



**ENGINEERING EXHIBIT
IN SUPPORT OF AN APPLICATION
FOR DIRECT MEASUREMENT OF POWER
AM STATION WQOF – WASHINGTON, DC
1260 kHz – 35 kW-D, 5 kW-N, U, DA-2
FACILITY ID: 8681**

Applicant: Relevant Radio, Inc.

March, 2024

TABLE OF CONTENTS

ENGINEERING STATEMENT OF JAMES D. SADLER

FIGURE

Tabulation of Operating Parameters	1
Summary of Nighttime Measured Field Strength Data	2
Tabulation of Field Strength Measurement Data	3



**STATEMENT OF JAMES D. SADLER
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Applicant: Relevant Radio, Inc.

I am a Technical Consultant, an employee in the firm of Carl T. Jones Corporation with offices located in Springfield, VA. My education and experience are a matter of record with the Federal Communications Commission.

Introduction

AM radio station WQOF, Washington, DC, is licensed to operate on a frequency of 1260 kHz, on an unlimited time basis, with a daytime power of 35 kW and a nighttime power of 5 kW. The station utilizes different directional patterns for its daytime and nighttime operations (DA-2).

Dish Wireless recently completed the installation of new cellular antennas and associated feed lines on the center tower of the WQOF nighttime directional array. The Dish Wireless antennas are located on the center tower near the top of the lower radiated skirt wire system. Prior to the equipment installation effort, Dish Wireless, through its contractors coordinated with the tower owner and the WQOF licensee.

Particular care was taken in the installation of the new antennas and associated feed lines due to the complexity of the radiated and detuning skirt wire systems located on the tower and the potential to alter one or both of the WQOF directional patterns. Prior to the installation of the new antennas, partial proof of performance measurements were performed on the non-directional and nighttime directional patterns and non-directional impedance measurements were performed at the base of the center tower. Because the center tower is not employed in the daytime directional antenna system and past experience with these kinds of changes has shown they have little effect on the daytime directional antenna system partial proof of performance measurements were not performed on the daytime directional pattern prior to the installation of the new antennas.

After completion of the Dish Wireless equipment installation, it was observed that the WQOF nighttime parameters had changed, and that the non-directional impedance of the center tower had changed as well. The daytime directional antenna monitor parameters were unaffected by the changes and measurement of the two daytime directional monitor points showed that the daytime pattern exhibited no significant adverse impact as a result of the installation.¹

Partial proof measurements performed on the non-directional and nighttime directional patterns showed that the nighttime pattern had been adversely impacted by the Dish Wireless equipment installation. Specifically, the inverse distance fields in the

¹ The daytime antenna system utilizes only the two end towers of the three tower array and therefore, the Dish Wireless modifications on the center tower would not be expected to significantly impact the daytime pattern. No changes are requested with respect to the daytime pattern.

null directions of the nighttime pattern (52 degree and 280 degree bearings) were significantly increased and in the case of the 280 degree bearing it was increased to a level exceeding the modified standard pattern value. Based on this finding, Relevant Radio, Inc., licensee of Station WQOF, authorized this office to: 1) perform minor adjustment of the nighttime directional pattern; 2) perform non-directional and nighttime directional partial proof field strength measurements; and 3) prepare this engineering statement, FCC Form 2100, Schedule 302-AM, and the associated figures in support of an Application for Direct Measurement of Power.

Non-directional and Nighttime Directional Partial Proof of Performance Field Strength Measurements

The post construction field strength measurements on the 280 degree nighttime monitored radial indicated that the inverse distance field on this radial was above the modified standard pattern value and; therefore, minor adjustment of the nighttime pattern was performed, by the undersigned, to bring the radiated value into compliance. The non-directional antenna impedance of Tower #1 (center) was measured, by the undersigned, using a Delta Electronics, Model OIB-3, operating impedance bridge. The measurement was performed at the J-Plug located in the output branch of the tower #1 ATU network with Towers #2 and #3 detuned. The measured non-directional base impedance of Tower #1 was determined to be, $Z_{ND\#1} = 171 + j 34$ Ohms. The transmitter was adjusted for a non-directional base current of 6.05 Amperes corresponding to a non-directional antenna input power of approximately 6,250 Watts. The nighttime

common point impedance was adjusted for $Z_{cp} = 50.0 -j 8.8$ Ohms ($Z_{cp} = 50 -j 7$ actual bridge reading uncorrected for frequency) and the transmitter was adjusted for a common point current of 10.39 Amperes.

