Engineering Statement

in support of

FCC Form 302-AM

August 10, 2019

WMC

Memphis, Tennessee

licensed to:

Entercom License, LLC

prepared by:

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Baton Rouge, Louisiana
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Overview:

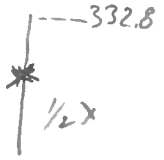
Entercom License, LLC, licensee of WMC, Memphis, Tennessee, recently replaced the tower light system on tower 1 with LED fixtures. Included in this project was the replacement of the entire tower light conduit system. After this work was done, they contracted with my firm, Michael Patton & Associates, to retune the array and measure the monitor points. All work has been completed; the details are discussed below.

Description of DA Array:

The WMC DA array consists of 4 towers arranged in a parallelogram. Towers 2 through 4 are self-supporting towers 97 meters (91° at 790 kHz) in height. Tower 1, also used as the support structure for the transmitting antennas for WMC-TV and WMC-FM, is a guyed tower 332.8 meters tall. Because the top section is detuned at WMC's frequency, it is considered to be 185° tall electrically.

Description of Tower 1:

Tower 1 requires a very complex arrangement to allow such a tall tower to be used as part of the WMC array. Two issues must be addressed: first, as the tower is much taller than the max height for an efficient radiator for WMC, the tower must be made to appear much shorter electrically at WMC's frequency than its physical height; and second, a method must be provided to allow the FM and TV rigid coax cables to cross the base insulator without shorting the tower to ground at WMC's frequency. The height issue is dealt with by using sectionalizing insulators at a point slightly more than ½ wavelength at WMC's frequency above ground, then detuning the top section via a tuning network in a weatherproof enclosure located at the sectionalizing break point, with the net result that the tower appears to only be as tall as the section below the insulators at 790 kHz. The base isolation issue is dealt with by isolating all coaxes from the tower from the base up to a point 1/4 wavelength at 790 kHz above the base, at which point they are all bonded over to the tower (historically called a "bazooka"). This isolation scheme is actually done twice on this tower; once at the base, and again at the sectionalizing insulator. The coax cables, all rigid lines, are supported inside the tower structure by a series of triangular brackets, both isolated and bonded to the tower sections.



DA Sample System:

The sample system consists of sample loops on all towers. On towers 2 through 4, these loops are located just above the base. On tower 1, there are two sample loops; one is 90° below the sectionalizing insulator (the "loop", or max RF current, point) which feeds the antenna monitor; a second loop is mounted at a point above the sectionalizing insulator and is used to adjust the detuning network. All sample signals are sent back to the transmitter building through equal length Heliax-type coax cables. The antenna monitor is a Potomac Instruments 1901 digital unit. The sample system meets all the requirements for Type Approval specified in 73.68 of the FCC rules.

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Description of work done:

The entire tower light system on Tower 1 was rebuilt. All new LED fixtures were installed, along with new conduits, electrical cables, and junction boxes. The original drawings for the old lighting system were used as a reference, and every effort was made to replicate the original system, with conduits located in the same places, bonded to the tower at the same points, and with junction boxes placed at the same heights.

Also, the FM antenna was taken down to the ground, rebuilt, and reflown. The antenna was remounted in the existing brackets, but the coax feeding it was rerouted slightly. As this antenna is located well above the top section's bazooka shorting point (but also far below the top of the tower), the move did not change and should not have affected the behavior of the bazooka.

Changes to Tower 1 impedance:

Despite the fact that every effort to replicate the old system was made, the base impedance and the DA drive point impedance for the tower after the above work was finished changed quite a bit, even after the detuning network at the sectionalizing insulator was painstakingly adjusted to properly detune the top section of the tower. Potential reasons for the change include that the new LED lighting system does not include any side marker lights (or associated conduit junction boxes); as the new LED lights draw much lower electrical current and therefore don't need as large a conductor size to feed them, the new conduits are smaller than before; and the changed coax feeding the WMC-FM antenna. Both day (ND) and night (DA) tower 1 ATU networks, and the phasor, had to be retuned to accommodate the changed impedances and to return the array to the licensed parameters. This was exacerbated by the fact that Tower 1 is slightly negative in the array, with drive point characteristics that are extremely dependent on the current and phase in that tower. But after several days of work, the array was brought back to its licensed parameters and is clearly stable at those values.

