
101.1 + 101.1 = 202.2	11.96 dBu	-79.17 dBc
102.3 + 101.1 = 203.4		
102.3 + 102.3 = 204.6	13.78 dBu	-77.35 dBc

**THIRD ORDER HITS:**

94.3 + 94.3 + 94.3 = 282.9	18.05 dBu	-73.08 dBc
95.7 + 94.3 + 94.3 = 284.3		
95.7 + 95.7 + 94.3 = 285.7		
95.7 + 95.7 + 95.7 = 287.1	15.92 dBu	-75.21 dBc
101.1 + 94.3 + 94.3 = 289.7		
102.3 + 94.3 + 94.3 = 290.9		
101.1 + 95.7 + 94.3 = 291.1		
102.3 + 95.7 + 94.3 = 292.3		
101.1 + 95.7 + 95.7 = 292.5		
102.3 + 95.7 + 95.7 = 293.7	13.83 dBu	-77.30 dBc
101.1 + 101.1 + 94.3 = 296.5		
102.3 + 101.1 + 94.3 = 297.7		
101.1 + 101.1 + 95.7 = 297.9		
102.3 + 102.3 + 94.3 = 298.9		
102.3 + 101.1 + 95.7 = 299.1		
102.3 + 102.3 + 95.7 = 300.3		
101.1 + 101.1 + 101.1 = 303.3	19.15 dBu	-71.98 dBc
102.3 + 101.1 + 101.1 = 304.5		
102.3 + 102.3 + 101.1 = 305.7		
102.3 + 102.3 + 102.3 = 306.9	17.62 dBu	-73.51 dBc

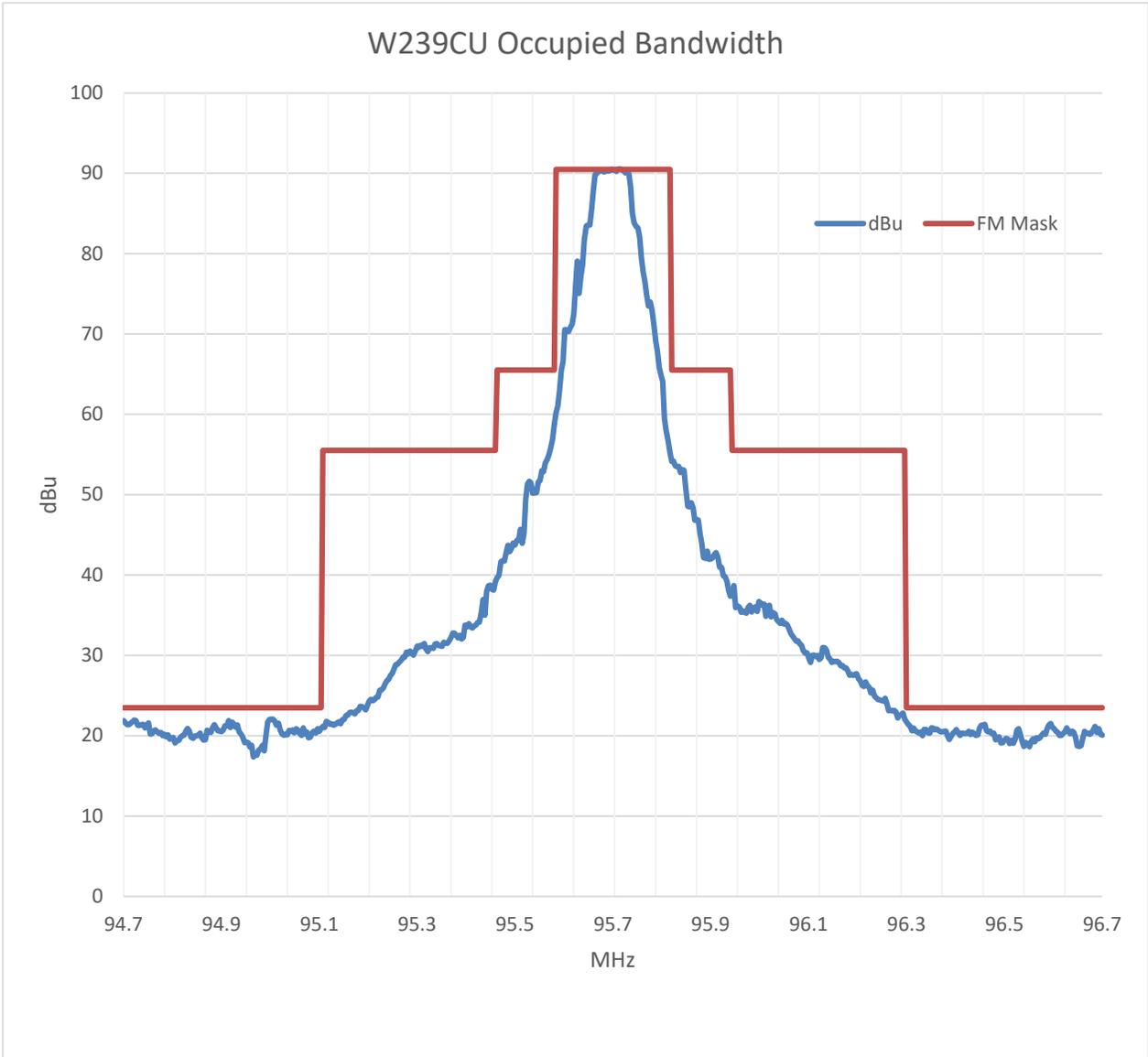
FOURTH ORDER HITS:

