TEST REPORT

Report Number: 3139008MIN-004
Project Number: 3139008

Testing performed on the
7295949, HydroLink Transceiver Module
FCC ID: OVA5949
Industry Canada ID: 3590A-5949

to
47 CFR Part 15.249:2006
RSS- 210, Issue 7, 2007

For
EcoWater Systems LLC

Test Performed by:	Test Authorized by:
Intertek Testing Services NA, Inc.	EcoWater Systems LLC
7250 Hudson Blvd., Suite 100	1890 Woodlane Drive
Oakdale, MN 55128	Woodbury, MN 55125

Prepared by: _____ Date: December 19, 2007
Norman Shpilsher

Reviewed by: _____ Date: December 19, 2007
Uri Spector

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1.0 GENERAL DESCRIPTION

Model:	7295949
Type of EUT:	HydroLink Transceiver Module
Serial Number:	N/A
FCC ID:	FCC ID: OVA5949
Industry Canada ID:	3590A-5949
Related Submittal(s) Grants:	None
Company:	EcoWater Systems LLC
Customer:	Mr. Vlad Komlev
Address:	1890 Woodlane Drive Woodbury, MN 55125
Phone:	(651) 731-7471
Fax:	(651) 731-7076
Test Standards:	☒ FCC Part 15.249 ☒ RSS–210, Issue 7, 2007 ☒ RSS-Gen, Issue 2, 2005 ☒ 47 CFR, Part 15:2005, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	December 17, 2007
Test Work Started:	December 17, 2007
Test Work Completed:	December 18, 2007
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	Transceiver
Operating Frequency	909.1 – 920.1MHz (three channels: 909.1, 913.1, and 920.1MHz)
Modulation:	FSK
Antenna(s) Info:	Type: Integral Antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 4.5 VDC ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
Test Methodology:	Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application
Special Test Arrangement:	The EUT was tested with continuous modulated or un-modulated mode under the test software
Test Facility:	The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been accredited by A2LA (Certificate No. 1427.01)
Justification:	None

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

☒ - Standby
☒ - Continuous modulated
☒ - Continuous un-modulated
☒ - Continuous receiving mode
☐ - Test program (customer specific)

Operating modes of the EUT:

No.	Description
1	
2	

Cables:

No.	Type	Length	Designation	Note
1	3-pair phone modular cable	0.3m	Communication cable (RJ11 connectors)	
2	2-pair phone modular cable	3m	Faucet LED cable (RJ11 connectors)	

Support equipment/Services:

No.	Item	Description
1	None	
2		

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☐ **Normal**

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be: ±4 dB at 10m and ±5.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

General notes: None

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.249(a) / RSS-210 A2.9	Field strength of fundamental	Pass
15.249(a) / RSS-210 A2.9	Field strength of harmonics	Pass
15.249(d) / RSS-210 A2.9	Field strength of spurious emissions	Pass
RSS- Gen 4.6.1	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	N/A
15.109/ICES-003	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	N/A

3.0 TEST CONDITIONS AND RESULTS

3.1 Field strength of fundamental, harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-10GHz

Test result: **Pass**

Max. Emissions margin at fundamental: 0.4 dB below the limits

Max. margin of harmonics and spurious emissions: 1.0 dB below the FCC 15.209 limits

Notes: Table 3.1.1 shows field strength of fundamentals.
Table 3.1.2 and Graphs 3.1.1 to 3.1.9 show field strength of harmonics and spurious emissions.
No emissions above ambient were detected at band edges of 902.0 and 928.0MHz.

Date:	December 17, 2007	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Norman Shpilsher	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Emissions at fundamentals	

Table 3.1.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
					Ch. 1					
909.03	V	121	21.1	3.6	0.0	68.8	93.6	94.0	-0.4	
909.03	H	209	21.1	3.6	0.0	66.8	91.6	94.0	-2.4	
					Ch. 2					
913.22	V	117	21.2	3.6	0.0	68.5	93.3	94.0	-0.7	
913.22	H	204	21.2	3.6	0.0	67.1	91.9	94.0	-2.1	
					Ch. 3					
920.03	V	114	21.2	3.7	0.0	68.4	93.3	94.0	-0.7	
920.03	H	210	21.2	3.7	0.0	67.7	92.6	94.0	-1.4	

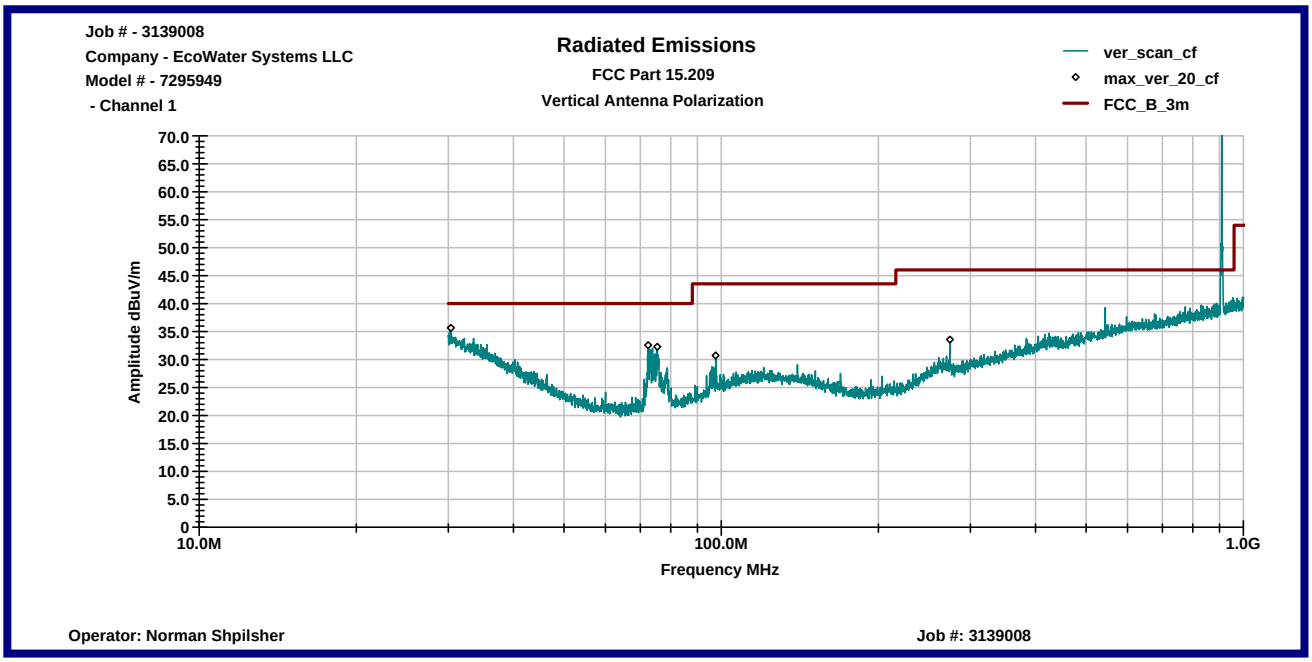
Date:	December 17, 2007	**Result:** **Pass**
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Norman Shpilsher	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Harmonics and spurious emissions	

Table 3.1.2

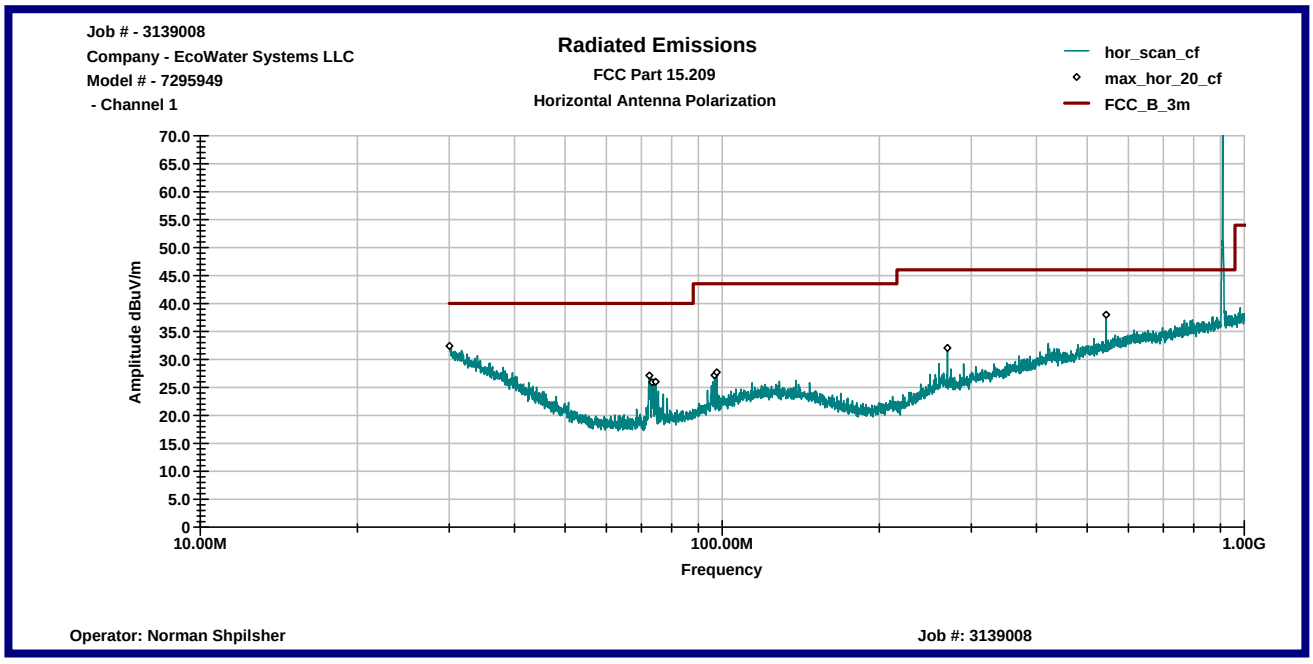
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
			Ch. 1				
72.464 MHz	V	24.3	8.2	0.0	32.5	40.0	-7.5
274.31 MHz	V	18.4	15.2	0.0	33.6	46.0	-12.5
1.818 GHz	V	19.9	33.1	0.0	53.0	54.0	-1.0
2.7316 GHz	V	35.8	32.3	37.9	30.2	54.0	-23.8
72.52 MHz	H	18.9	8.2	0.0	27.1	40.0	-12.9
270.11 MHz	H	16.6	15.5	0.0	32.0	46.0	-14.0
543.88 MHz	H	17.1	20.9	0.0	38.0	46.0	-8.0
1.818 GHz	H	17.2	33.1	0.0	50.4	54.0	-3.6
2.7316 GHz	H	42.1	32.3	37.9	36.5	54.0	-17.5
			Ch. 1				
72.353 MHz	V	27.4	8.2	0.0	35.6	40.0	-4.4
274.31 MHz	V	18.5	15.2	0.0	33.6	46.0	-12.4
1.826 GHz	V	18.9	32.9	0.0	51.8	54.0	-2.2
2.7424 GHz	V	34.3	32.3	37.9	28.7	54.0	-25.3
73.243 MHz	H	19.3	8.3	0.0	27.5	40.0	-12.5
543.88 MHz	H	17.0	20.9	0.0	37.9	46.0	-8.1
1.8825 GHz	H	16.5	33.3	0.0	49.8	54.0	-4.2
2.7424 GHz	H	40.0	32.3	37.9	34.4	54.0	-19.6
			Ch. 3				
72.52 MHz	V	22.8	8.2	0.0	31.0	40.0	-9.0
274.31 MHz	V	18.1	15.2	0.0	33.3	46.0	-12.8
1.8405 GHz	V	18.8	32.6	0.0	51.4	54.0	-2.6
2.7604 GHz	V	35.2	32.4	37.9	29.6	54.0	-24.4
270.11 MHz	H	17.5	15.5	0.0	33.0	46.0	-13.0
543.88 MHz	H	17.2	20.9	0.0	38.1	46.0	-8.0
1.8405 GHz	H	15.1	32.6	0.0	47.7	54.0	-6.3
2.764 GHz	H	40.0	32.4	37.9	34.4	54.0	-19.6