Condition of array:

After all the above work was completed, the monitor point field strength readings were measured, and all monitor points were found to be well below the limits given in the most recent WMC license. Given that the sample system was not modified in any way during the tower 1 lighting system rebuild, that the licensed DA parameters were obtained with minimal changes to any components other than the tower 1 ATU and phasor branch, and that no monitor points were even close to their licensed limits, it is the conclusion of this engineer that no further analysis of the WMC array is warranted at this time. This conclusion is bolstered by the licensee's plans to completely rebuild the array in the near future, complete with new ground system, phasor, and ATUs. Given that this array rebuild will require a full proof of performance, performing a partial proof now seems unnecessary.

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Monitor point descriptions:

The monitor point descriptions on the most recent (2001) WMC license do not meet contemporary standards for such descriptions. Although none of the points have been moved or become unsuitable, a few of the point descriptions should be updated due to changes in the area of the measurement location. Included with this report are updated descriptions of each point, along with their GPS coordinates and recent photographs.

Correction of typographical errors on license:

The antenna monitor parameters given on the 2001 license are incorrect; it shows the base current ratios instead of the antenna monitor sample ratios. The instant Form 302 shows the correct parameters. Included here in support of this is the operating parameters page from the September, 1988 partial proof from Cohen, Dippell, and Everist, consulting engineers.

Impedance data:

In addition to the changed value for the tower 1 daytime (ND) base impedance, we request that the DA common point impedance be changed from 54Ω to 50Ω.

Antenna monitor replacement:

Some years past, the WMC antenna monitor was upgraded from the Potomac Instruments AM-19D specified in the 2001 license to a Potomac 1901. Although the required before-and-after measurements of parameters and monitor points, called for by 73.68(e)(2), were made at that time, and no significant changes were observed to the parameters or the field readings, thus not triggering the partial proof requirement of 73.68(e)(3), no application to modify the license, as specified by 73.68(e)(4), was filed. At this point, the only course of action open to WMC is to request that the station's license be modified to show the current antenna monitor.

Conclusions:

All work on the new tower light system for tower 1 at WMC has been completed. The array is operating in accordance with the licensed parameters and is stable. The requested changes and corrections to the WMC license are fully justified and appropriate. The instant application has been carefully prepared in all particulars and should be granted.

Respectfully Submitted,

George Michael Patton
Michael Patton & Associates
August 15, 2019

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Monitor Point Data:

Monitor Point Radial:	Reading (measured 7/29/2019):	Limit (from 2001 license):
40°	6.3 mV/m	16.2 mV/m
77°	11.9 mV/m	19.3 mV/m
148°	5.8 mV/m	16.5 mV/m
222°	29.7 mV/m	68.2 mV/m
229°	13.8 mV/m	55.0 mV/m
265°	135 mV/m	158.5 mV/m
313°	25.3 mV/m	82.8 mV/m
354°	18.1 mV/m	27.9 mV/m

Antenna Impedances & Currents:

Mode:	Power level:	Measurement point:	Impedance:	Operating current:
Daytime (ND)	5.0 kW	Tower 1 base	127 -j225Ω	6.27A
Nighttime (DA)	5.4 kW	Common point	50 +j0Ω	10.4A

Antenna Monitor Parameters:

Tower:	Ratio	Phase:
1 (NW)	0.63	-94°
2 (NE)	1.01	+121°
3 (SE)	0.65	+25°
4 (SW)	1.00	0°

COHEN, DIPPELL AND EVERIST, P. C.

