

# ENGINEERING REPORT

## 2012 Auxiliary Application Radio Frequency (RF) Protection Study

**WNOR(FM) – Norfolk, VA (Analog Auxiliary)**  
**WNOR(FM) – Norfolk, VA (Analog & HD/IBOC)**  
**WJOI(AM) – Norfolk, VA (Analog & HD/IBOC)**  
June, 2012

### CERTIFICATION OF ENGINEERS

The firm of Munn-Reese, Inc., Broadcast Engineering Consultants, with offices at 385 Airport Drive, Coldwater, Michigan, has been retained for the purpose of preparing the technical data forming this report.

The data utilized in this report was taken from the FCC Secondary Database and data on file. While this information is believed accurate, errors or omissions in the database and file data are possible. This firm may not be held liable for damages as a result of such data errors or omissions.


The report has been prepared by properly trained electronics specialists under the direction of the undersigned whose qualifications are a matter of record before the Federal Communications Commission.

I declare under penalty of the laws of perjury that the contents of this report are true and accurate to the best of my knowledge and belief.

June 29, 2012

*MUNN-REESE, INC.*

By

  
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## License Renewal

### Compliance with Radiofrequency Radiation Guidelines

This firm was retained to study the potential for human exposure to non-ionizing radiofrequency radiation at the common site of existing station(s) WJOI(AM) and WNOR(FM), both licensed to Norfolk, VA. There are no other licensed facilities located within 315 meters of the common site. ***The applicant would like to note that this proposed WNOR(FM) analog auxiliary facility will only operate during periods of time when the co-located WNOR(FM) analog primary facility is rendered silent. However for purposes of this RF Compliance Study, and out of an overabundance of caution, all co-located facilities, including the WNOR(FM) primary and analog facilities have been included at full operational power.***

This proposed WNOR(FM) – Norfolk, VA Analog Auxiliary facility will operate on CH254B (98.7 MHz) with 9.7 kW ERP circular polarization (H&V). The Analog Auxiliary facility will broadcast from a separate WNOR(FM) auxiliary antenna mounted 99 meters above ground level (AGL). The auxiliary antenna will employ a 1-Bay, 1.0  $\lambda$  (wavelength) spaced, Collins G5CPS-1 “rotor-tiller” type antenna employing an EPA Type 3 element as defined by FM Model Version 2.10 Beta issued March 22, 1995.

The WNOR(FM) – Norfolk, VA analog primary FM facility operates on CH254B (98.7 MHz) with 46.0 kW ERP circular polarization (H&V). The facility broadcasts with an antenna COR mounted 155 meters above ground level (AGL). The antenna employed is a 4-Bay, 1.0  $\lambda$  (wavelength) spaced, Collins G5CPS-4AC-3 “rotor-tiller” type antenna employing EPA Type 3 elements as defined by FM Model Version 2.10 Beta issued March 22, 1995.

The WNOR(FM) – Norfolk, VA HD/IBOC facility operates on CH254B (98.7 MHz) with 0.46 kW ERP circular polarization (H&V). The HD/IBOC facility broadcasts from the WNOR(FM) auxiliary antenna mounted 126 meters above ground level (AGL). The HD antenna employed is a 2-Bay, 1.0  $\lambda$  (wavelength) spaced, ERI LPX-2E “rotor-tiller” type antenna employing EPA Type 3 elements as defined by FM Model Version 2.10 Beta issued March 22, 1995.

The WJOI(AM) – Norfolk, VA analog AM facility operates on a frequency of 1230 kHz with a daytime and nighttime non-directional power of 0.627 kW. Both modes of operation employ the same single, vertical radiator of 243.6° or 0.677  $\lambda$  (wavelengths) for operation on 1230 kHz. Existing fencing has been measured to be 4.49 meters (14.7 feet) for the single tower. WJOI(AM) also operates with a calculated HD/IBOC power of 36.89 watts into the same tower. Therefore for purposes of this RF Renewal Study, the WJOI(AM) analog and HD/IBOC operations have been analyzed as one common contribution equaling 0.664 kW.