Graph 3.1.1

Vertical antenna polarization

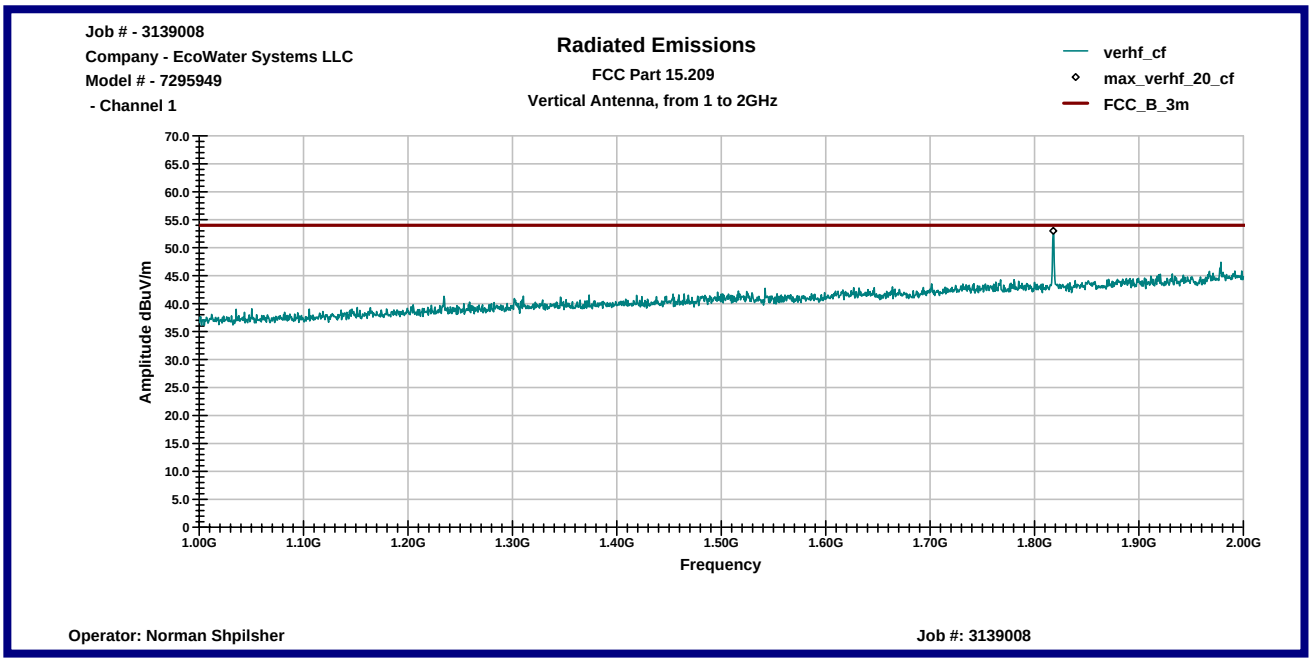


Horizontal antenna polarization

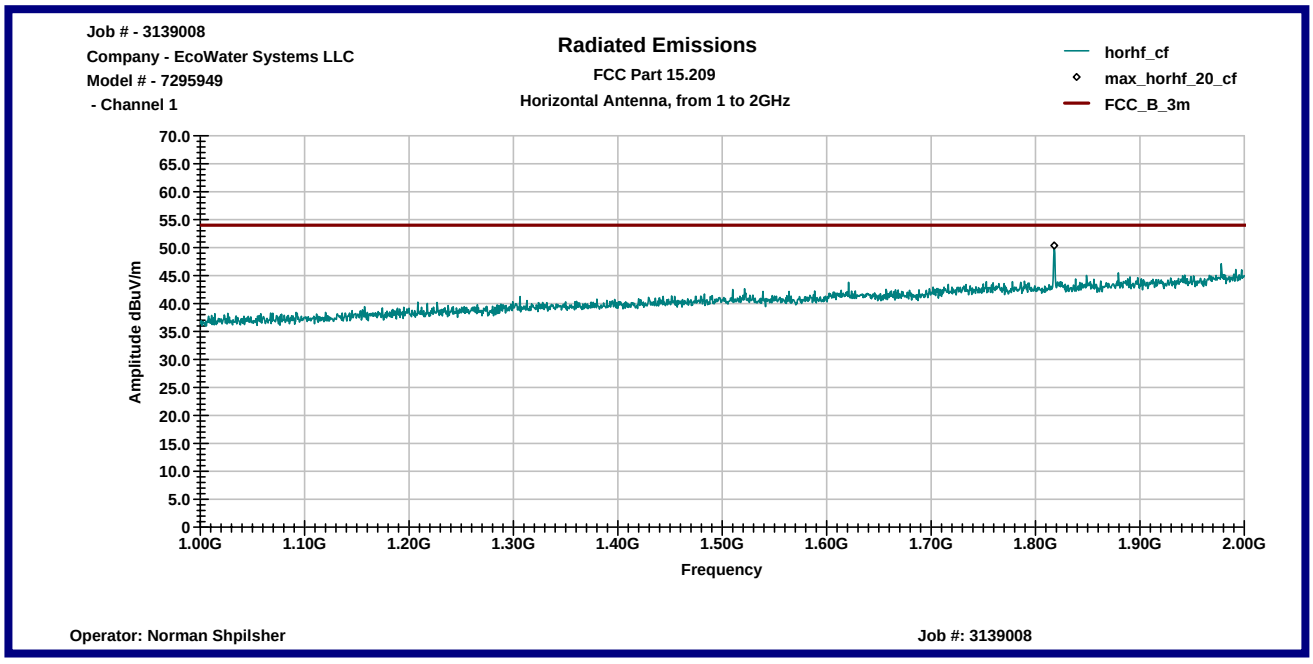


Graph 3.1.2

Vertical antenna polarization

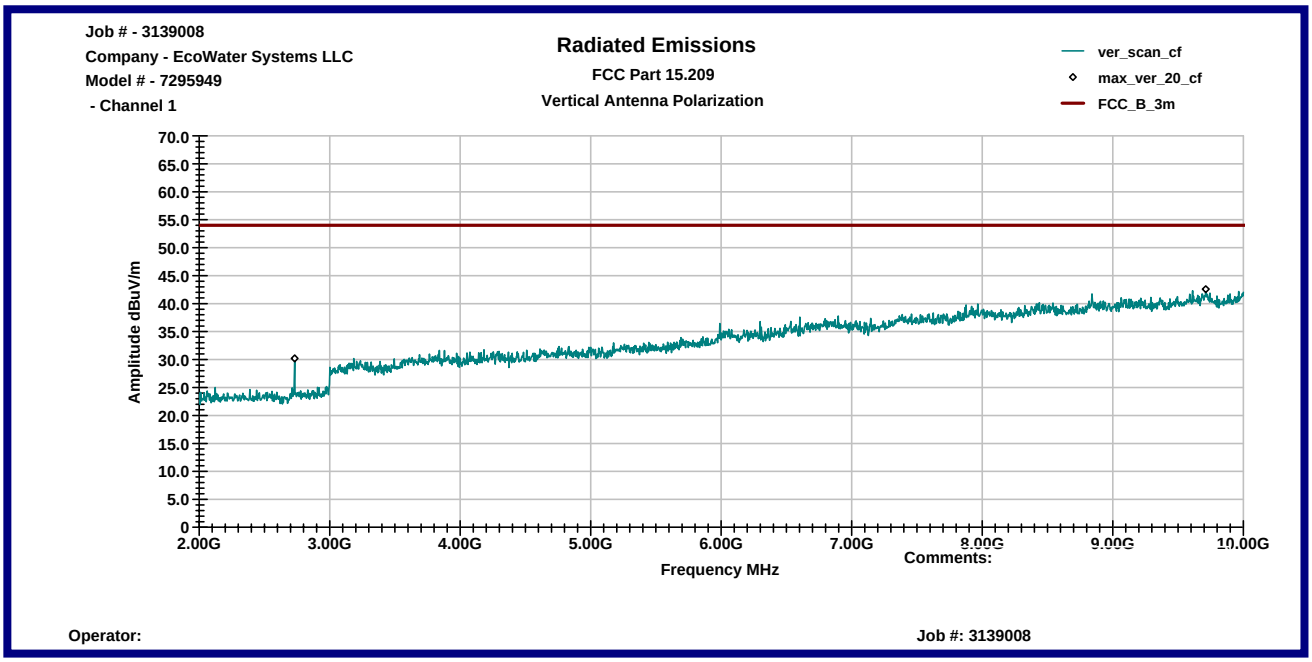


Horizontal antenna polarization

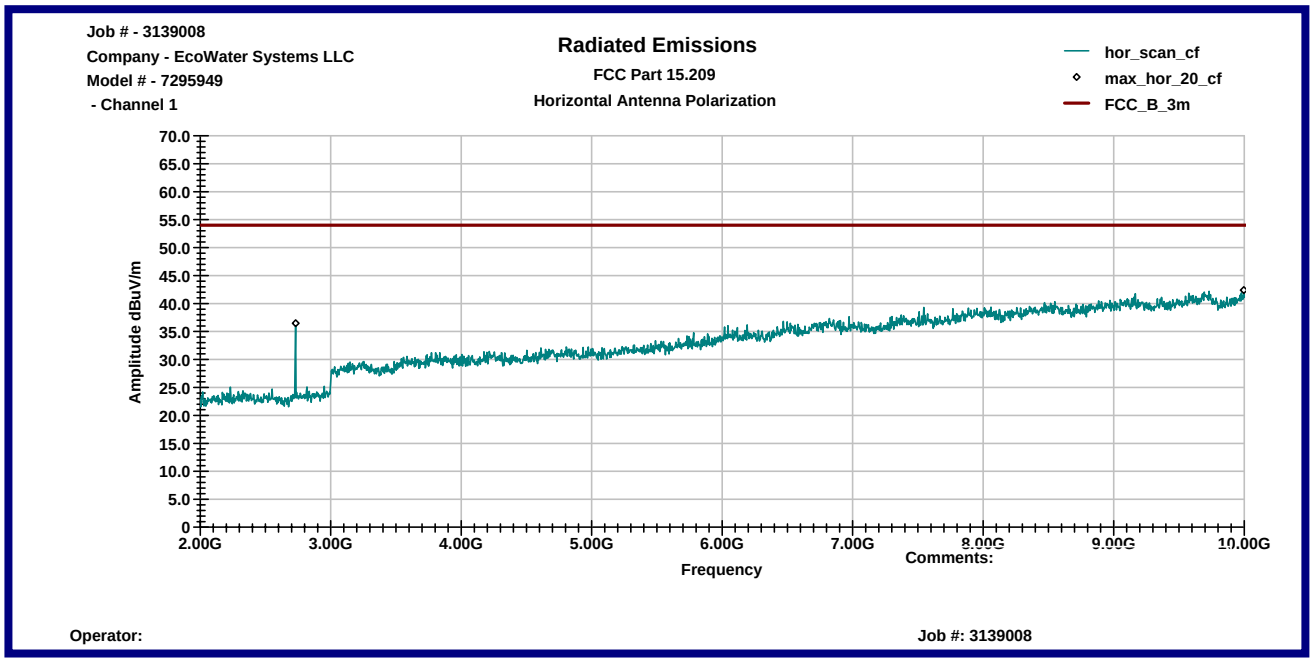