Non-directional and nighttime directional partial proof field strength measurements were then performed on all four nighttime monitored radials. A minimum of eight field strength measurements were performed on each radial bearing at the same locations that were measured in the 2012 nighttime full proof-of-performance, including the monitor point locations, at distances generally between 3 kilometers and 15 kilometers from the transmitter site. All measurements were made during the period between two hours following local sunrise and two hours prior to local sunset to minimize the potential for skywave interference.

All of the field strength measurements were performed by Mr. Tom Ringer and Mr. Ben Milton, contract engineers working for Carl T. Jones Corporation; Mr. Dan Cavegn, Senior Technician with Carl T. Jones Corporation; and the undersigned. Each of these individuals is experienced in performing field strength measurements on AM directional patterns.

A total of four field intensity meters were used to make the measurements. Pertinent information on each field intensity meter is contained in the following Table.

<u>Manufacturer/Model</u>	<u>Serial Number</u>	<u>Calibration Date</u>
Potomac Instruments/FIM-41	989	March, 2012
Potomac Instruments/FIM-41	2008	February, 2012
Potomac Instruments/FIM-41	2185	January, 2021
Potomac Instruments/FIM-41	2244	August, 2023

The performance of the four field intensity meters was verified by comparing measured field strength values at several different full scale settings and verifying that the field strength values, as measured on each meter, agreed within the manufactures stated accuracy.

The measured 2024 non-directional and nighttime directional field strengths are tabulated in Figure 3. For each measurement location, the 2024 nighttime directional field strength was compared to the 2024 non-directional field strength. An arithmetic and logarithmic ratio was calculated for each location and the average ratio calculated for each radial bearing. The antilogarithm of the averages were multiplied by the measured non-directional inverse distance fields contained in the 2012 Proof to yield the 2024 nighttime directional inverse distance field values.

A comparative summary of the 2024 nighttime measured field strength data and the modified standard pattern radiation for the four measured radials is contained herein as Figure 2. In no case does the 2024 nighttime inverse distance field exceed the authorized modified standard pattern value. The new WQOF operating parameters are tabulated in Figure 1.

Monitor Point Values and Locations

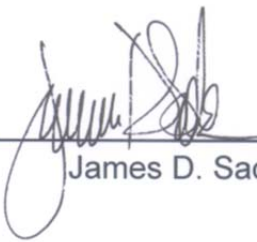
Analysis of the nighttime partial proof field strength measurements indicates that no change in the maximum field strength values of any of the four nighttime monitor points is warranted. No change to the monitoring point locations or descriptions is proposed.

Summary

It is submitted that the daytime and nighttime directional patterns of Station WQOF are in proper adjustment and compliant with the station's authorization. Further, it is requested that a superseding license be issued to reflect the changes in the nighttime operating parameters.

This engineering statement, FCC Form 2100, Schedule 302-AM, and the associated figures were prepared by me or under my direct supervision and the information therein is believed to be true and correct.

Dated: March 1, 2024



James D. Sadler

**TABULATION OF OPERATING PARAMETERS
STATION WQOF – WASHINGTON, DC
1260 kHz – 35 kW-D, 5 kW-N, U, DA-2**

Daytime Directional

	<u>Tower 2</u>	<u>Tower 3</u>
Theoretical Field Ratio	1.000	0.540
Theoretical Phase (deg.)	0.0	-177.0
Spacing (deg.)	0.0	160.0
Orientation (deg. T)	0.0	145.0
Antenna Monitor Ratio	1.000	0.635
Antenna Monitor Phase (deg.)	0.0	-168.3
Common Point Resistance (Ohms)		50.0
Common Point Current (amperes)		27.15
Antenna Input Power (Watts)		36,855

Nighttime Directional

	<u>Tower 1</u>	<u>Tower 2</u>	<u>Tower 3</u>
Theoretical Field Ratio	1.000	0.555	0.555
Theoretical Phase (deg.)	0.0	+151.3	-151.3
Spacing (deg.)	10.0	80.0	80.0
Orientation (deg. T)	165.5	325.0	145.0
Antenna Monitor Ratio	1.000	0.490	0.260
Antenna Monitor Phase (deg.)	0.0	+169.0	-105.5
Common Point Resistance (Ohms)			50.0
Common Point Current (amperes)			10.39
Antenna Input Power (Watts)			5,400

