



TEST REPORT

Report Number: 101011128MIN-001
Project Number: G101011128

Testing performed on the
RM2510, Class II Permissive Changes
FCC ID: LW2RM2510
Industry Canada ID: 2731A-RM2510

to
47 CFR Part 15. 247:2010
RSS- 210, Issue 8, 2010

For
Rosemount Inc./Therm-O-Disc Inc.

Test Performed by:
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Oakdale, MN 55128 USA

Test Authorized by:
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Date: February 12, 2013

Reviewed by: Uri Spector
Uri Spector

Date: February 12, 2013

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1.0 GENERAL DESCRIPTION

Model:	RM2510
Type of EUT:	2.4GHz Wireless HART Radio Module
Intertek Sample ID:	MIN1301310822-002
FCC ID:	LW2RM2510
Industry Canada ID:	2731A-RM2510
Related Submittal(s) Grants:	Class II Permissive Changes
Company:	Therm-O-Disc
Customer:	Mr. Tuong Nguyen
Address:	1320 South Main Street Mansfield, OH 44907 USA
Phone:	(419) 525-8382
Fax:	419) 525-8365
e-mail:	Tuong.Nguyen@Emerson.com
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15:2010, §15.247 <input checked="" type="checkbox"/> RSS-210, Issue 8, 2010 <input checked="" type="checkbox"/> RSS-Gen, Issue 3, 2010 <input type="checkbox"/> 47 CFR, Part 15:2010, §15.107 and §15.109, Class <input type="checkbox"/> ICES-003, Issue 4:2004 <input type="checkbox"/> Other
Type of radio:	<input type="checkbox"/> Stand -alone <input checked="" type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	January 29, 2013
Test Work Started:	January 29, 2013
Test Work Completed:	February 6, 2013
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



1.1 Product Description; Test Facility

Product Description:	2.4 – 2.4835GHz Transceiver
Transmitter Type:	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> Digital Modulation <input type="checkbox"/> WiFi <input type="checkbox"/> Blue Tooth
Operating Frequency Range(s):	From 2400 to 2483.5 MHz
Number of Channels:	16 (from channel 0 to 15)
Modulation:	QPSK
Emission Designator:	1M37G7D
Antenna(s) Info:	Type: Internal PCB antenna Gain: 2 dBi <input checked="" type="checkbox"/> RF connector provided
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter power configuration:	<input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source <input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input checked="" type="checkbox"/> 3.0 VDC <input type="checkbox"/> Other: <input type="text"/> <input type="text"/> Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
Special Test Arrangement:	N/A
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009 and FCC DTS Measurement Guide



1.2 EUT Configuration

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

- Standby
- Continuous transmissions (modulated signal)
- Continuous transmissions (un-modulated signal)
- Continuous receiving
- Test program (customer specific)
- [REDACTED]

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel, middle channel, and upper channel

Cables:

No.	Type	Length	Designation	Note
1	Unshielded	<3m	Ethernet	

Support equipment/Services:

No.	Item	Description
1	Laptop PC	

General Note: The EUT is modified from the original certification using a different antenna. Therefore, the Maximum Output and Spurious Radiated Emissions were measured. RF exposure was calculated to reflect a new antenna.

1.3 Environmental conditions

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

Normal

Temperature:	+15 to +35 ° C
Humidity:	20-75 %
Atmospheric pressure:	86-106 kPa

Extreme

<input type="checkbox"/> Temperature:	-20 to +50 ° C
<input type="checkbox"/> Supply voltage:	85% to +115%

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated measurements has been determined to be:

± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted measurements at antenna terminal has been determined to be:

± 1.0 dB

The expanded uncertainty ($k = 2$) for line conducted measurements 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(μ V/m)

RA = Receiver Amplitude in dB(μ V)

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(μ V) 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(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

General notes:



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
15.247(b), (c) / RSS-210 A8.4	Maximum peak output power	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