Graph 3.1.3

Vertical antenna polarization

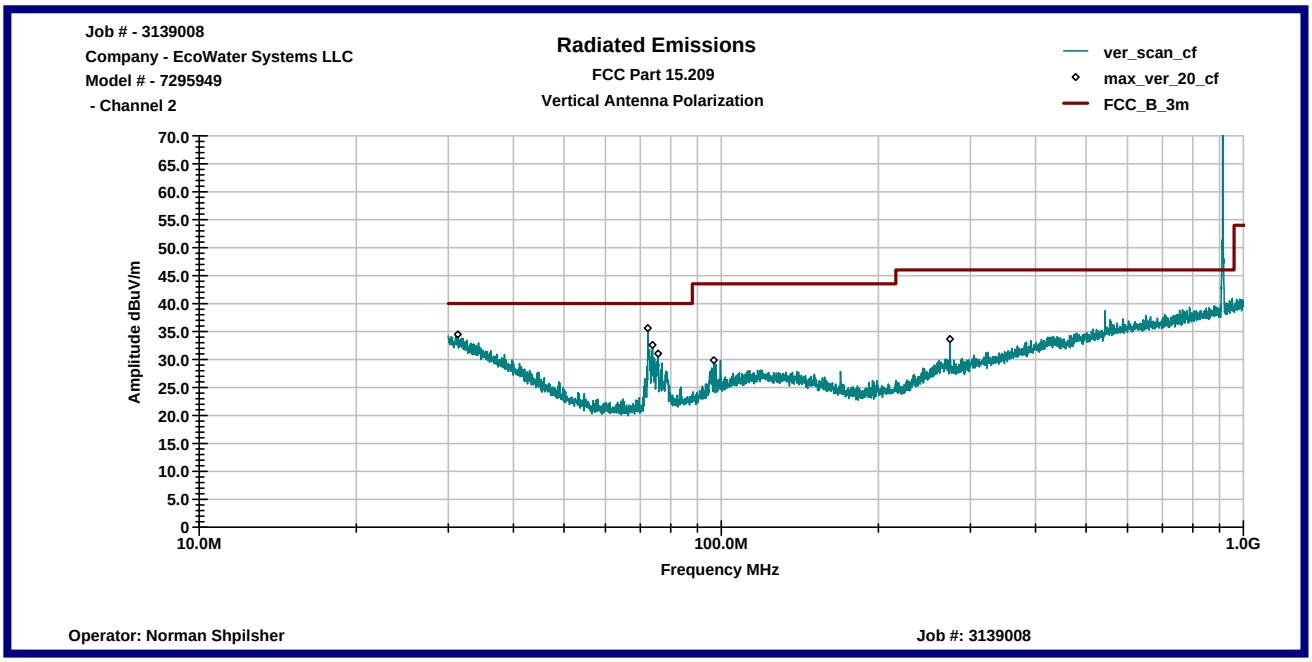


Horizontal antenna polarization

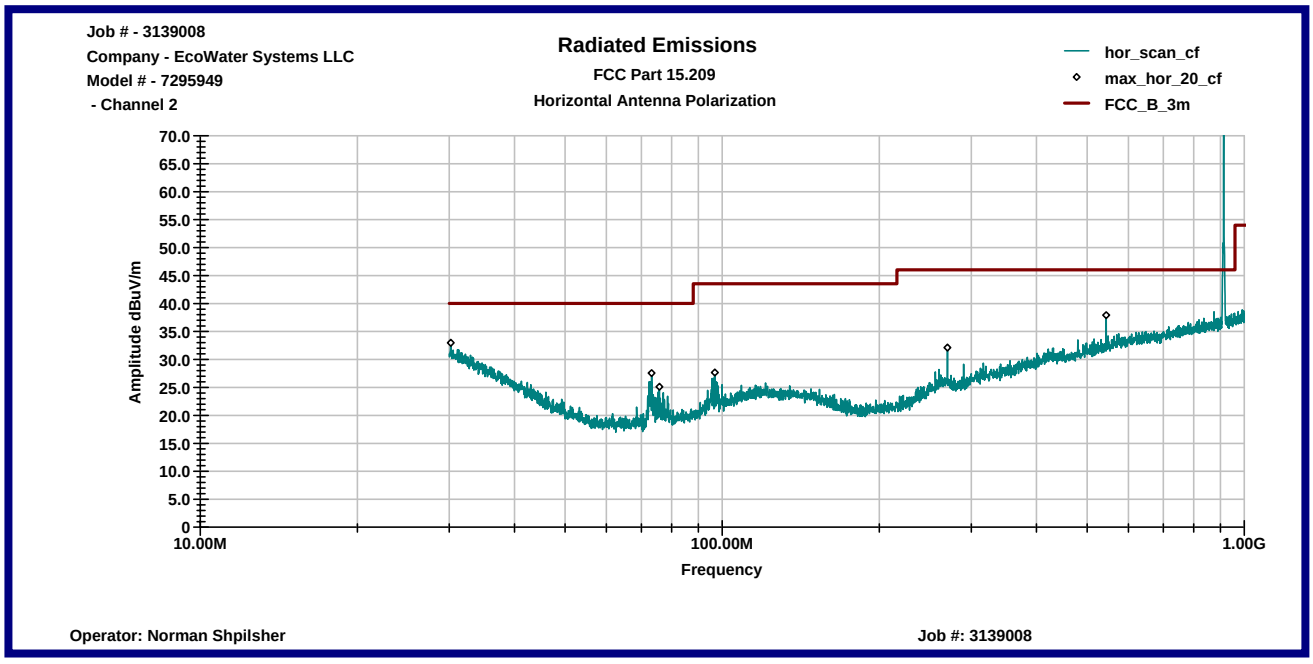


Graph 3.1.4

Vertical antenna polarization

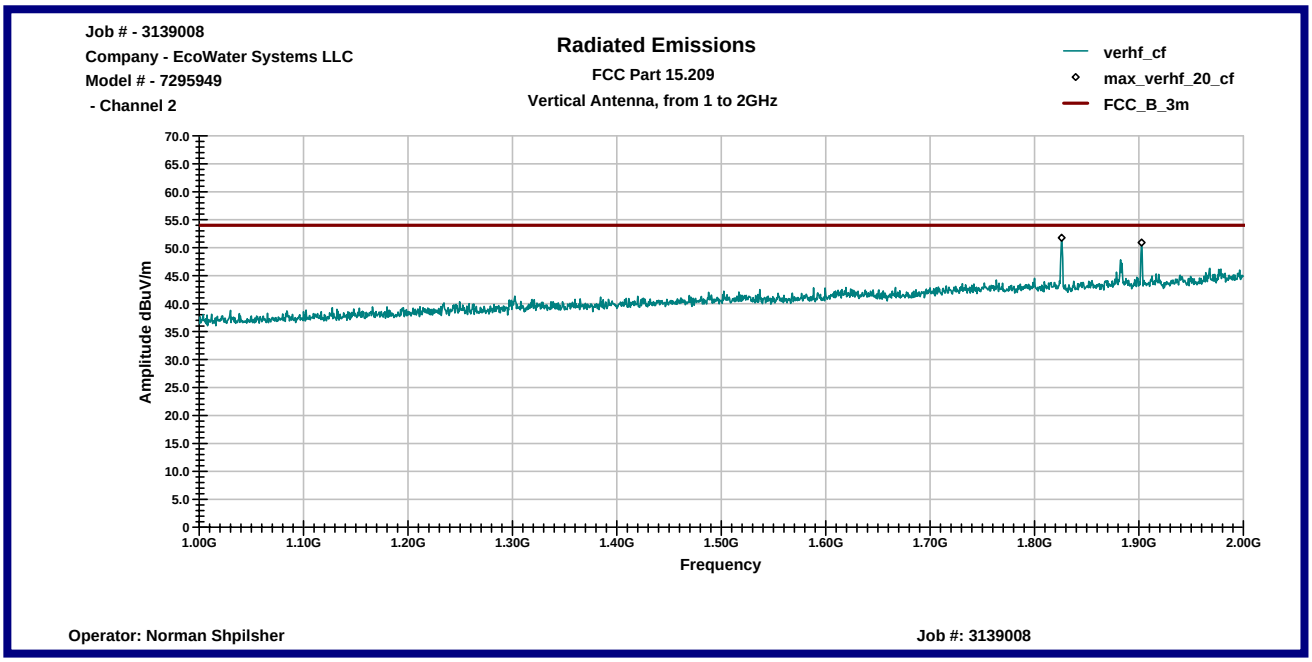


Horizontal antenna polarization

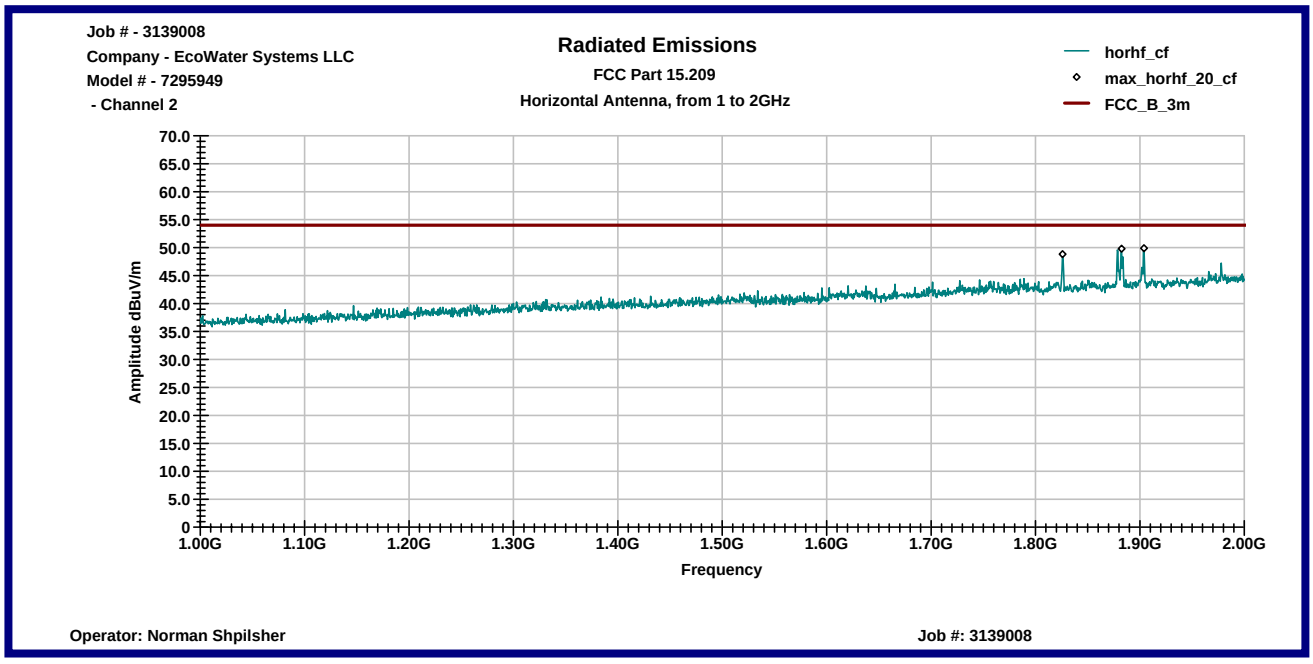


Graph 3.1.5