Non-Directional Test Operation

Tower 1 Base Resistance (Ohms)	171
Tower 1 Base Current (amperes)	6.05
Antenna Input Power (Watts)	6,250

Tower Number and ASR Cross Reference

<u>Tower Number</u>	<u>ASR Number</u>
1	1042694
2	1042695
3	1042696

SUMMARY OF NIGHTTIME MEASURED FIELD STRENGTH DATA
STATION WQOF - WASHINGTON, DC
1260 kHz, 35 kW-D, 5 kW-N, DA-2

Monitored Radial (deg. T.)	2012 ND Inverse Distance Field Strength (mV/m at 1 km)	DA-N / ND Antilog of Average Ratio	DA-N Measured Inverse Distance Field Strength (mV/m at 1 km)	Nighttime Modified Standard Pattern Radiation (mV/m at 1 km)
52	725	0.0593	43.0	60.0
198	760	1.0794	820	877
280	800	0.0654	52.3	61.2
325	790	0.3363	266	368

TABULATION OF FIELD STRENGTH MEASUREMENT DATA
STATION WQOF - WASHINGTON, DC
1260 kHz, 35 kW-D, 5 kW-N, DA-2

52 Degrees True Radial

2012 Proof Point		6.25 kW, ND			5 kW, DA-NIGHT				
		Distance		Field		Time	Field		Log
<u>Number</u>	<u>(kilometers)</u>	<u>Date</u>	<u>Time</u>	<u>Strength</u>	<u>Date</u>	<u>(local)</u>	<u>Strength</u>	<u>Ratio</u>	<u>Ratio</u>
			<u>(local)</u>	<u>(mV/m)</u>			<u>(mV/m)</u>	<u>(DA-N/ND)</u>	<u>(DA-N/ND)</u>
11	3.41	12/1/2023	1319	90	12/1/2023	1335	0.37	0.0041	-2.3860
12	4.22	12/1/2023	1325	58	12/1/2023	1347	1.1	0.0190	-1.7220
13 MP	5.58	12/1/2023	1312	18.5	12/1/2023	1401	1.65	0.0892	-1.0497
14	6.48	12/1/2023	1302	30	12/1/2023	1406	0.65	0.0217	-1.6642
15	7.31	12/1/2023	1257	16.75	12/1/2023	1412	1.6	0.0955	-1.0199
16	8.02	12/1/2023	1249	25.5	12/1/2023	1421	0.6	0.0235	-1.6284
17	8.24	12/1/2023	1247	11	12/1/2023	1425	0.85	0.0773	-1.1120
18	9.69	12/1/2023	1238	9.8	12/1/2023	1432	1	0.1020	-0.9912
19	11.20	12/1/2023	1232	3.5	12/1/2023	1440	0.56	0.1600	-0.7959
20	12.90	12/1/2023	1225	6.9	12/1/2023	1445	0.78	0.1130	-0.9468
21	14.00	12/1/2023	1221	5.1	12/4/2023	1021	0.9	0.1765	-0.7533
22	15.40	12/1/2023	1214	2.5	12/4/2023	1026	0.56	0.2240	-0.6498
Average Ratio								0.0922	-1.2266
Antilog of Average									0.0593

TABULATION OF FIELD STRENGTH MEASUREMENT DATA
STATION WQOF, WASHINGTON, DC
1260 kHz, 35 kW-D, 5 kW-N, DA-2

198 Degrees True Radial

2012 Proof Point		6.25 kW, ND			5 kW, DA-NIGHT				
		Distance		Field		Field		Log	
Number	(kilometers)	Date	Time (local)	Strength (mV/m)	Date	Time (local)	Strength (mV/m)	Ratio (DA-N/ND)	Ratio (DA-N/ND)
14	2.38	11/28/2023	1111	158	12/1/2023	1351	170	1.0759	0.0318
15	2.87	11/28/2023	1116	106	12/1/2023	1357	128	1.2075	0.0819
16	3.34	11/28/2023	1118	97.5	12/1/2023	1401	105	1.0769	0.0322
17	3.77	11/28/2023	1122	50.5	12/1/2023	1406	54	1.0693	0.0291
18	4.41	11/28/2023	1127	73	12/4/2023	1309	90	1.2329	0.0909
19	4.91	11/28/2023	1133	54	12/1/2023	1419	49	0.9074	-0.0422
20 MP	5.31	11/28/2023	1136	51	12/1/2023	1423	82	1.6078	0.2062
	6.63	11/28/2023	1145	38	12/1/2023	1432	37	0.9737	-0.0116
22	7.94	11/28/2023	1150	18.5	12/1/2023	1444	13.9	0.7514	-0.1242
23	9.75	11/28/2023	1156	5.5	12/4/2023	1330	6	1.0909	0.0378
Average Ratio								1.0994	0.0332
Antilog of Average									1.0794