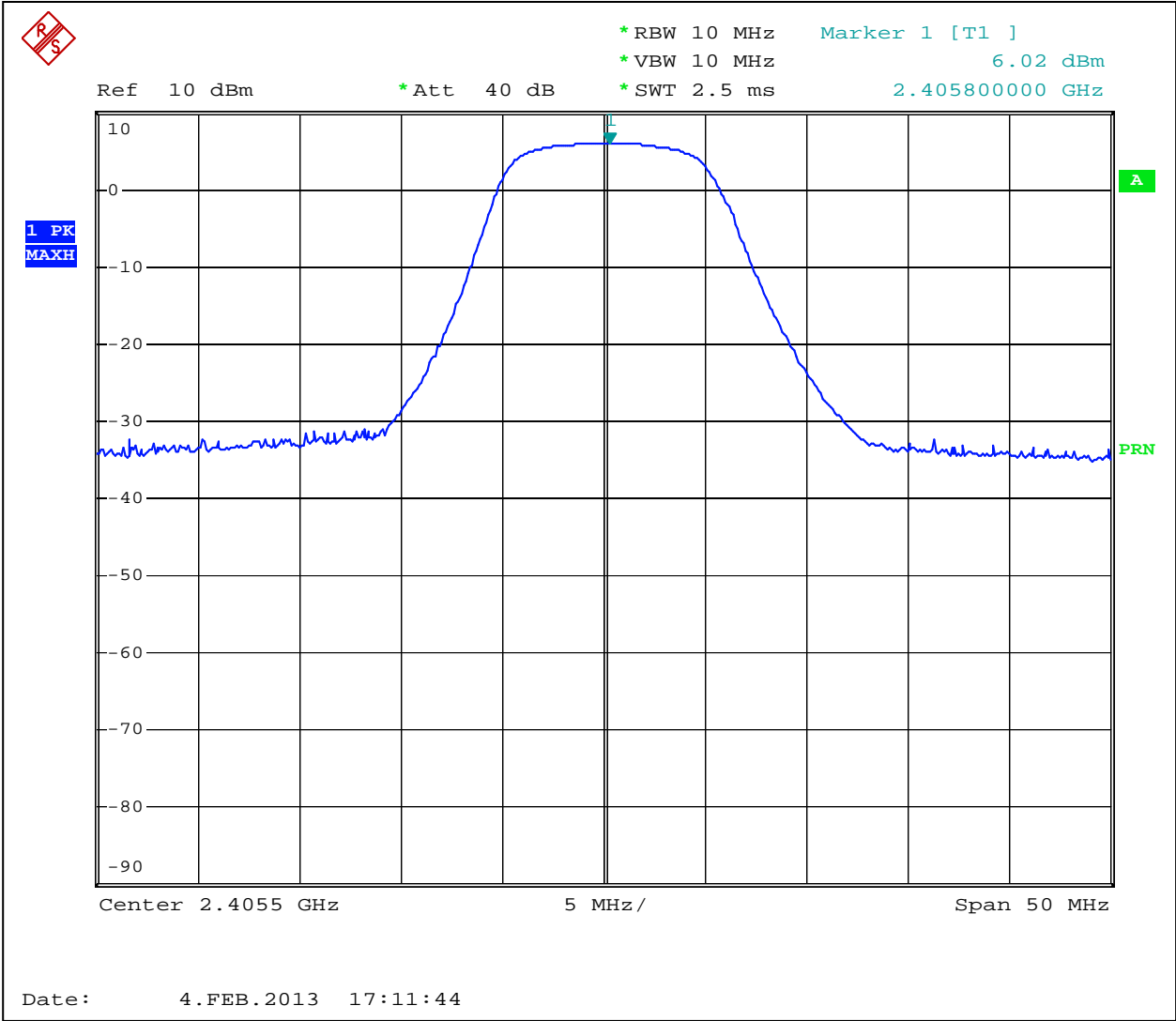
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