Vertical antenna polarization

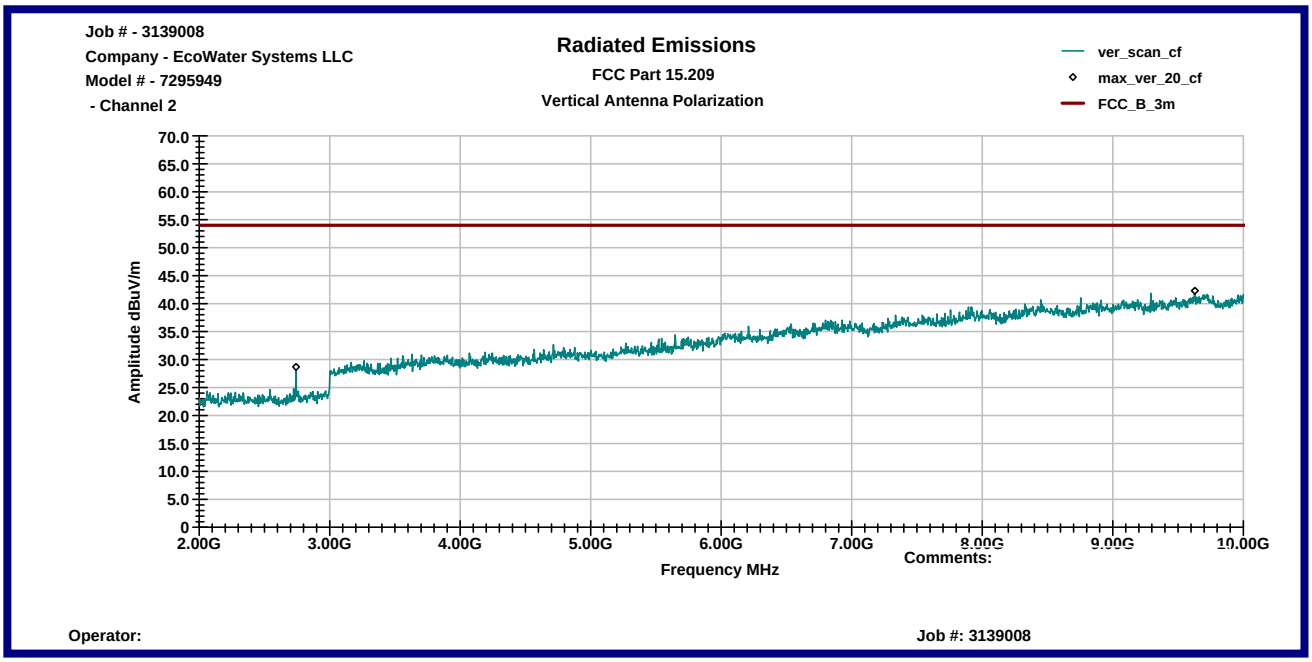


Horizontal antenna polarization

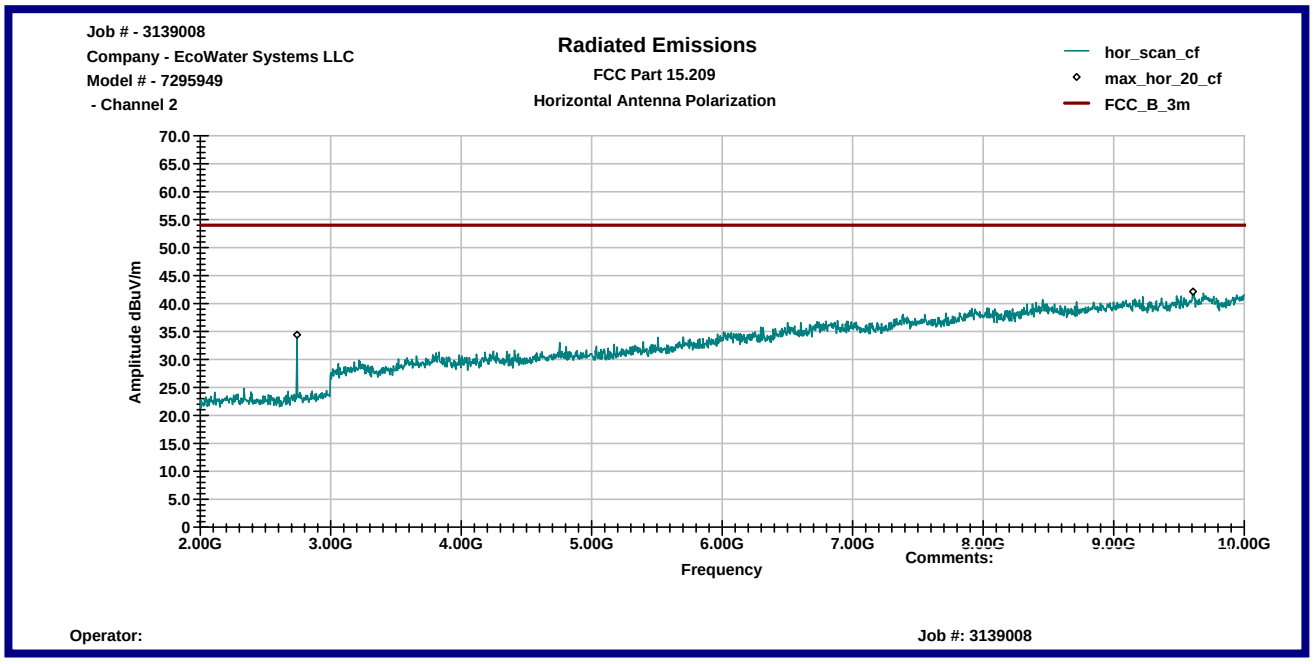


Graph 3.1.6

Vertical antenna polarization

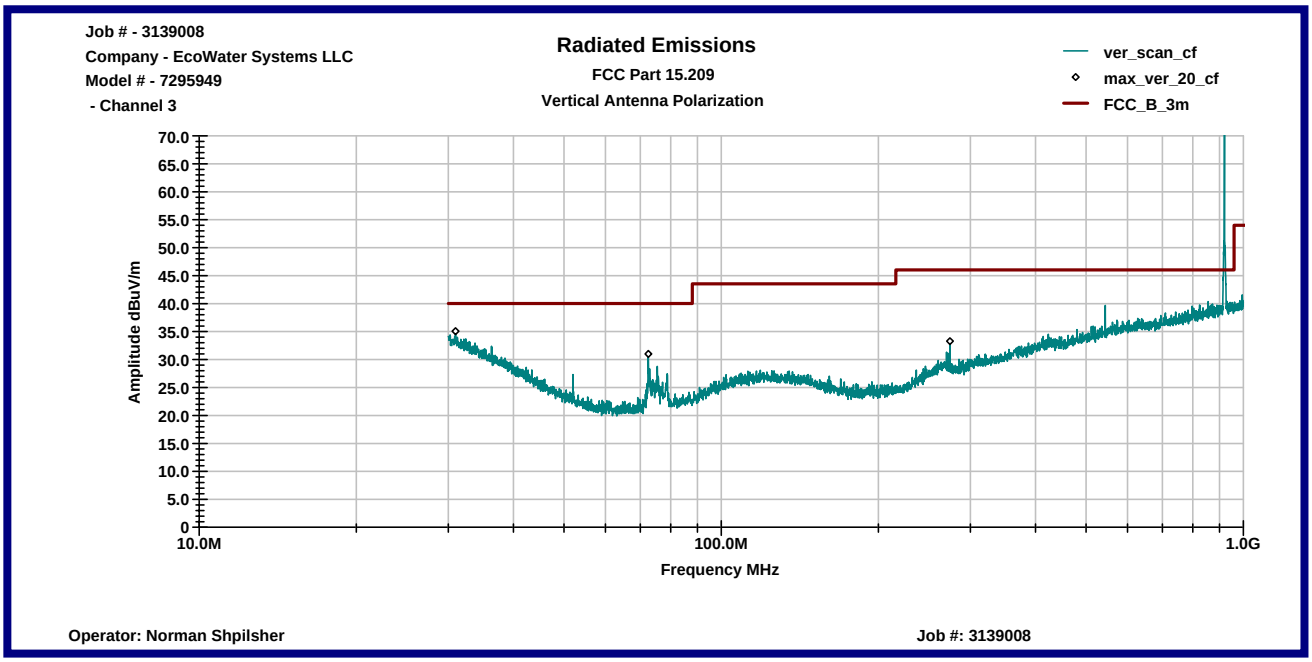


Horizontal antenna polarization

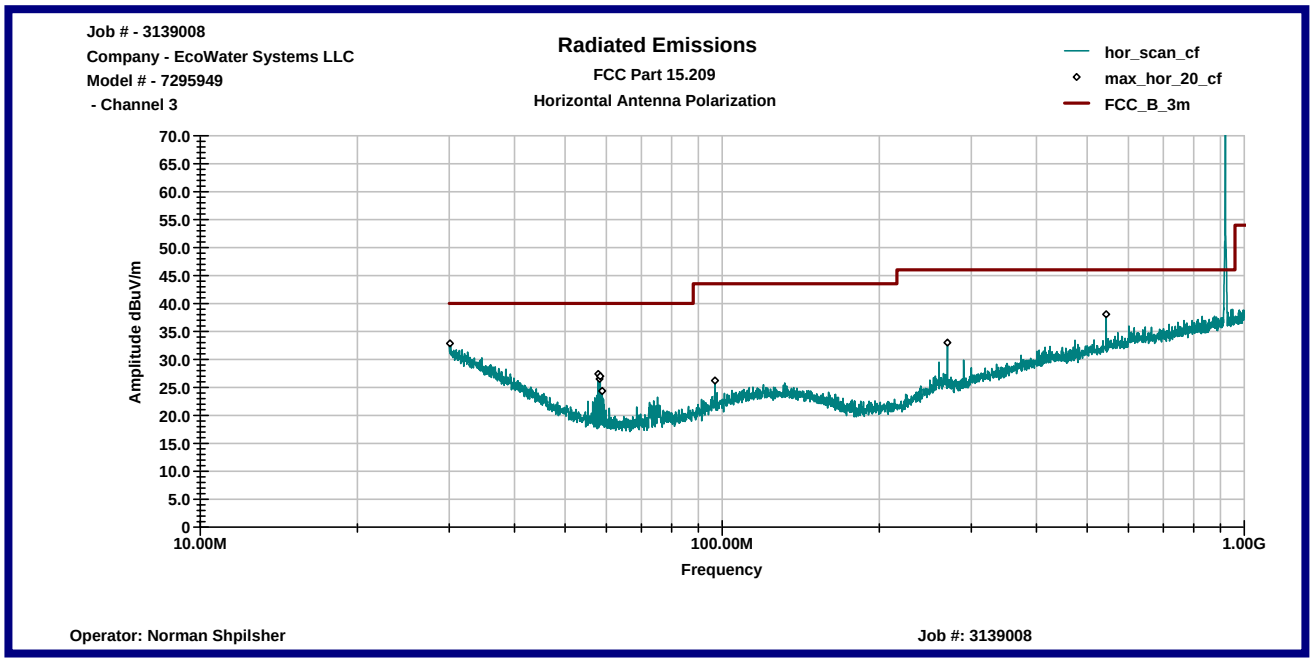


Graph 3.1.7