TABULATION OF FIELD STRENGTH MEASUREMENT DATA
STATION WQOF - WASHINGTON, DC
1260 kHz, 35 kW-D, 5 kW-N, DA-2

280 Degrees True Radial

2012 Proof		6.25 kW, ND			5 kW, DA-NIGHT				
Point Number	Distance (kilometers)	Date	Time (local)	Field Strength (mV/m)	Date	Time (local)	Field Strength (mV/m)	Ratio (DA-N/ND)	Log Ratio (DA-N/ND)
10	3.82	12/1/2023	1218	71	11/30/2023	1300	3.05	0.0430	-1.3670
11 MP	4.38	12/1/2023	1212	33	11/30/2023	1246	0.65	0.0197	-1.7056
12	5.02	12/1/2023	1204	32.5	11/30/2023	1238	1.29	0.0397	-1.4013
13	5.76	12/1/2023	1229	17.2	11/30/2023	1308	1.98	0.1151	-0.9389
14	6.81	12/1/2023	1235	19.5	11/30/2023	1314	1.69	0.0867	-1.0621
15	7.77	12/1/2023	1239	14.3	11/30/2023	1319	1.12	0.0783	-1.1061
16	9.34	12/1/2023	1244	9.2	11/30/2023	1324	0.78	0.0848	-1.0717
17	10.70	12/1/2023	1233	6.6	11/30/2023	1317	0.59	0.0894	-1.0487
18	12.00	12/1/2023	1203	4.6	11/30/2023	1238	0.29	0.0630	-1.2004
19	13.10	12/1/2023	1210	5	11/30/2023	1311	0.4	0.0800	-1.0969
20	14.50	12/1/2023	1220	4.2	11/30/2023	1304	0.39	0.0929	-1.0322
Average Ratio								0.0720	-1.1846
Antilog of Average									0.0654

TABULATION OF FIELD STRENGTH MEASUREMENT DATA
STATION WQOF - WASHINGTON, DC
1260 kHz, 35 kW-D, 5 kW-N, DA-2

325 Degrees True Radial

2012 Proof Point		6.25 kW, ND			5 kW, DA-NIGHT				
		Distance	Time	Field		Time	Field	Ratio	Log
<u>Number</u>	<u>(kilometers)</u>	<u>Date</u>	<u>(local)</u>	<u>Strength</u>	<u>Date</u>	<u>(local)</u>	<u>(mV/m)</u>	<u>(DA-N/ND)</u>	<u>Ratio</u>
				<u>(mV/m)</u>				<u>(DA-N/ND)</u>	<u>(DA-N/ND)</u>
10 MP	2.57	11/28/2023	1118	118	12/1/2023	1358	41	0.3475	-0.4591
11	3.75	11/28/2023	1125	56	12/1/2023	1403	15.3	0.2732	-0.5635
12	4.24	11/28/2023	1128	65.5	12/1/2023	1405	18.6	0.2840	-0.5467
13	5.09	11/28/2023	1132	30.4	12/1/2023	1410	10.3	0.3388	-0.4700
14	5.47	11/28/2023	1135	32.5	12/1/2023	1413	10.4	0.3200	-0.4949
15	6.29	11/28/2023	1139	26.4	12/1/2023	1417	9.8	0.3712	-0.4304
16	7.83	11/28/2023	1144	14.8	12/1/2023	1422	5.8	0.3919	-0.4068
17	8.90	11/28/2023	1150	16.4	12/1/2023	1426	6.1	0.3720	-0.4295
18	9.55	11/28/2023	1202	12.6	12/1/2023	1429	4.4	0.3492	-0.4569
19	9.83	11/28/2023	1206	10.5	12/1/2023	1432	3.85	0.3667	-0.4357
20	11.30	11/28/2023	1212	7.3	12/1/2023	1436	2.45	0.3356	-0.4742
21	11.64	11/28/2023	1216	5.45	12/1/2023	1441	1.68	0.3083	-0.5111
Average Ratio								0.3382	-0.4732
Antilog of Average									0.3363