$94.3 + 94.3 + 94.3 + 94.3 = 377.2$	17.21 dBu	-73.92 dBc
$95.7 + 94.3 + 94.3 + 94.3 = 378.6$		
$95.7 + 95.7 + 94.3 + 94.3 = 380.0$		
$95.7 + 95.7 + 95.7 + 94.3 = 381.4$		
$95.7 + 95.7 + 95.7 + 95.7 = 382.8$	14.05 dBu	-77.08 dBc
$101.1 + 94.3 + 94.3 + 94.3 = 384.0$		
$102.3 + 94.3 + 94.3 + 94.3 = 385.2$		
$101.1 + 95.7 + 94.3 + 94.3 = 385.4$		
$102.3 + 95.7 + 94.3 + 94.3 = 386.6$		
$101.1 + 95.7 + 95.7 + 94.3 = 386.8$		
$102.3 + 95.7 + 95.7 + 94.3 = 388.0$		
$101.1 + 95.7 + 95.7 + 95.7 = 388.2$		
$102.3 + 95.7 + 95.7 + 95.7 = 389.4$		
$101.1 + 101.1 + 94.3 + 94.3 = 390.8$		
$102.3 + 101.1 + 94.3 + 94.3 = 392.0$		
$101.1 + 101.1 + 95.7 + 94.3 = 392.2$		
$102.3 + 102.3 + 94.3 + 94.3 = 393.2$		
$102.3 + 101.1 + 95.7 + 94.3 = 393.4$		
$101.1 + 101.1 + 95.7 + 95.7 = 393.6$		
$102.3 + 102.3 + 95.7 + 94.3 = 394.6$		
$102.3 + 101.1 + 95.7 + 95.7 = 394.8$		
$102.3 + 102.3 + 95.7 + 95.7 = 396.0$		
$101.1 + 101.1 + 101.1 + 94.3 = 397.6$		
$102.3 + 101.1 + 101.1 + 94.3 = 398.8$		
$101.1 + 101.1 + 101.1 + 95.7 = 399.0$		
$102.3 + 102.3 + 101.1 + 94.3 = 400.0$		
$102.3 + 101.1 + 101.1 + 95.7 = 400.2$		
$102.3 + 102.3 + 102.3 + 94.3 = 401.2$		
$102.3 + 102.3 + 101.1 + 95.7 = 401.4$		
$102.3 + 102.3 + 102.3 + 95.7 = 402.6$		
$101.1 + 101.1 + 101.1 + 101.1 = 404.4$	10.98 dBu	-80.15 dBc
$102.3 + 101.1 + 101.1 + 101.1 = 405.6$		
$102.3 + 102.3 + 101.1 + 101.1 = 406.8$		
$102.3 + 102.3 + 102.3 + 101.1 = 408.0$		
$102.3 + 102.3 + 102.3 + 102.3 = 409.2$	11.41 dBu	-79.72 dBc

The required suppression, based on 250 watts ERP, is -67 dBc.