Vertical antenna polarization

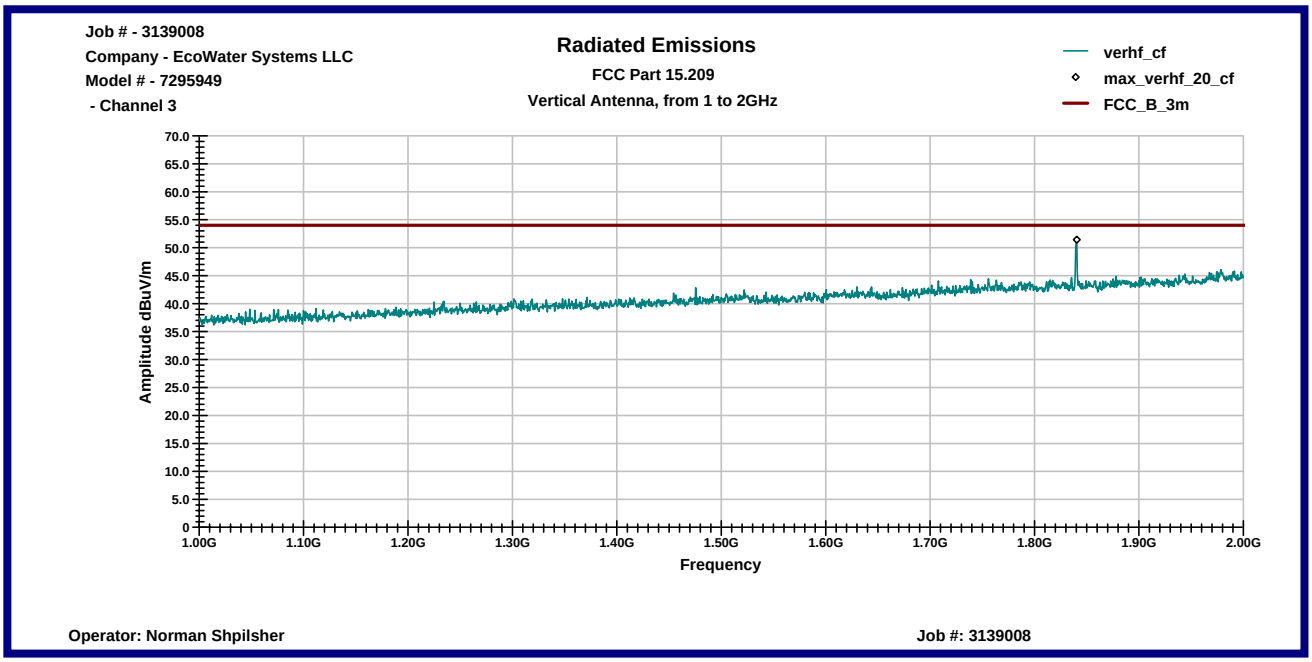


Horizontal antenna polarization

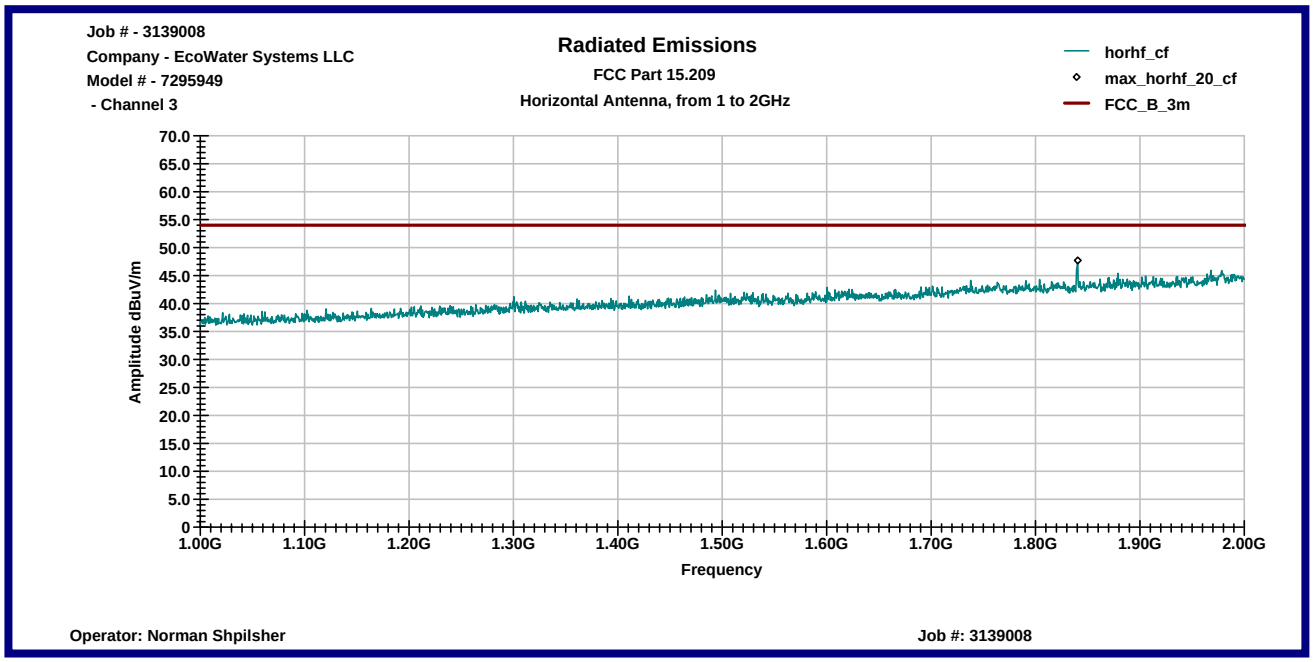


Graph 3.1.8

Vertical antenna polarization

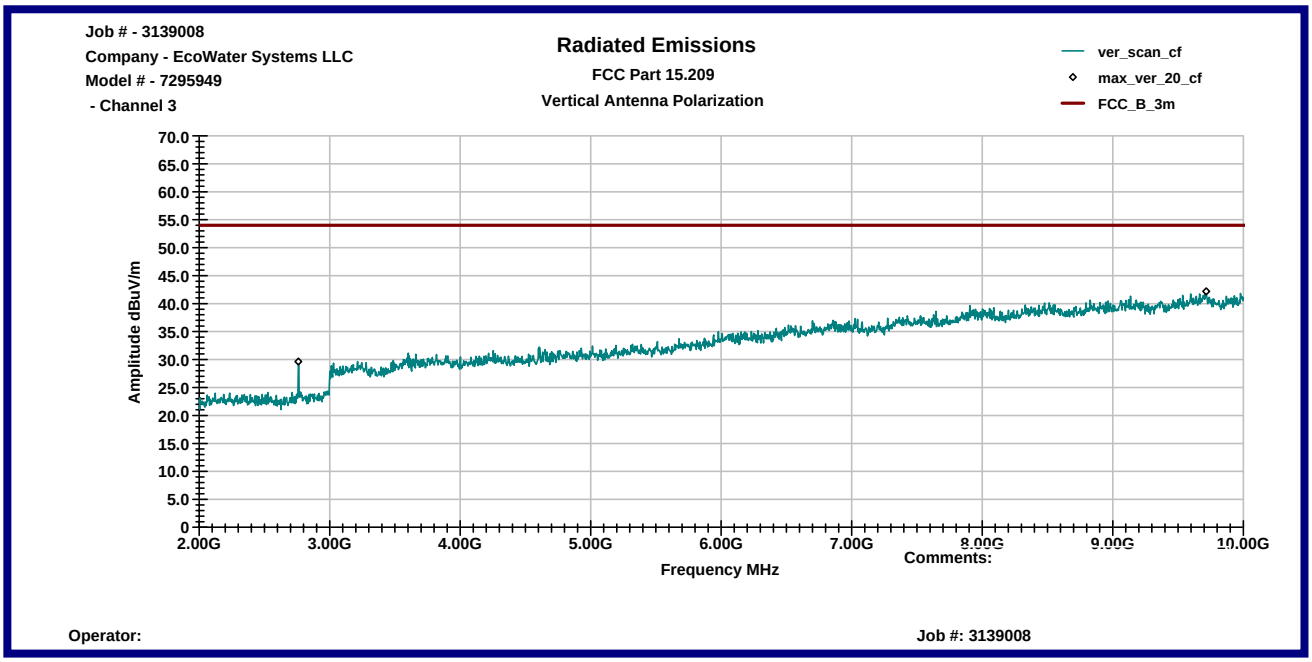


Horizontal antenna polarization

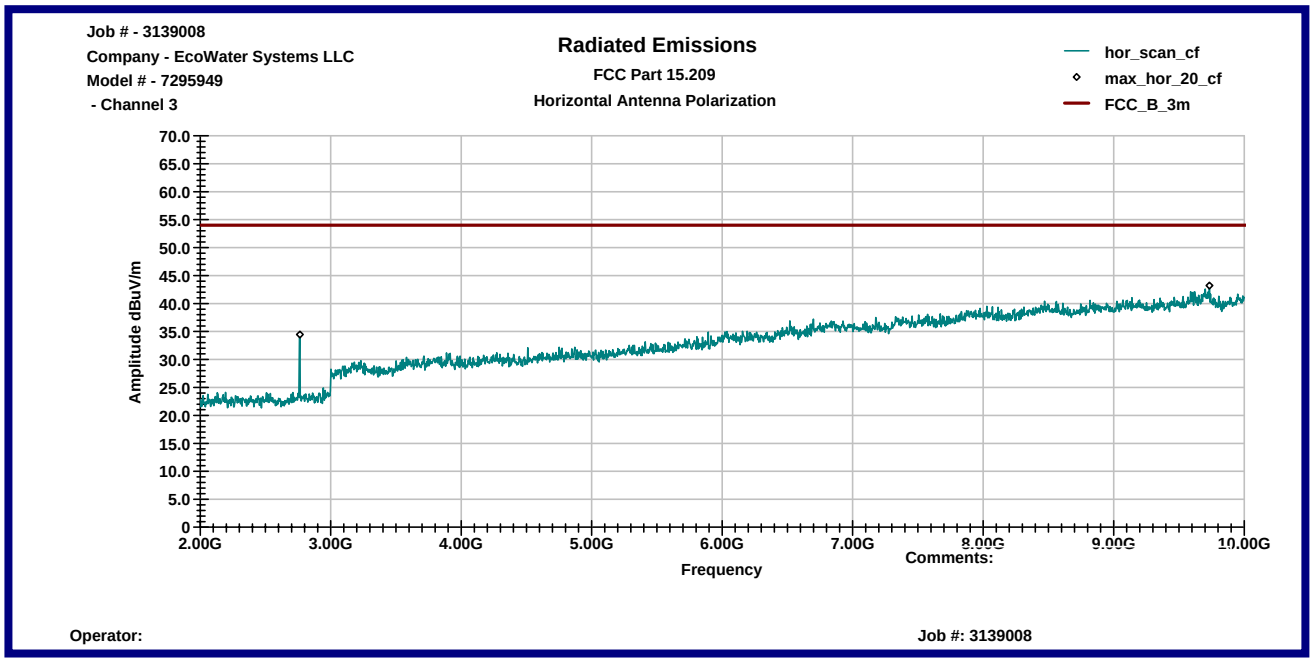


Graph 3.1.9