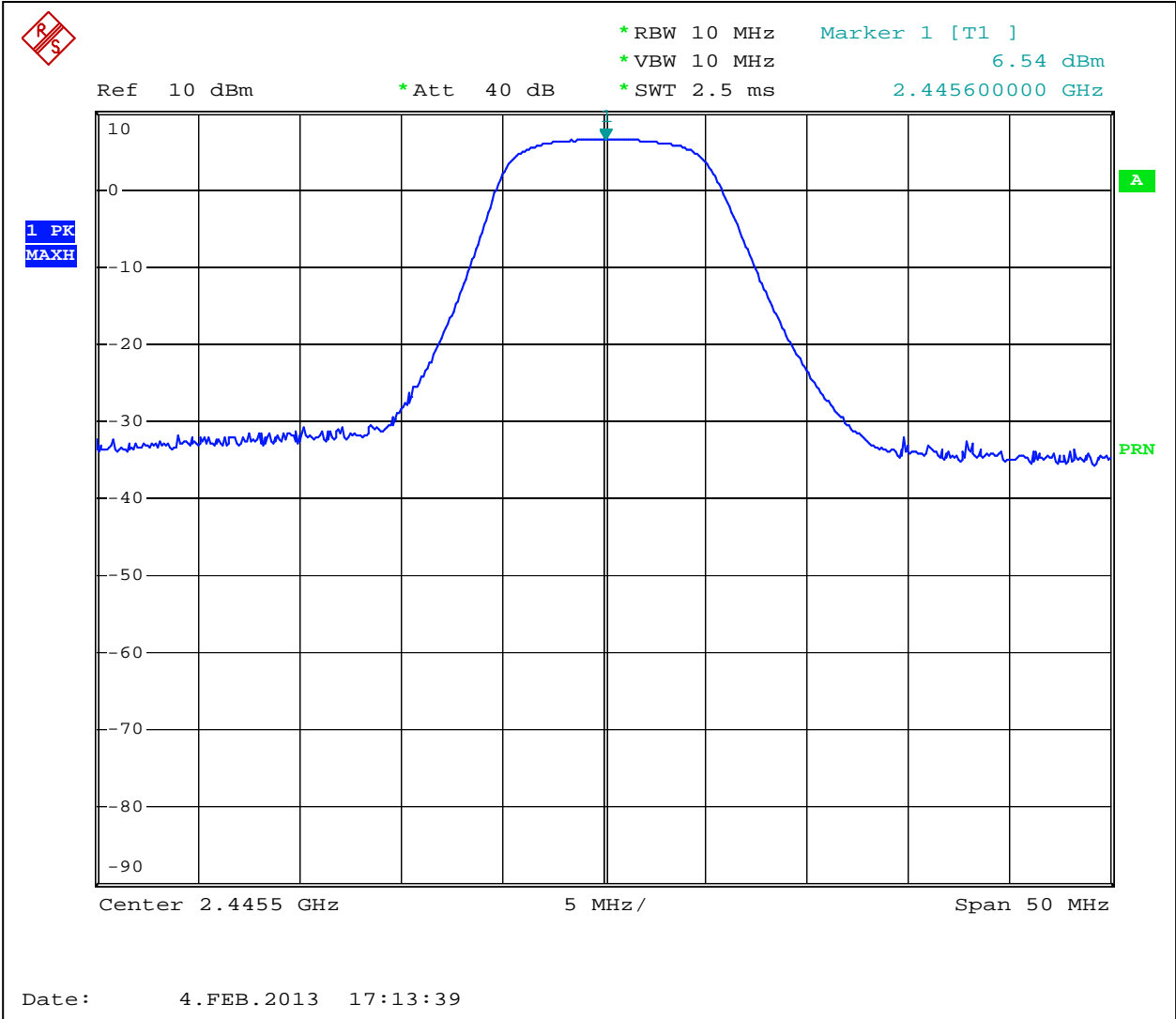
Max. Margin: 22.16dB below the limits

Power Output:	Conducted					
Frequency Range:	<input type="checkbox"/> 902-928MHz		<input checked="" type="checkbox"/> 2400-2483.5MHz		<input type="checkbox"/> 5725-5850MHz	
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2405	6.02	1.30	7.32	30	0	-22.68
Middle Frequency MHz						
2445	6.54	1.30	7.84	30	0	-22.16
Upper Frequency MHz						
2480	5.81	1.30	7.11	30	0	-22.89
RBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
VBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
Antenna Gain:	<input checked="" type="checkbox"/> < 6dBi <input type="checkbox"/> >6dBi and = dBi, Output power reduction = dB					