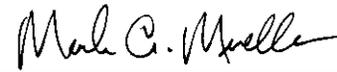
**Occupied Bandwidth**

The occupied bandwidth under normal modulation conditions was measured using the same Anritsu MS2721B spectrum analyzer and a calibrated whip antenna. The analyzer was run in peak store mode for 10 minutes with a resolution bandwidth of 3 KHz. All four transmitters “passed” the occupied bandwidth test, with W239CU shown here as an example.



This engineering exhibit was prepared by me and is true and correct to the best of my knowledge and belief.

March 2, 2020



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Mark A. Mueller

**Engineering Exhibit For  
Herbert M. Hoppe Revocable Trust  
W M I N ( A M )  
Sauk Rapids, Minnesota  
March 2020**

This engineering exhibit was prepared in response to FM translator construction permit BNPFT-20181018ABJ (K232GA, FCC Facility ID 202576), BNPFT-20180509ACH (W239CU, FCC Facility ID 202610), BNPFT-20180509ACT (W266DT, FCC Facility ID 202589) and BNPFT-20180509ACG (W272EG, FCC Facility ID 202611) special operating conditions which require before and after partial proof of performance readings on WMIN (AM), Sauk Rapids, Minnesota (FCC Facility ID 161428):

4 This construction permit authorizes the mounting of an antenna on a directional tower of the AM station identified below. Prior to installation of the antenna, the permittee shall notify the AM station licensee so that, if necessary, the AM station may determine operating power by the indirect method (see Section 73.51 of the Commission's Rules) and request a Special Temporary Authorization pursuant to Section 73.1635 of the Commission's Rules to operate with parameters at variance. The permittee must conduct a partial proof of performance as defined in Section 73.154 of the Commission's Rules both before and after construction to show that the AM station has not been adversely affected. If the operating parameters of the AM station differ from licensed values following the antenna installation, the results of the partial proof of performance shall be filed with the Commission by the AM station licensee using form FCC 302-AM. (See Section 1.30003 of the Commission's Rules.) The permittee must submit confirmation of completion of the requirements of this condition in the application for license to cover this construction permit.

Station WMIN(AM), Sauk Rapids, MN, Fac. ID No. 161428.

*(Note: this is condition #5 on BNPFT-20180509ACH)*

The implementation of the facilities authorized in these four construction permits was achieved via a combined antenna system which involves only one two bay antenna and associated transmission line, mounted at the top of WMIN tower #7 which is used daytime only (the WMIN nighttime array uses towers #1, #3, #5 and #6). The transmission line crosses the base insulator via a Kintronic Labs ISO-100-FM isolation coil which presents a parallel impedance of more than 4000 ohms at 1010 KHz. This is more than 20 times the 185 ohm operating impedance of the tower and as one would expect had little effect on the array, with the antenna monitor parameters

shifting less than 5% and 5°. Once the antenna, transmission line and isolation coil were installed the WMIN daytime pattern was adjusted to exactly the licensed parameters and an eight point partial proof of performance was run on the two monitored radials (158.5° and 349.5°) as required by §73.154 using the same points measured in September 2019 prior to the installation of the equipment. Comparison of the two sets of readings shows that this addition to tower #7 has had no adverse effect on the WMIN antenna. Because of this no WMIN FCC Form 302-AM for direct power measurement is required.

Attached are field intensity measurement data for each of the two daytime monitor point radials as required for a Partial Proof of Performance. Field readings were taken September 3, 2019 and February 28, 2020 by the writer. The writer's Potomac Instruments FIM-41 field intensity meter was used, most recently calibrated May 20, 2019. The common point current was 6.06 amps (1,836 watts). Points were selected from the most recent full antenna proof of performance and license application BL-20081006AJB issued May 18, 2009 and are the same used for a partial proof in 2010. There are at least eight points per radial with one being the specified monitor point. The weather was normal for central Minnesota for both sets of measurements.