This site has been evaluated for compliance with the FCC guidelines concerning human exposure to radiofrequency radiation. The standards employed are detailed in OET Bulletin No. 65 (Edition 97-01). Software packages were used to determine the individual contribution of each station. A software package designed for use with AM stations (under the previous OST Bulletin No. 65, October 1985) was used to determine the contribution of this facility to the non-ionizing radiofrequency radiation present at this site. This program bases its calculations on data found in Figures 1, 2, and 3 of Appendix D of OST Bulletin No. 65, October 1985. FM non-ionization radiation levels were predicted using both the array pattern, the calculations of which are based on the number of bays in the antenna and wavelength spacing between the bays, and the element pattern which is determined by using measured element data prepared by the E.P.A. and published in “An Engineering Assessment of the Potential Impact of Federal Radiation Protection Guidance on the AM, FM and TV Services,” by Paul C. Gailey and Richard Tell - April 1985, U.S. Environmental Protection Agency, Las Vegas, NV.

## License Renewal

### Compliance with Radiofrequency Radiation Guidelines

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The results of the evaluation for the AM contribution(s) have been shown in both graphical and tabular forms at the end of this report. The tabular form lists the portion of the tabular output for each station, showing the region of maximum non-ionizing radiation. (The maximum values have been indicated by the use of **highlighted print**.) For the AM contribution, the maximum contribution has been assumed using the common daytime/nighttime power of 0.667 kW in conjunction with the measured fencing distance of 4.49 meters. The tabulation of AM data use the units of measurement,  $V^2/m^2$  and  $A^2/m^2$ , which were used in the previous standards as set forth in OST Bulletin No. 65, October 1985. Inspection of the tabulations will show that the maximum contribution of WJOI(AM) at the AM tower is made by the electric field. At this point, the field has a predicted value of  $2827 V^2/m^2$ , or 53.170 V/m, which represents 8.68% of the more stringent 614 V/m uncontrolled limit.

The results of the evaluation for the FM station have been shown at the end of this RF compliance discussion. To ensure complete protection, the maximum FM contribution has been assumed without regard for the AM restricted access fencing distance.

To evaluate the total exposure to non-ionizing radiofrequency radiation it is necessary to sum the individual contributions as a decimal fraction of the maximum permissible limit. If the resulting sum is less than or equal to unity, the exposure is concluded to be within the guidelines of OET Bulletin No. 65 (Edition 97-01). The table that follows provides the same information with respect to those locations defined as an "uncontrolled environment." This includes locations where there could be exposure to the general public. The total decimal fraction is also shown.

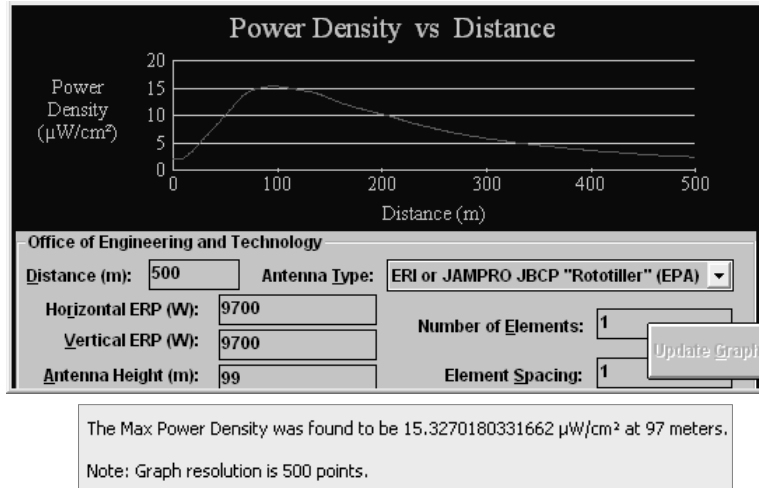
<u>Contributing Station</u>	<u>Maximum Contribution</u>	<u>Uncontrolled Environment Limit</u>	<u>Decimal Fraction of Limit</u>
WNOR(FM) (Analog Auxiliary)	15.327 $\mu W/cm^2$	200 $\mu W/cm^2$	0.07664
WNOR(FM) (Analog Primary)	11.389 $\mu W/cm^2$	200 $\mu W/cm^2$	0.05695
WNOR(FM) (HD/IBOC Primary)	0.2871 $\mu W/cm^2$	200 $\mu W/cm^2$	0.00144
WJOI(AM) (Analog & HD/IBOC)	53.170 V/m	614 V/m	0.08660
<b>Total Decimal Fraction:</b>			<b>0.22163</b>

Since the Total Decimal Fraction is less than unity for the uncontrolled environment, the operation of the combined transmitting plants is in compliance with the provisions of OET Bulletin No. 65 (Edition 97-01). Protection of the uncontrolled environment implies protection of the controlled environment. There are no other broadcast sources of radiofrequency non-ionizing radiation present at this site.