Vertical antenna polarization



Horizontal antenna polarization



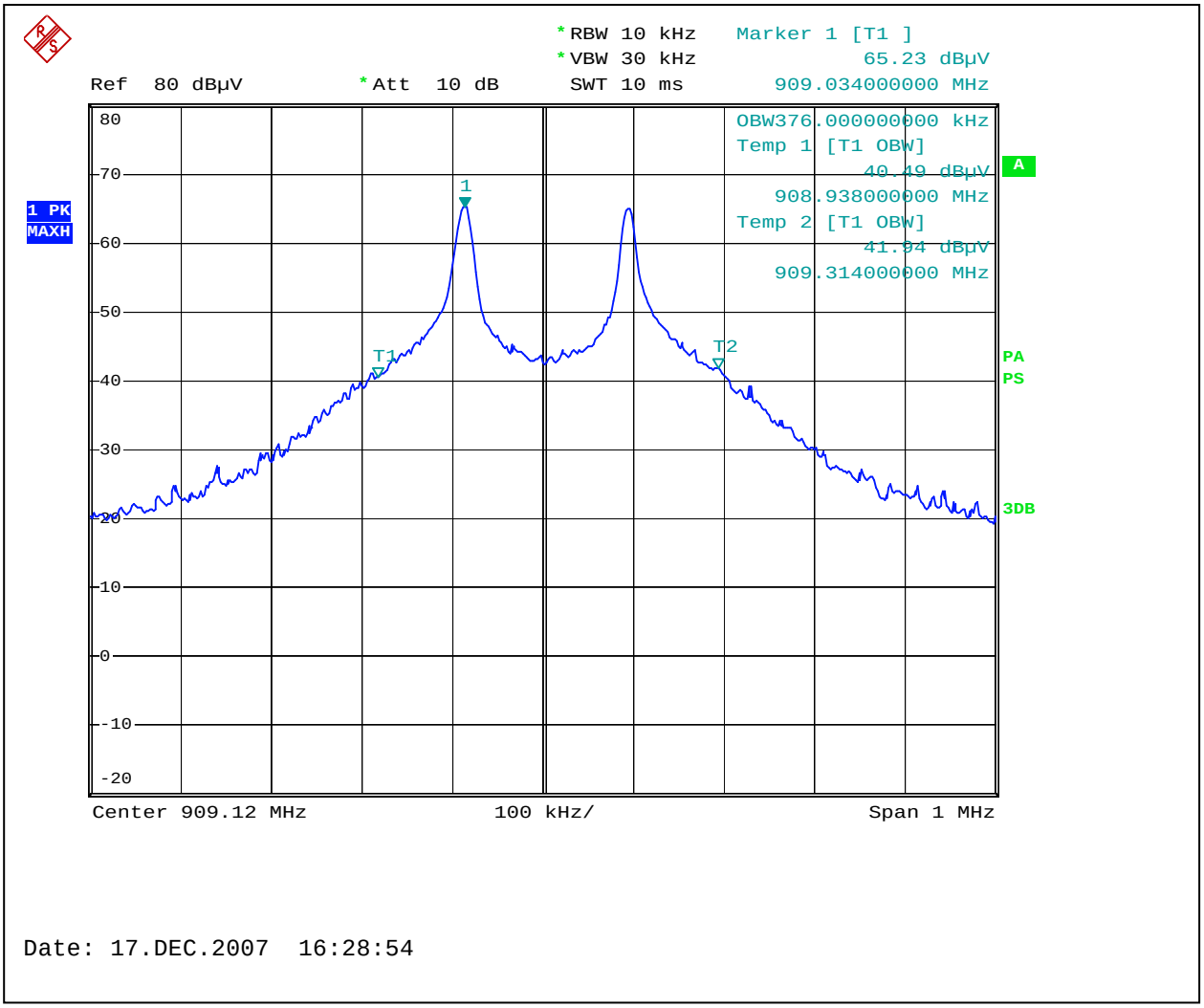
3.2 Bandwidth of Emissions

Channel	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
Channel 1		376
Channel 2		368
Channel 3		356

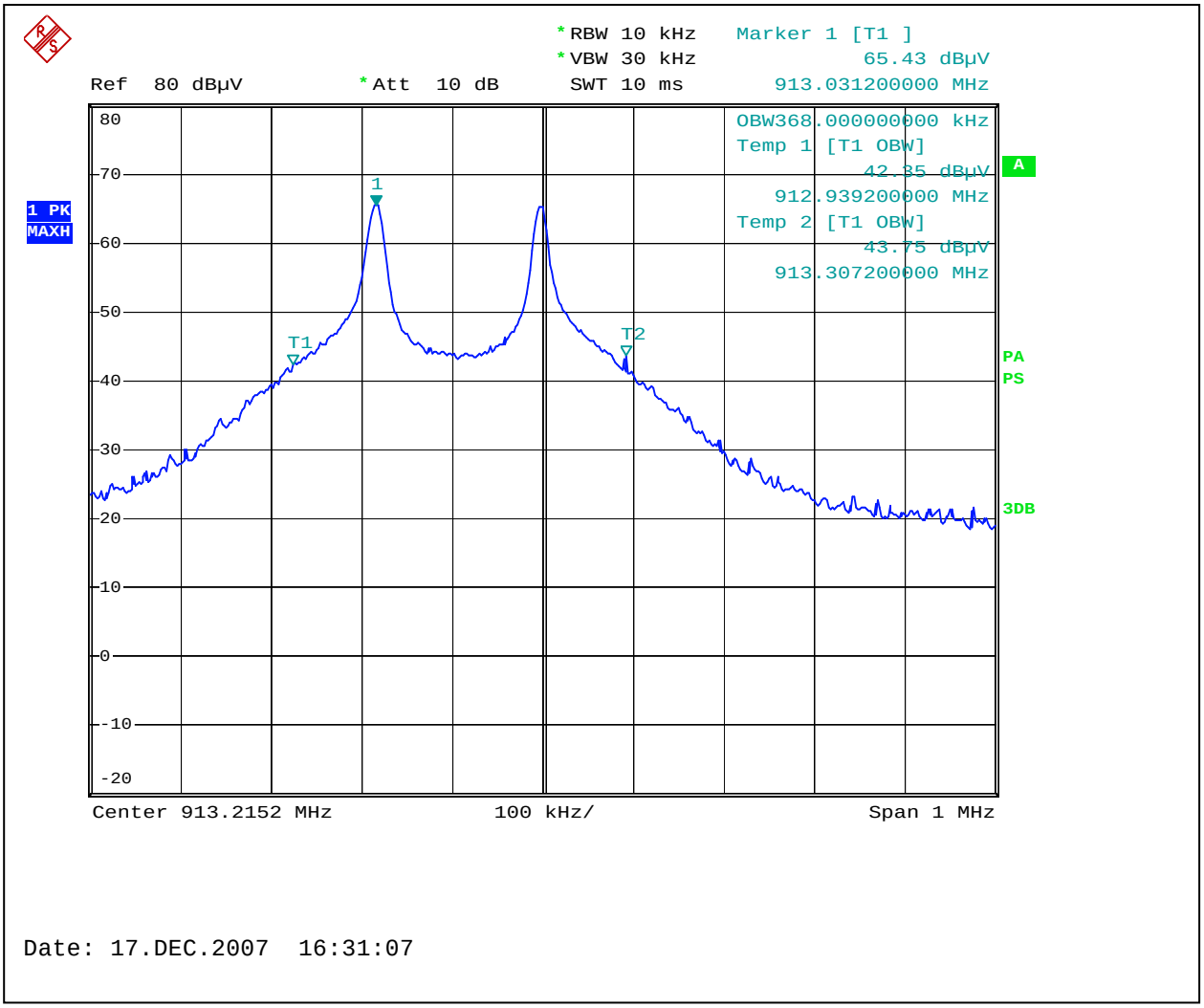
Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