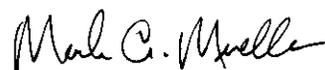
**Before and after monitor point readings**

<u>Day Monitor points</u>	<u>Limit</u>	<u>Before</u>	<u>After</u>
158.5° (1.87 KM)	29.02 mV/m	22.0	25.5
349.5° (3.04 KM)	116.7 mV/m	109	110

Measurements taken by Mark A. Mueller using his FIM-41 s/n 1655.

This engineering exhibit was prepared by me and is true and correct to the best of my knowledge and belief.

March 2, 2020



Mark A. Mueller

**WMIN Daytime Partial Proof of Performance Measurements**

Field Intensity Measurements "Before" Daytime Directional Antenna  
 WMIN, Sauk Rapids, Minnesota 158.5° True 1010 KHz

Loc	Orig. 2008	2019	Date	Time	Log Ratio	Dist. (KM)
5 MP	23.50	22.00	09/03/2019	13:28	-0.0286	1.87
8	15.50	14.00	09/03/2019	13:34	-0.0442	3.10
9	11.30	10.00	09/03/2019	13:37	-0.0531	3.48
10	10.60	9.70	09/03/2019	13:40	-0.0385	3.69
11	7.00	6.90	09/03/2019	13:47	-0.0062	4.54
12	4.70	4.50	09/03/2019	13:54	-0.0189	6.26
13	1.90	1.75	09/03/2019	14:05	-0.0357	9.80
14	2.55	2.60	09/03/2019	14:15	0.0084	11.53

MP-Monitor Point  
 Engineer: Mark Mueller, FIM 41  
 Weather: 72° cloudy

Avg. Log Ratio: -0.0271  
 Average Ratio: 0.9395  
 2008 IDF: 56.00  
 2019 IDF: 52.61  
 Std. Pattern: 67.65

Field Intensity Measurements "After" Daytime Directional Antenna  
 WMIN, Sauk Rapids, Minnesota 158.5° True 1010 KHz

Loc	Orig. 2008	2020	Date	Time	Log Ratio	Dist. (KM)
5 MP	23.50	25.50	02/28/2020	09:05	0.0355	1.87
8	15.50	16.00	02/28/2020	09:11	0.0138	3.10
9	11.30	12.50	02/28/2020	09:15	0.0438	3.48
10	10.60	11.10	02/28/2020	09:18	0.0200	3.69
11	7.00	7.20	02/28/2020	09:25	0.0122	4.54
12	4.70	4.85	02/28/2020	09:31	0.0136	6.26
13	1.90	2.00	02/28/2020	09:41	0.0223	9.80
14	2.55	2.65	02/28/2020	09:50	0.0167	11.53

MP-Monitor Point  
 Engineer: Mark Mueller, FIM 41  
 Weather: 20° sunny

Avg. Log Ratio: 0.0222  
 Average Ratio: 1.0526  
 2008 IDF: 56.00  
 2020 IDF: 58.94  
 Std. Pattern: 67.65

# Mueller Broadcast Design

613 S. La Grange Road  
La Grange, Illinois 60525  
(708) 352-2166

Field Intensity Measurements "Before" Daytime Directional Antenna  
WMIN, Sauk Rapids, Minnesota 349.5° True 1010 KHz

Loc	Orig. 2008	2019	Date	Time	Log Ratio	Dist. (KM)
8 MP	105.00	109.00	09/03/2019	12:39	0.0162	3.04
9	67.00	70.00	09/03/2019	12:46	0.0190	4.34
10	39.00	41.50	09/03/2019	12:51	0.0270	5.62
11	32.20	34.00	09/03/2019	12:58	0.0236	7.36
12	26.00	28.00	09/03/2019	13:03	0.0322	8.15
13	23.00	24.00	09/03/2019	13:08	0.0185	9.68
14	14.50	15.50	09/03/2019	13:15	0.0290	11.33
15	13.30	14.50	09/03/2019	13:20	0.0375	11.89