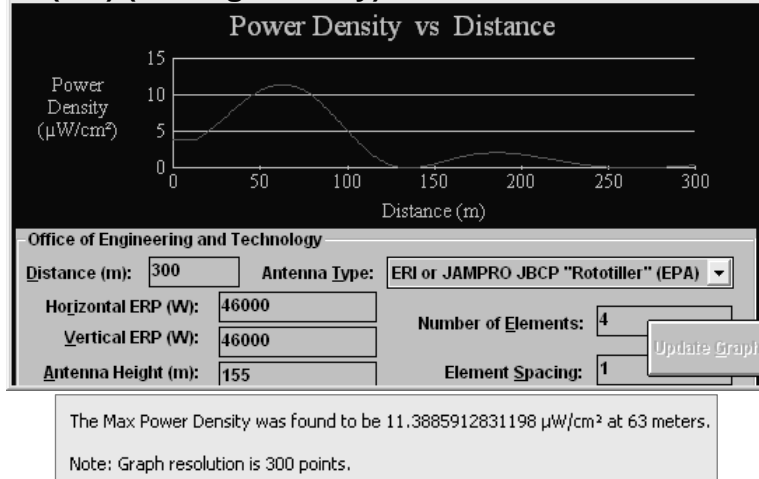
In addition to the protection afforded by the existing AM fencing and the FM antenna heights above ground, the facility is properly marked with signs, and entry to the facility is restricted by means of fencing with locked doors and/or gates. Any other means as may be required to protect employees and the general public will be employed.

In the event work would be required in proximity to the antenna such that the person or persons working in the area would be potentially exposed to fields in excess of FCC guidelines, an agreement, signed by all broadcast parties at the site, is in effect for the offending transmitter(s) to reduce power, or cease operation during the critical period.

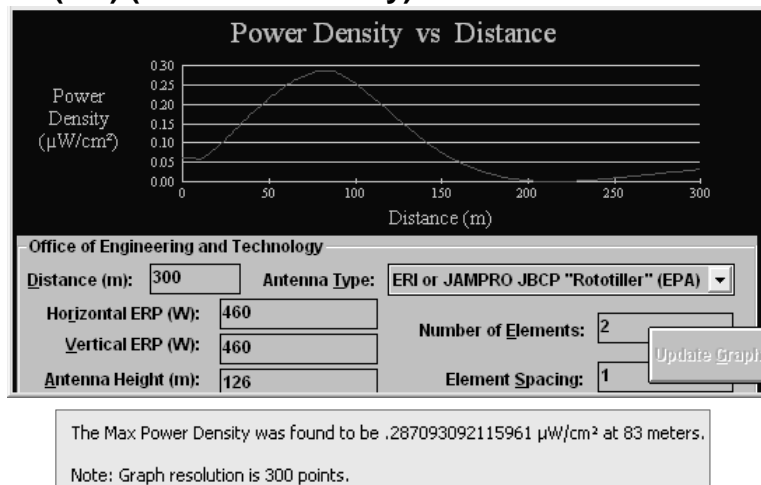
# **PLOT AND TAB OF TOTAL POWER DENSITY WNOR(FM) (Analog Auxiliary) - Channel 254B - Norfolk, VA**