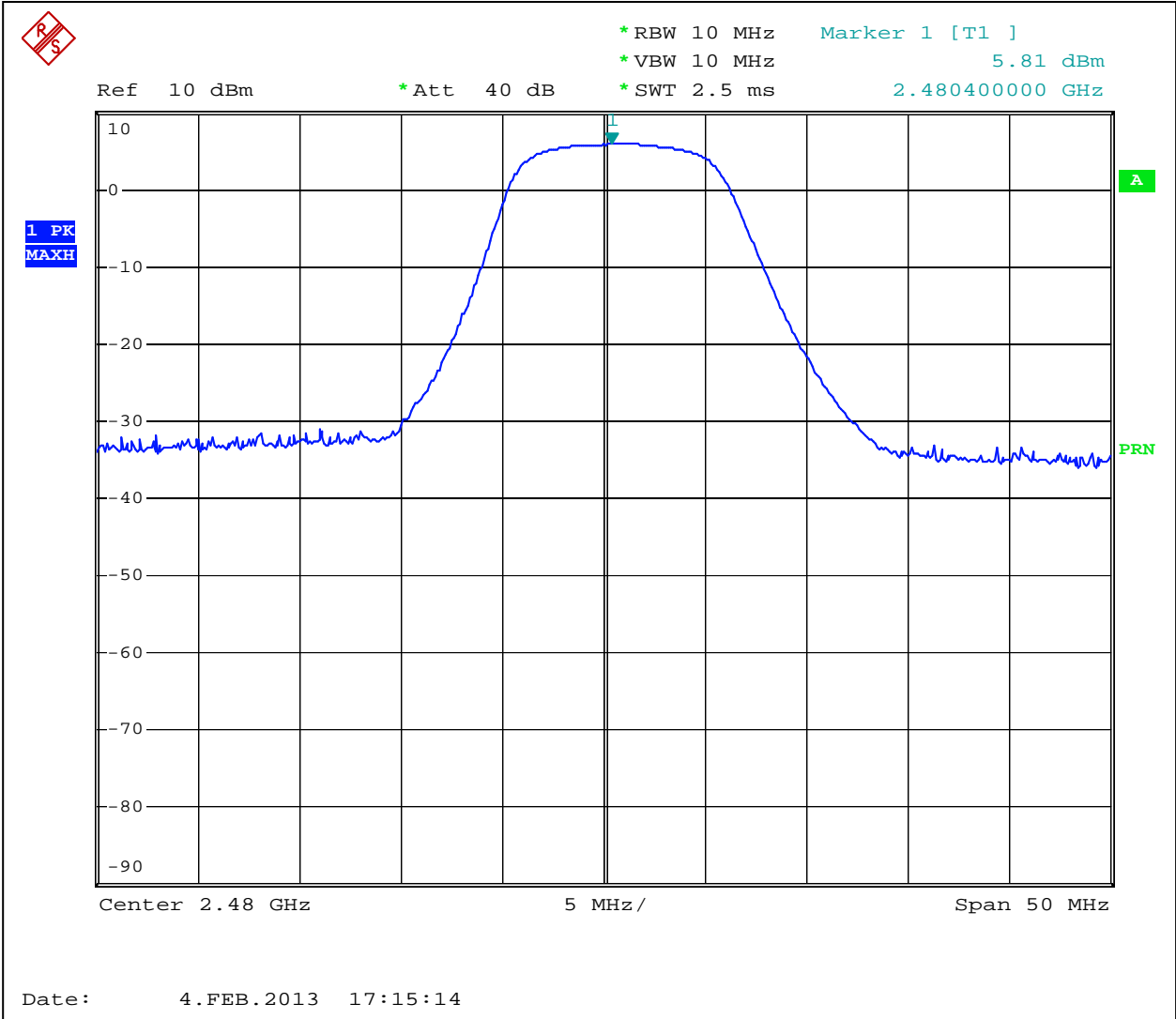
Notes:



Graph 3.1.1



Graph 3.1.2



Graph 3.1.3



3.2 Radiated spurious emissions

Test location: OATS Anechoic Chamber Other

Test distance: 10 meters 3 meters

Frequency Range: 30MHz to 25GHz (10th Harmonic)