MP-Monitor Point  
Engineer: Mark Mueller, FIM 41  
Weather: 72° cloudy

Avg. Log Ratio: 0.0254  
Average Ratio: 1.0602  
2008 IDF: 412.00  
2019 IDF: 436.79  
Std. Pattern: 457.83

Field Intensity Measurements "After" Daytime Directional Antenna  
WMIN, Sauk Rapids, Minnesota 349.5° True 1010 KHz

Loc	Orig. 2008	2020	Date	Time	Log Ratio	Dist. (KM)
8 MP	105.00	110.00	02/28/2020	10:31	0.0202	3.04
9	67.00	71.00	02/28/2020	10:37	0.0252	4.34
10	39.00	42.00	02/28/2020	10:41	0.0322	5.62
11	32.20	35.50	02/28/2020	10:47	0.0424	7.36
12	26.00	29.00	02/28/2020	10:52	0.0474	8.15
13	23.00	24.50	02/28/2020	10:57	0.0274	9.68
14	14.50	16.00	02/28/2020	11:04	0.0428	11.33
15	13.30	15.00	02/28/2020	11:08	0.0522	11.89

MP-Monitor Point  
Engineer: Mark Mueller, FIM 41  
Weather: 20° sunny

Avg. Log Ratio: 0.0362  
Average Ratio: 1.0870  
2008 IDF: 412.00  
2020 IDF: 447.84  
Std. Pattern: 457.83

**Engineering Exhibit For  
Herbert M. Hoppe Revocable Trust  
W X Y G ( A M )  
Sauk Rapids, Minnesota  
March 2020**

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5 This construction permit authorizes the mounting of an antenna on a directional tower of the AM station identified below. Prior to installation of the antenna, the permittee shall notify the AM station licensee so that, if necessary, the AM station may determine operating power by the indirect method (see Section 73.51 of the Commission's Rules) and request a Special Temporary Authorization pursuant to Section 73.1635 of the Commission's Rules to operate with parameters at variance. Following installation of the antenna, the permittee must make a base impedance measurement on the AM station as described in Section 73.151(c)(1) of the Commission's Rules. If the new measured base resistance and reactance values vary by more than +/- 2 ohms and +/- 4 percent from the corresponding modeled resistance and reactance values contained in the moment method proof underlying the AM station's current license, the AM station licensee must file form FCC 302-AM and all required data in accordance with the requirements of Section 1.30003(b)(2) of the Commission's Rules.) The permittee must submit confirmation of completion of the requirements of this condition in the application for license to cover this construction permit.

Station WXYG(AM), Sauk Rapids, MN, Fac. ID No. 161448.  
(Note: this is condition #6 on BNPFT-20180509ACH)

The implementation of the facilities authorized in these four construction permits was achieved via a combined antenna system which involves only one two bay antenna and associated transmission line, mounted at the top of WXYG tower #7. The transmission line crosses the base insulator via a Kintronic Labs ISO-100-FM isolation coil which presents a parallel impedance of more than 2000 ohms at 540 KHz. This is more than 100 times the 18.5 ohm operating

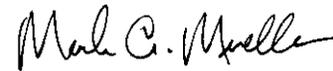
impedance of the tower and as one would expect had little effect on the array, with the antenna monitor parameters shifting less than 5% and 3°. Once the antenna, transmission line and isolation coil were installed WXYG tower #7 self-impedance was measured at the same location and under the same conditions using the same equipment as it was for the most recent license application (BMML- 20160706ABU). The measurement results were:

<u>Model</u>	<u>2016 Measured</u>	<u>2020 Measured</u>
18.06 - j109.68	18.5 – j108.6	18.1 – j110.5

As can be seen, the addition of this antenna and associated transmission line and isolation coil has actually resulted in a closer match to the model and no further action is necessary. Because of this no WXYG FCC Form 302-AM for direct power measurement is required.

This engineering exhibit was prepared by me and is true and correct to the best of my knowledge and belief.