# **PLOT AND TAB OF TOTAL POWER DENSITY WNOR(FM) (Analog Primary) - Channel 254B - Norfolk, VA**

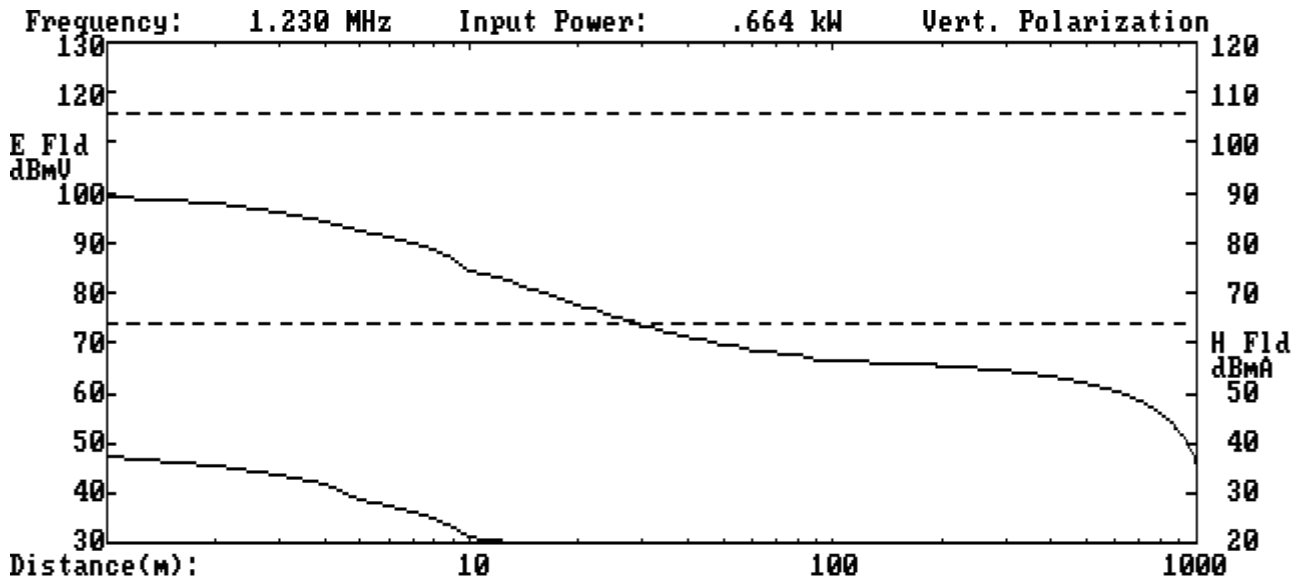


# **PLOT AND TAB OF TOTAL POWER DENSITY WNOR(FM) (HD/IBOC Primary) - Channel 254B - Norfolk, VA**



# PLOT AND TAB OF ELECTRIC AND MAGNETIC FIELD STRENGTHS

## WJOI(AM) (Analog and HD/IBOC) - 1230 kHz - Norfolk, VA



Summary of Input Data:    WJOI(AM)    Frequency: 1.230 MHz  
 Vertical Input Power : 0.664 kW    Antenna Type: AM NON-D  
 Vertical Element Type Number: 1    Height of observer: 2.0 Meters

Element Data: Vertical Number of elements: 1  
 Distance from analysis reference point: .0 meters  
 Azimuth from analysis reference point: N .0 E  
 Height of tower above reference plane: 243.6 Degrees

Element Number	Distance From Center (wavelengths)		Relative Power	Relative Phase	
1.	.00		1.000	.0	
	Horizontal Polarization		Vertical Polarization		Total Power
Distance (meters)	E2 Field (V2/m2)	H2 Field (A2/m2)	E2 Field (V2/m2)	H2 Field (A2/m2)	Density (mW/cm2)
1.00	0.	.0000	8026.	.0052	.6461
2.00	0.	.0000	5998.	.0037	.4732
3.00	0.	.0000	4265.	.0025	.3270
4.00	0.	.0000	2827.	.0015	.2076
5.00	0.	.0000	1683.	.0008	.1150
6.00	0.	.0000	1305.	.0006	.0893
7.00	0.	.0000	975.	.0005	.0669
8.00	0.	.0000	693.	.0003	.0477
9.00	0.	.0000	459.	.0002	.0317
10.00	0.	.0000	273.	.0001	.0190
11.00	0.	.0000	235.	.0001	.0171
12.00	0.	.0000	200.	.0001	.0153
13.00	0.	.0000	168.	.0001	.0136
14.00	0.	.0000	139.	.0001	.0119
15.00	0.	.0000	112.	.0001	.0104
16.00	0.	.0000	100.	.0001	.0097
17.00	0.	.0000	88.	.0001	.0091
18.00	0.	.0000	77.	.0001	.0085
19.00	0.	.0000	66.	.0001	.0079
20.00	0.	.0000	57.	.0001	.0072
21.00	0.	.0000	52.	.0001	.0069
22.00	0.	.0000	47.	.0001	.0065
23.00	0.	.0000	42.	.0001	.0062
24.00	0.	.0000	38.	.0001	.0058
25.00	0.	.0000	34.	.0001	.0054