Test result: **Pass**

Max. Margin: 21.1dB below the limits

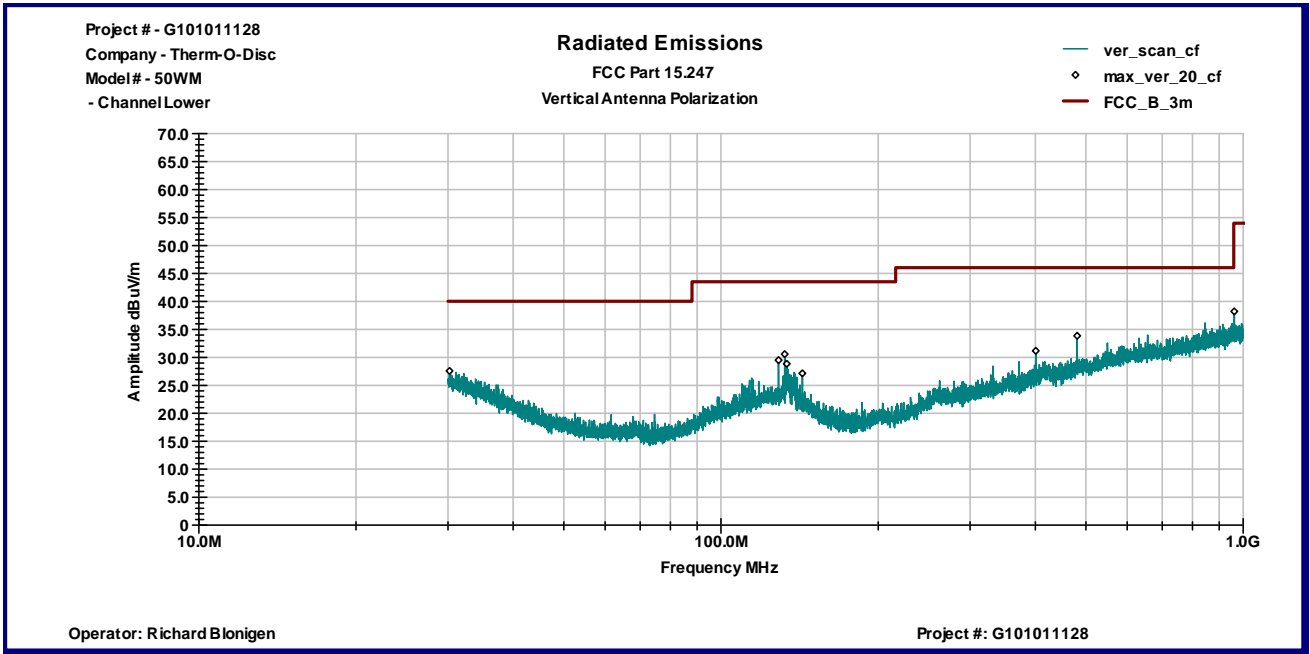
- Notes:**
1. The table 3.2.1 shows radiated spurious of the 2nd, 3rd, and 4th harmonics in the restricted band of operation per FCC 15.205
 2. The fundamental frequency and emissions unrelated to transmitter were omitted from table.
 3. No emissions were detected above ambient above 4th harmonic.
 4. The detected peak emissions were below 74dB μ V/m as shown in graphs 3.2.13–3.2.18
-



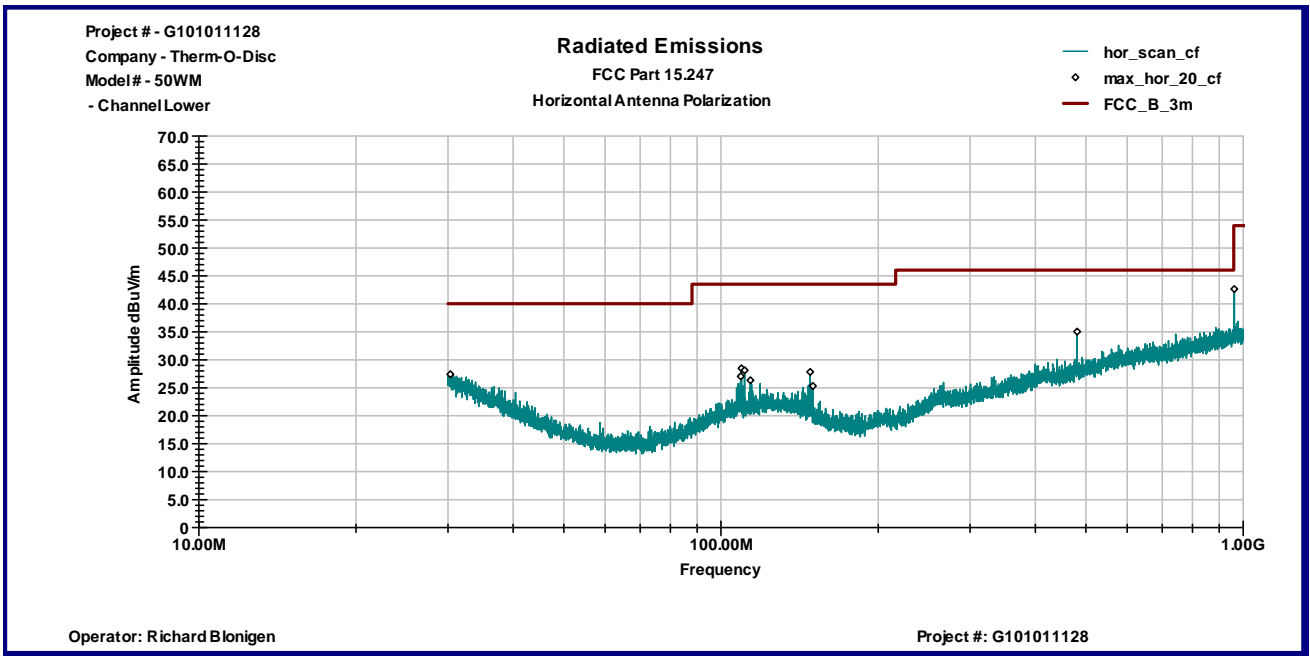
Date:	January 30 – February 6, 2013	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Richard Blonigen	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.2.1

