
Media Control, Incorporated

27451 Everett Street, Southfield, MI 48076

(248) 557-7274

MOMENT METHOD RE-CERTIFICATION

WRDT-AM 560 kHz DAD

0.5 kW

Monroe, Michigan

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Prepared by Russell C. Harbaugh, Jr., P.E.

E-Mail: rharbaughj@aol.com

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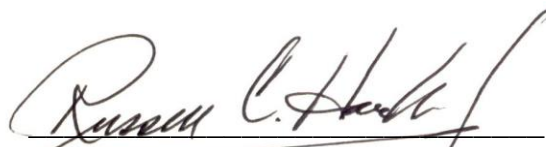
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1. ENGINEERING QUALIFICATIONS

Russell C. Harbaugh, Jr. P.E. deposes and states that:

- He prepared the attached Moment Method re-certification of the WRDT-AM, Monroe, Michigan facility.
- He has been involved in radio and television broadcast engineering for over 35 years and that he conducted AM and FM measurements and has submitted same to the Federal Communication Commission.
- He is the holder of a Bachelor of Science Degree in Electrical Engineering from Lawrence Technological University.
- He is a Registered Professional Engineer (P.E.) in the State of Michigan.
- He is a member in good standing in the Association of Federal Communications Consulting Engineers (AFCCE), the Institute of Electrical Engineers (IEEE), and the Society of Broadcast Engineers (SBE).
- He is an SBE Certified Professional Broadcast Engineer (CPBE) and Certified Broadcast Network Technologist (CBNT).
- He is the holder of a FCC Lifetime General License (formerly a First Class FCC License).
- He works as a contract engineer for numerous broadcast facilities around the state of Michigan.



Russell C. Harbaugh, Jr. P.E.

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2. BACKGROUND

Radio Station WRDT-AM 560 kHz, Monroe, Michigan, daytime directional antenna facility, is licensed pursuant to the moment method modeling provisions of 47 C.F.R. §73.151(c). As such, the recertification required by 47 C.F.R. §73.155 for the facility is due biennially. The recertification measurements of the daytime sampling system are tabulated below. The results of these measurements show that the sample system continues to meet the requirements of 47 C.F.R. §73.151(c).

3. WRDT-AM OPERATION

WRDT-AM is licensed to operate on 560 kHz with 0.5 kW into a daytime four (4) tower directional antenna array.

4. ANTENNA MONITOR AND SAMPLE LINES

The sampling system consists of Delta Electronics TCT-3 current transformers, with three (3) turn of conductor through transformer, 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 3/8-inch foam-dielectric coaxial transmission lines. The antenna monitor is a Potomac Instruments AM-19 Type 1901.

5. SAMPLING SYSTEM MEASUREMENTS

Sampling system impedance measurements were conducted using Hewlett Packard 8753A Network Analyzer, companion Agilent Model 85046A S-Parameter test set, and 50 Ohm calibration set. The sample lines were disconnected from the antenna monitor and measurements were made looking into the connector at the end of each sample line. Measurements were made without the sample line connected to the toroidal sample unit at the base of the tower and in an open-circuit (un-terminated) condition. Impedance measurements were then made with the sample line connected to the sampling unit at the base of the tower.

In an un-terminated transmission line, reactance zeros will occur at odd multiples of 90 degrees electrical length (90 degrees, 270 degrees, 450 degrees, etc.) as the electrical length is varied by changing frequency. Reactance zero occurs where the reactance passes through zero on the analyzer. At that frequency, for lines with loss, resistance is very low. This measurement is used to determine the multiple of 90 degrees, which in this case was found to be 270 degrees, where zero reactance occurs closest to the station’s carrier frequency. The following table shows the frequencies derived by the ratio of the frequencies, and the impedance at carrier with the base sample device connected.

SAMPLING TRANSMISSION LINES			
WRDT-AM		560 kHz	0.5 kW Day
Cable Manufacturer =	Andrew		
Type Number =	LDF2-50	Velocity Factor =	0.88

SAMPLING LINE MEASUREMENTS					
TOWER	Sampling Line Open-Circuit Resonance Below 560 kHz (kHz)	Sampling Line Open-Circuit Resonance Above 560 kHz (kHz)	Sampling Line Calculated Electrical Length at 560 kHz (Degrees)	Measured Sampling Line with Toroid Connected at 560 kHz (Ohms)	Sampling Line Calculated Physical Length at 560 kHz (Meters)
1	721.05	1,209.43	209.70	53.6+0.3j	274.4
2	722.56	1,211.87	209.26	53.3+0.6j	273.8
3	723.21	1,213.37	209.07	53.3+0.5j	273.6
4	722.32	1,208.27	209.32	53.8+0.3j	273.9

Electrical Length = (Station F / Closest Marker to Station F) * 270 Degrees
Physical Length = Electrical Length * Lamda * Velocity Factor

The sampling lines meet the requirement that they be equal in electrical length to within one (1) electrical degree of each other.