March 2, 2020



Mark A. Mueller

**Engineering Exhibit For  
Tri-County Broadcasting, Inc.**

**W B H R ( A M )**

**W V A L ( A M )**

**Sauk Rapids, Minnesota**

**March 2020**

This engineering exhibit was prepared in response to FM translator construction permit BNPFT-20181018ABJ (K232GA, FCC Facility ID 202576), BNPFT-20180509ACH (W239CU, FCC Facility ID 202610), BNPFT-20180509ACT (W266DT, FCC Facility ID 202589) and BNPFT-20180509ACG (W272EG, FCC Facility ID 202611) special operating conditions which require that measurements be taken to verify that the installation of the equipment related to these construction permits has had no adverse effect on WBHR and WVAL, Sauk Rapids, Minnesota (FCC Facility IDs 26980 and 78914):

6 The AM station(s) identified below may be affected by the facilities authorized by this construction permit. Pursuant to Section 1.30004 of the Commission's Rules, at least 30 days prior to commencement of construction of the facilities authorized herein, the permittee must provide notification of the construction to the AM station licensee. As part of this notification, the permittee must examine the potential impact of the construction of the authorized facilities on the AM station using a moment method analysis. The analysis shall consist of a model of the AM antenna together with the potential re-radiating tower in a lossless environment. The model shall employ the methodology specified in Section 73.151(c) of the Commission's Rules, except that the AM antenna elements may be modeled as a series of thin wires driven to produce the required radiation pattern, without any requirement for measurement of tower impedances. If the AM station was authorized pursuant to a directional proof of performance based on field strength measurements, the permittee may, in lieu of the moment method analysis, demonstrate with measurements taken before and after construction that field strength values at the monitoring points do not exceed the licensed values. If the construction results in radiation values in excess of the AM station's licensed standard pattern or augmented pattern values, the permittee is responsible for the installation and maintenance of any detuning apparatus necessary to restore proper operation of the directional antenna. (See Section 1.30002 of the Commission's Rules.) The permittee must submit confirmation of completion of these notice and analysis requirements in the application for license to cover this construction permit. If the facilities authorized by this Construction Permit do not result in a significant modification of the existing tower specified as defined in Section 1.30002(d) of the Commission's Rules, the permittee shall submit a certification and any necessary evidence supporting that certification in the Application for License.

Station WBHR(AM), Sauk Rapids, MN, Fac. ID No. 26980.

Station WVAL(AM), Sauk Rapids, MN, Fac. ID No. 78914.

*(Note: this is condition #4 on BNPFT-20180509ACH)*

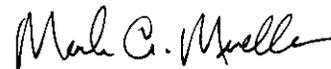
The implementation of the facilities authorized in these four construction permits was achieved via a combined antenna system which involves only one two bay antenna and associated transmission line, mounted at the top of existing tower #7 in this shared array, which is not used by either WBHR or WVAL. The transmission line crosses the base insulator via a Kintronic Labs ISO-100-FM isolation coil which presents a parallel impedance of more than 2500 ohms at 660 KHz and 3000 ohms at 800 KHz. This is more than 75 times the self impedance of the tower and as one would expect had little effect. Once the antenna, transmission line and isolation coil were installed the tower #7 self-impedance was measured at the same location and under the same conditions using the same equipment as it was for the most recent license applications (BMML-20121005AGV and BMML-20121005AGU). The measurement results were:

<u>Station</u>	<u>Model</u>	<u>2012 Measured</u>	<u>2020 Measured</u>
WBHR	26.01 - j45.31	25.70 - j46.10	26.92 -j43.33
WVAL	38.82 + j22.85	38.71 + j24.31	37.75 +j20.10

As can be seen, the addition of this antenna and associated transmission line and isolation coil to tower #7 has not resulted in the tower exceeding +/-2 ohms +/-4% resistance or reactance compared to the model values for each station and no further action is necessary. No physical tower construction was required.

This engineering exhibit was prepared by me and is true and correct to the best of my knowledge and belief.

March 2, 2020



Mark A. Mueller