Notes: None

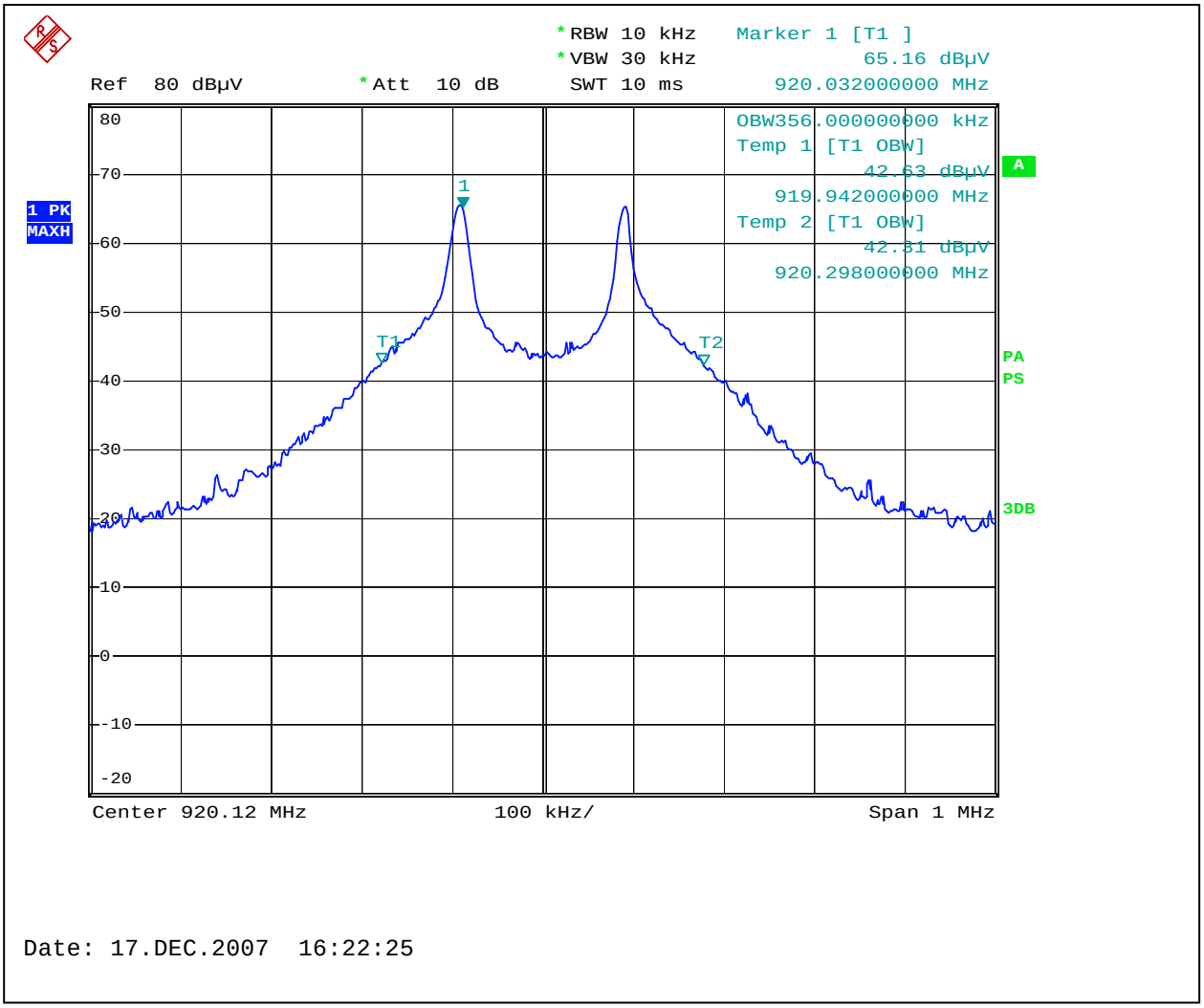
Graph 3.2.1


*RBW 10 kHz
*VBW 30 kHz
Ref 80 dBµV
*Att 10 dB
SWT 10 ms
Marker 1 [T1]
65.23 dBµV
909.034000000 MHz
OBW376.000000000 kHz
Temp 1 [T1 OBW]
40.49 dBµV
908.938000000 MHz
Temp 2 [T1 OBW]
41.94 dBµV
909.314000000 MHz
1 PK
MAXH
A
PA
PS
3DB
T1
T2
80
70
60
50
40
30
20
10
0
-10
-20
Center 909.12 MHz
100 kHz/
Span 1 MHz
Date: 17.DEC.2007 16:28:54

Graph 3.2.2


*RBW 10 kHz
*VBW 30 kHz
Ref 80 dBµV
*Att 10 dB
SWT 10 ms
Marker 1 [T1]
65.43 dBµV
913.031200000 MHz
OBW368.000000000 kHz
Temp 1 [T1 OBW]
42.35 dBµV
912.939200000 MHz
Temp 2 [T1 OBW]
43.75 dBµV
913.307200000 MHz
1 PK
MAXH
A
PA
PS
3DB
T1
T2
80
70
60
50
40
30
20
10
0
-10
-20
Center 913.2152 MHz
100 kHz/
Span 1 MHz
Date: 17.DEC.2007 16:31:07

Graph 3.2.3


*RBW 10 kHz
*VBW 30 kHz
Ref 80 dBµV
*Att 10 dB
SWT 10 ms
Marker 1 [T1]
65.16 dBµV
920.032000000 MHz
OBW356.000000000 kHz
Temp 1 [T1 OBW]
42.63 dBµV
919.942000000 MHz
Temp 2 [T1 OBW]
42.31 dBµV
920.298000000 MHz
1 PK
MAXH
A
PA
PS
3DB
T1
T2
80
70
60
50
40
30
20
10
0
-10
-20
Center 920.12 MHz
100 kHz/
Span 1 MHz
Date: 17.DEC.2007 16:22:25

3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).

3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoric Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-5GHz

Max. Emissions margin: 15.6 dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.5.1 and Graphs 3.5.1 and 3.5.2)

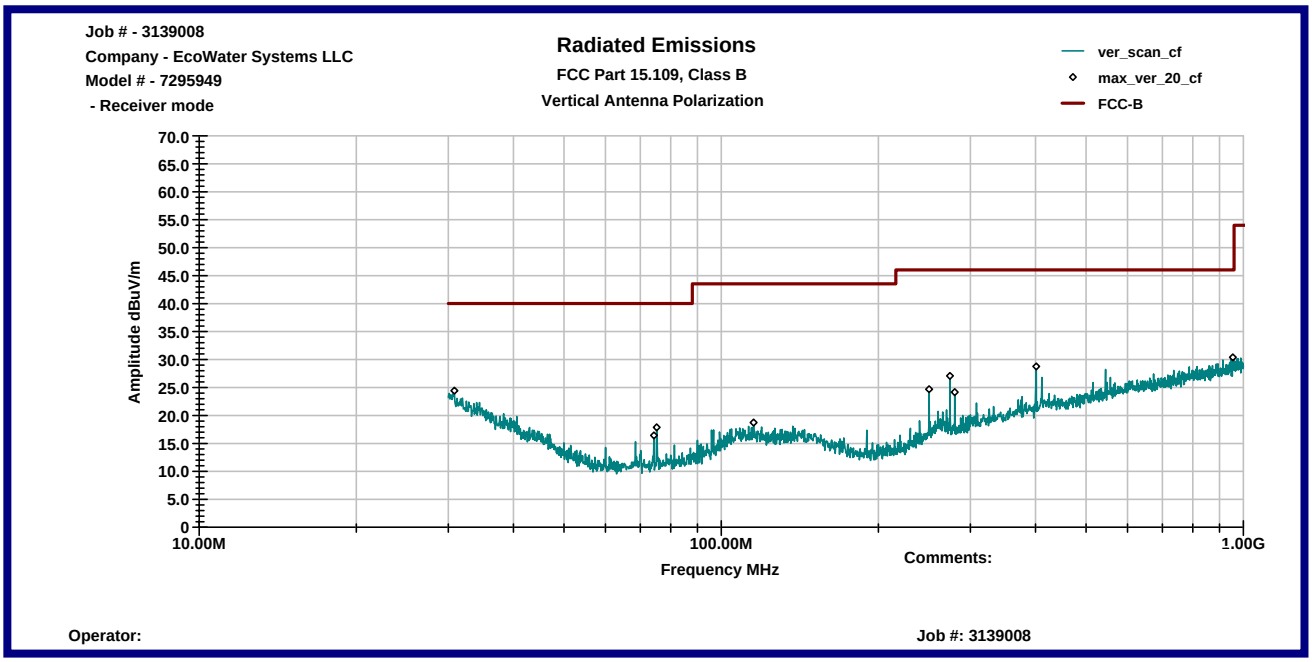
Date:	December 18, 2007	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B	
Tested by:	Norman Shpilsher	
Test Point:	Enclosure	
Operation mode:	Transmitting function is off / standby mode	
Note:		