The Network Analyzer setup was used to measure the impedance of the sample lines at 1/8th wavelength (45 degrees) immediately above and below the station’s carrier frequency. The following equation was used to calculate the characteristic impedance of each sample line.

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

SAMPLING LINE CHARACTERISTIC IMPEDANCE					
TOWER	+45 Degree Offset Frequency (kHz)	+45 Degree Offset Impedance (Ohms)	-45 Degree Offset Frequency (kHz)	-45 Degree Offset Impedance (Ohms)	Calculated Z ₀ Characteristic Impedance (Ohms)
1	841.22	14.5+47.6j	600.87	10-49.94j	50.3
2	842.98	14.6+47.9j	602.13	10-49.32j	50.2
3	843.75	14.5+47.89j	602.68	9.85-49j	50.0
4	842.71	14.7+47.7j	601.94	10.1-48.9j	49.9

Line Z₀ must be within +/- two (2) Ohms.

The results of the measurements and calculated characteristic impedance are presented in the following table:

The sampling line measurements meet the characteristic impedance requirement that they be equal to within +/- 2 Ohms of each other.

6. TORODIAL TRANSFORMER CALIBRATION

The toroidal transformers for each tower were calibrated by measuring their output values. The calibration of the Delta TCT-3 current transformers was verified by removing them all from the ATUs and installing them on a test jig so that each was located very close to the adjacent transformer (spacing of less than two inches). Short transmission lines of equal length were connected between the outputs of all four current transformers and the inputs of the antenna monitor. The Potomac 1901 antenna monitor was calibrated using the internal calibration function. A single source of RF current on the carrier frequency was fed through a conductor passing through all of the current transformers, and the differential phases and ratios were noted on the antenna monitor as follows:

DAY TOROID CALIBRATION USING TOWER #2 AS REFERENCE					
WRDT-AM		560	kHz	0.5 kW Day	
Toroid Calibration	Tower #1	Tower #2	Tower #3	Tower #4	
Phase (Degrees)	0.60	0.00	-0.19	-0.40	
Loop (Ratio)	0.982	Reference	0.990	0.996	
Serial Number	004	003	005	002	

The Delta TCT-1 toroidal transformer has an advertised magnitude accuracy of +/- 2% and a phase accuracy of +/- 3 degrees. Therefore, the toroid to toroid accuracy for all Four (4) units exceeds that of the rated accuracy.

7. ANTENNA MONITOR SETTINGS

After the toroids were installed in the antenna tuning unit cabinets and the sampling lines connected to the toroid and antenna monitor, the antenna monitor readings were trimmed to within licensed daytime and nighttime parameters, as follows:

Antenna Monitor Readings		
Tower	Loop Ratio	Phase (Degrees)
1	1.024	-001.5
2	1.000	000.0
3	1.115	-088.6
4	0.918	-089.6

8. FIELD STRENGTH MEASUREMENTS

Field strength measurements were obtained at the locations noted in the station's application for moment method operation.

Radial Azimuth =			013.0	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.90	41-55-32.6	83-25-00.4	10/15/15	1315	110.0	
2	4.63	41-55-54.3	83-24-53.8	10/15/15	1324	84.0	
3	5.43	41-56-19.3	83-24-46.3	10/15/15	1338	84.0	
Descriptions							
1	North parking lot, 1st parking space of 1st Baptist Church on north side of North Custer Road						
2	Intersection of W. Lorain and John Rolfe Street at the northeast corner						
3	1621 Northridge Drive at the driveway entrance						

Radial Azimuth =			076.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	4.15	41-53-58.9	83-22-43.9	10/15/15	1403	2.6	
2	5.00	41-54-05.2	83-22-09.2	10/15/15	1420	2.2	
3	5.68	41-54-10.6	83-21-38.6	10/15/15	1443	2.5	
Descriptions							
1	In front of 623 Norwood Drive at mail box						
2	Monroe Water Treatment Plant, west side door off East Front Street and inside fence						
3	East Elm Avenue 50 feet west of utility pole #S10WE844 in median						

Radial Azimuth =		097.5		Radial shortened because of Lake Erie and ponds			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	1.60	41-53-21.1	83-24-30.3	10/15/15	1510	38.0	
2	1.90	41-53-19.6	83-24-17.1	10/15/15	1518	24.0	
3	2.65	41-53-17.0	83-23-44.9	10/15/15	1529	21.0	
Descriptions							
1	In front of doublewide trailer #371 on Holly Glen Street						
2	Hull Road at mail box 15207						
3	North side of Laplaisance Road across street from large "Speedway Gas" sign						