OPERATING PARAMETERS FOR
WMC, MEMPHIS, TENNESSEE
790 KHZ 5 KW DA-N
SEPTEMBER 1988

Phase Monitor Indications*
(Nighttime Only)

Tower	Phase degrees	Loop Ratio
1 NW	-94	0.63
2 NE	+121	1.01
3 SE	+25	0.65
4 SW	0	1.00

*Potomac Instruments AM-19D(210)

Antenna Currents

Tower	Base Current (amperes)		Ratio	
	Daytime	Nighttime	Daytime	Nighttime
1 NW	4.83	1.24	--	0.135
2 NE	--	6.1	--	0.636
3 SE	--	5.9	--	0.641
4 SW	--	9.2	--	1.0

Common point = 10 amperes

Resistance Values

Common Point (nighttime): Measured Value = 54 ohmns
Northwest Tower (daytime): Measured Value = 214 ohms

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
40 DEGREE RADIAL NIGHT

The 40 degree monitoring point is centered on the driveway to the Bartlett-Ellendale Cemetery, also known as the Pisgah Cemetery in Bartlett, Tennessee. The point is approximately 400 feet southwest of the intersection of Memphis-Arlington Road and Oak Road.

The photograph is facing southwest.

NAD 83 Coordinates	35 13 41.7 N 89 49 41.4 W	Distance to WMC Antenna	5.15 miles 8.29 kM
Maximum Field DA	16.2 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
77 DEGREE RADIAL NIGHT

The 77 degree monitor point is centered on the SW traffic island in the front of St. Benedict High School in Cordova, Tennessee. The location is about 50 feet from the edge of Belleview Drive, east of Germantown Parkway. The street address for the school is 2100 North Germantown Parkway.

The photograph is facing north.

NAD 83 Coordinates	35 11 08.2 N 89 47 31.3 W	Distance to WMC Antenna	5.42 miles 8.72 kM
Maximum Field DA	19.3 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
148 DEGREE RADIAL NIGHT

The 148 degree monitor point is on the northwest corner of the intersection of Oak Hill Road and Oak Hill Cove in Memphis, Tennessee. The measurement point is line with the opening in the oak tree.

The photograph is facing north.

NAD 83 Coordinates	35 05 56.7 N 89 50 05.8 W	Distance to WMC Antenna	5.74 miles 9.24 kM
Maximum Field DA	16.5 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
222 DEGREE RADIAL NIGHT

The 222 degree monitoring point is centered on the sidewalk in front of the house at 120 Wallace Road in Memphis, Tennessee.

The photograph is facing northeast.

NAD 83 Coordinates	35 08 04.8 N 89 55 27.9 W	Distance to WMC Antenna	3.30 miles 5.31 kM
Maximum Field DA	68.2 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
229 DEGREE RADIAL NIGHT

The 229 degree monitoring point is located at the intersection of Minden Road and St. Alban's Fairway in Memphis, Tennessee. The point is on the center dividing island on Minden Road, centered with the St. Alban's Fairway street.

The photograph is facing south.

NAD 83 Coordinates	35 08 15.6 N 89 55 52.2 W	Distance to WMC Antenna	3.42 miles 5.50 kM
Maximum Field DA	55.0 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
265 DEGREE RADIAL NIGHT

The 265 degree monitoring point is centered on the sidewalk in the driveway of the home at 1241 Wrenwood Avenue in Memphis, Tennessee.

The photograph is facing west - southwest.

NAD 83 Coordinates	35 09 55.9 N 89 55 57.1 W	Distance to WMC Antenna	2.64 miles 4.25 kM
Maximum Field DA	158.5 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
313 DEGREE RADIAL NIGHT

The 313 degree monitoring point is located within River Grove Apartments in Memphis, Tennessee across from the apartment at 3968 Rio Lobo Court, in the field directly across from 3968, 15 feet from the curb.

The photograph is facing northeast.

NAD 83 Coordinates	35 12 09.5 N 89 55 50.8 W	Distance to WMC Antenna	3.35 miles 5.39 kM
Maximum Field DA	82.8 mV/M		

WMC MEMPHIS, TN
AUGUST 2019
DIRECTIONAL ANTENNA MONITORING POINT
354 DEGREE RADIAL NIGHT

The 354 degree monitoring point is centered on the driveway of the home at 3985 Austin Peay Highway in Memphis, Tennessee, about 15 feet from the curb.

The photograph is facing northeast.

NAD 83 Coordinates	35 14 04.1 N 89 53 46.2 W	Distance to WMC Antenna	4.59 miles 7.39 kM
Maximum Field DA	27.9 mV/M		