Table 3.5.1

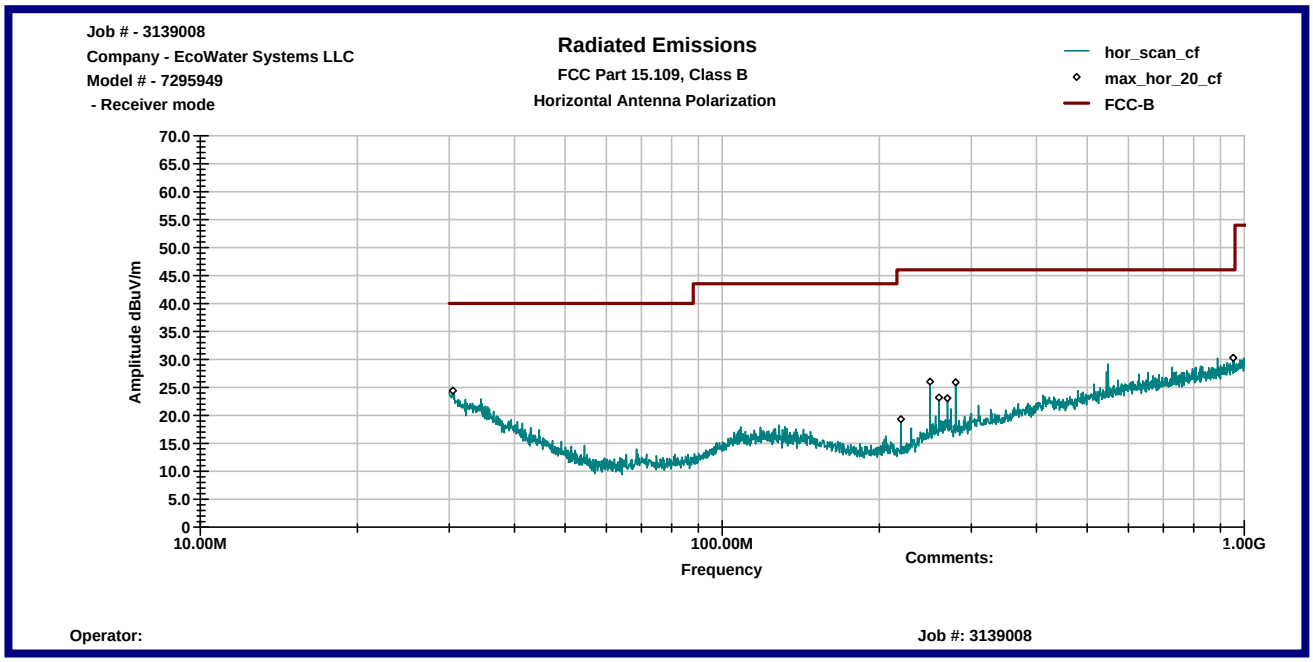
Frequency	Antenna Polarity	Peak Reading dBµV	Total CF dB1/m	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB
30.831 MHz	V	4.3	20.1	24.4	40.0	-15.6
74.333 MHz	V	8.0	8.4	16.4	40.0	-23.6
75.228 MHz	V	9.4	8.5	17.8	40.0	-22.2
115.37 MHz	V	5.2	13.6	18.7	43.5	-24.8
250.17 MHz	V	10.3	14.4	24.7	46.0	-21.4
274.28 MHz	V	11.9	15.2	27.1	46.0	-19.0
280.07 MHz	V	9.1	15.1	24.2	46.0	-21.9
401.13 MHz	V	10.2	18.6	28.8	46.0	-17.3
954.73 MHz	V	5.0	25.4	30.4	46.0	-15.6
30.485 MHz	H	4.1	20.3	24.4	40.0	-15.6
219.95 MHz	H	7.7	11.6	19.3	46.0	-26.7
250.17 MHz	H	11.6	14.4	26.0	46.0	-20.0
260.13 MHz	H	7.8	15.4	23.2	46.0	-22.8
270.1 MHz	H	7.6	15.5	23.1	46.0	-23.0
280.07 MHz	H	10.8	15.1	25.9	46.0	-20.1
952.61 MHz	H	4.9	25.3	30.3	46.0	-15.7

Graph 3.5.1

Vertical antenna polarization

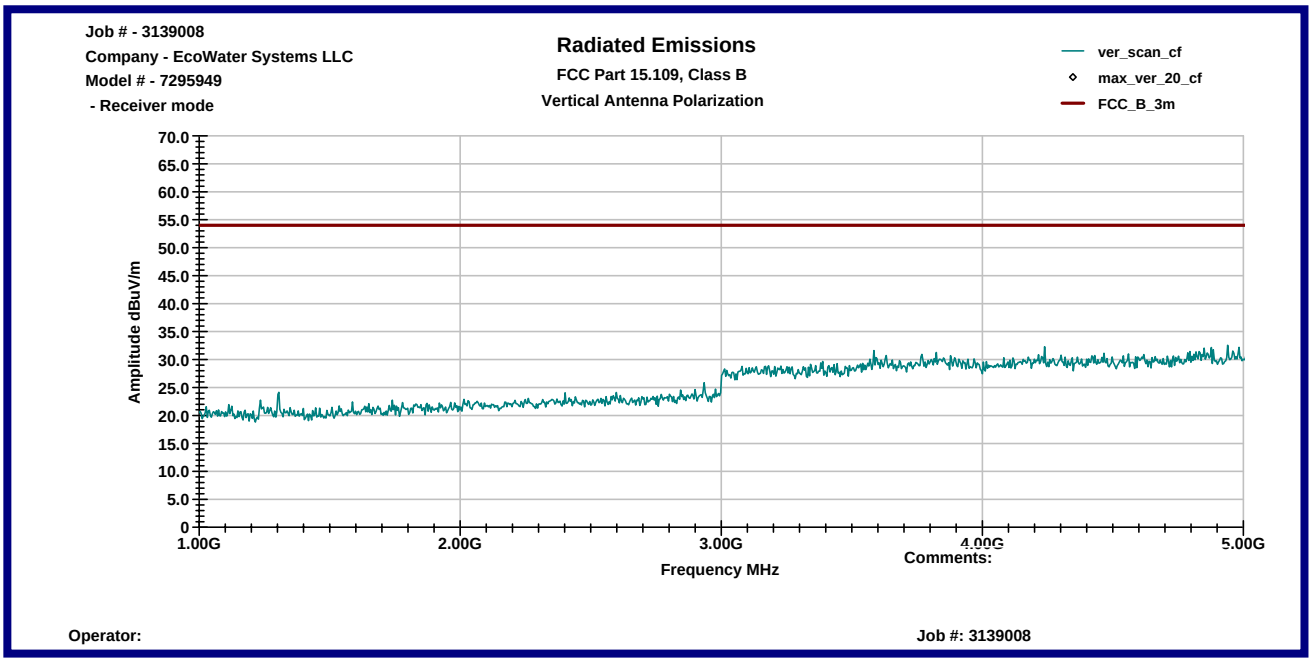


Horizontal antenna polarization

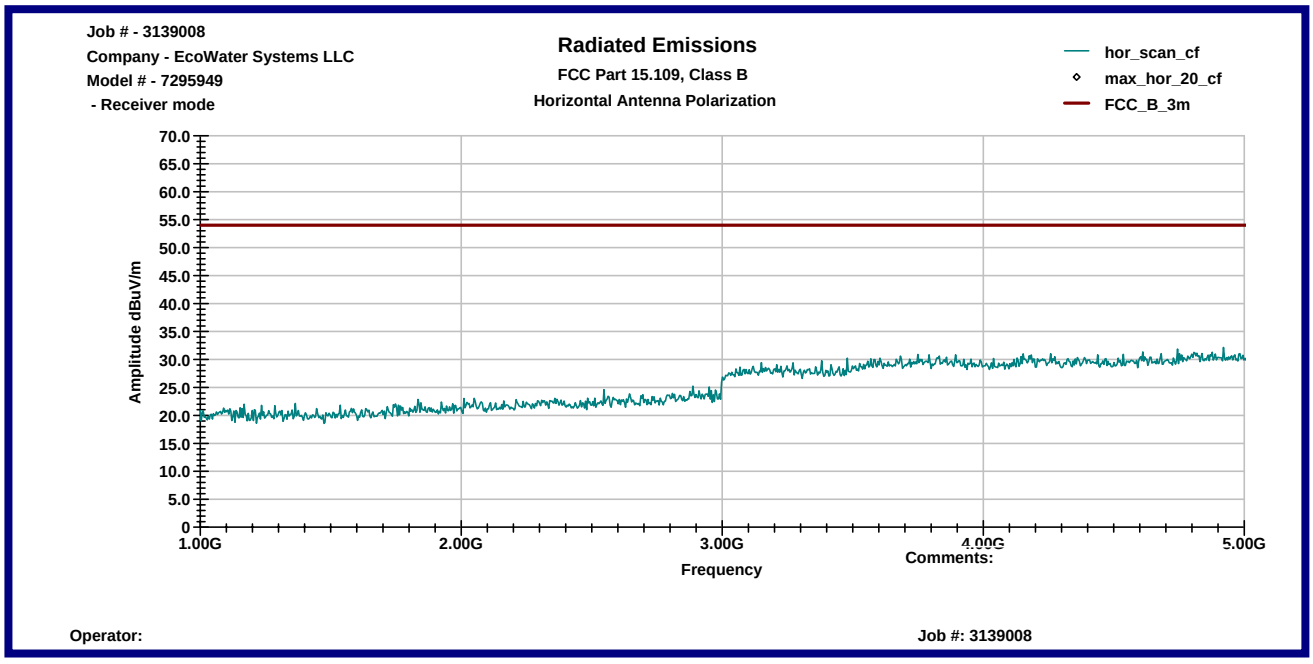


Graph 3.5.2

Vertical antenna polarization



Horizontal antenna polarization



3.6 Digital device conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	08/23/2008	☒
Spectrum Analyzer	R & S	ESCI	100358	04/27/2008	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	07/30/2008	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2630	09/07/2008	☐
Horn Antenna	EMCO	3115	9507-4513	01/09/2008	☒
Horn Antenna	EMCO	3115	6579	03/06/2008	☐
Waveguide Horn Antenna	EMCO	3116	9904-2423	07/20/2008	☐
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	04/24/2008	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	11/05/2008	☐
Pre-Amplifier	MITEQ	AMF-6F-26004000-40-8P	13224444	11/05/2008	☐
Pre-Amplifier	HP	8447F OPT H64	3113A04974	03/07/2008	☐
System	TILE! Instrument Control		Ver. 3.4.K.29	VBU	☒