Radial Azimuth =		131.5		NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	2.52	41-52-34.9	83-24-18.8	10/15/15	1551	4.5	
2	3.09	41-52-21.6	83-24-00.4	10/15/15	1615	3.6	
3	4.02	41-52-02.0	83-23-27.7	10/15/15	1635	2.5	
4	4.30	41-51-56.0	83-23-18.3	11/15/15	1649	3.2	
Descriptions							
1	Across street from "40 MPH" sign east of Hull Road and Albain Road intersection						
2	South bound I75 west side 0.1 mile south of where E. Albain entrance road meets the interstate						
3	Laplaisance Road 20 feet southwest of mail box #13773						
4	Shady Lane in front of mail box #13760						

Radial Azimuth =			149.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.60	41-51-48.1	83-24-17.8	10/15/15	1701	6.0	
2	3.81	41-51-41.6	83-24-14.8	10/15/15	1710	5.5	
3	4.74	41-51-16.6	83-23-54.0	10/15/15	1720	5.0	
Descriptions							
1	I75 north bound Service Plaza at its historical marker in front of building						
2	Lighthouse Road at mail box #13308						
3	Allen Hurst Road north of Mortor Creek Road 200 feet south of "Yield / Except Right Turn" sign						

Radial Azimuth =			172.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.77	41-51-27.5	83-25-17.5	10/16/15	942	4.8	
2	4.91	41-50-51.9	83-25-11.6	10/16/15	1005	3.5	
3	5.42	41-50-34.5	83-25-08.5	10/16/15	1020	3.4	
Descriptions							
1	Laplaisance Road 210 feet southwest of mail box #12904						
2	North Otter Creek Road at mail box #5633						
3	South Otter Creek Road, 300 feet northwest of "N 75 Detroit" sign						

Radial Azimuth =			193.0	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.85	41-51-26.7	83-26-15.8	10/16/15	1042	7.0	
2	5.52	41-50-35.3	83-26-31.9	10/16/15	1050	4.7	
3	7.11	41-49-44.9	83-26-47.9	10/16/15	1058	3.7	
Descriptions							
1	Laplaisance Road across the street from mail box #4856						
2	Stein Road at "RR Crossing" sign 200 feet northeast of mail box #4430						
3	At "Left Curve" sign on Kelly Road north of Cousino Road						

Radial Azimuth =			213.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.79	41-51-45.7	83-27-10.1	10/16/15	1110	3.00	
2	6.17	41-50-44.4	83-28-04.0	10/16/15	1120	1.00	
3	7.49	41-50-05.9	83-28-38.7	10/16/15	1148	1.30	
Descriptions							
1	South Otter Creek Road in front of mail boxes #4118 and #4123						
2	South Dixie Highway at driveway entrance next to mail box #12294						
3	Wood Road 300 feet southeast of mail box #2966						

Radial Azimuth =			236.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.42	41-52-26.7	83-27-44.6	10/16/15	1159	8.0	
2	5.52	41-51-49.6	83-28-58.4	10/16/15	1210	5.0	
3	7.68	41-51-12.0	83-30-15.3	10/16/15	1224	3.4	
Descriptions							
1	North Otter Creek Road at mail box #3534						
2	Dunlap Road across the street from mail boxes #13546 and #13547						
3	West Stein Road 150 feet west of mail box #2160 and "St. Johns Catholic Cemetary" sign						

Radial Azimuth =			254.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	4.51	41-52-49.0	83-28-47.6	10/16/15	1230	2.00	
2	6.66	41-52-30.1	83-30-19.3	10/16/15	1242	1.50	
3	7.34	41-52-24.7	83-30-46.1	10/16/15	1254	1.40	
Descriptions							
1	North Otter Creek Road at curb in front of front door to house #2843						
2	South Otter Creek Road at mail box #1906						
3	Strausburg Road at "Intersection" sign south of South Otter Creek Road						

Radial Azimuth =			288.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.91	41-54-08.3	83-28-19.6	10/15/15	1107	17.0	
2	6.74	41-54-36.7	83-30-16.9	10/15/15	1115	11.0	
3	8.71	41-54-57.3	83-31-38.2	10/15/15	1129	8.0	
Descriptions							
1	Virginia Court at driveway entrance curb to house #15795						
2	Strausburg Road southwest of mail box #2112 at driveway entrance curb						
3	Martell Road 300 feet south of West Dunbar Road and south of mail box #1984						

Radial Azimuth =			309.5	NAD-83			
Point No.	Distance (km)	Latitude	Longitude	Date	Time	Field (mV/m)	Comment
1	3.46	41-54-38.3	83-27-34.3	10/15/15	1230	11.00	
2	4.71	41-55-05.6	83-28-16.8	10/15/15	1240	9.20	
3	7.02	41-55-52.3	83-29-34.4	10/15/15	1250	4.80	
Descriptions							
1	Hodge Road at driveway entrance curb to house #16000						
2	In front of front door to #1500 Raisenville Road on west side of road						
3	Strausburg Road across the street from mail box #1011						

9. CONCLUSION

The obtained measurements demonstrate that the WRDT-AM daytime sample system exceeds the operating parameters described in Section 73.155 of the Commission's Rules. Good engineering procedures were observed during the course of the measurements and the results believed to be accurate.