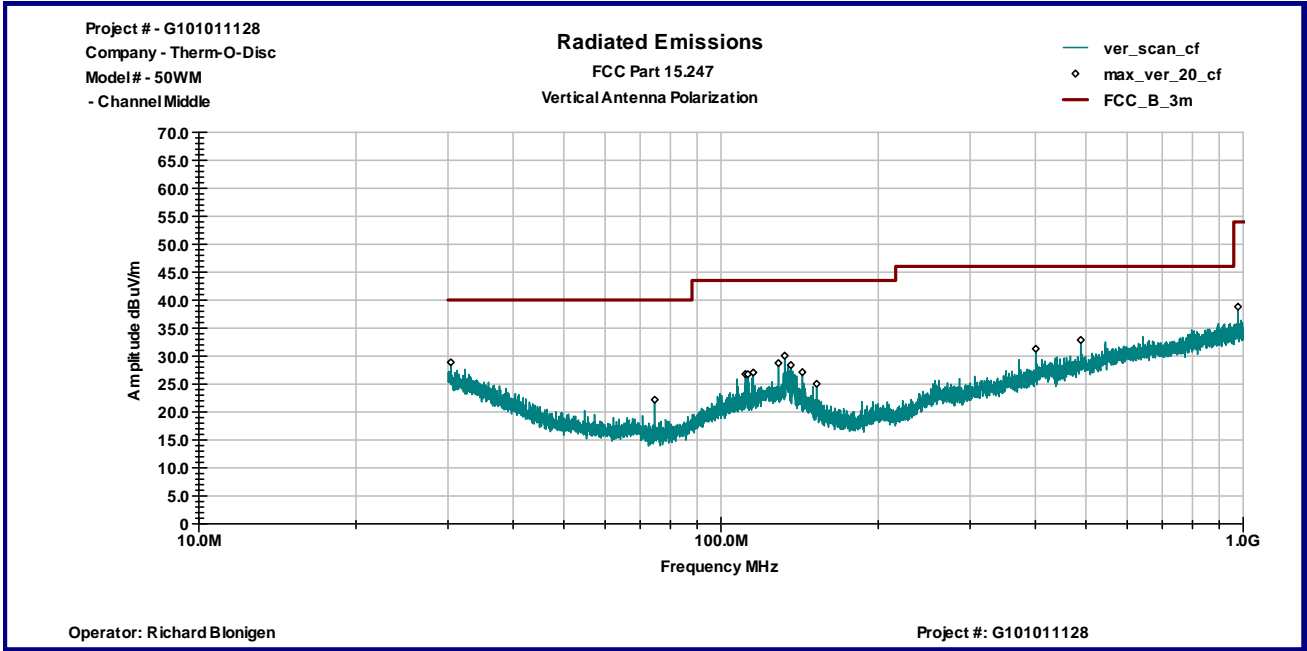
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	AVG Reading dBµV	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Channel Lower										
4801.00	V	152	33.0	4.1	39.2	28.9	26.8	54.0	-27.1	
7217.00	V	187	35.7	4.9	38.2	27.9	30.4	54.0	-23.6	
9618.00	V	165	38.0	5.8	37.1	24.3	31.0	54.0	-23.0	
4801.00	H	140	33.0	4.1	39.2	29.2	27.1	54.0	-26.8	
7217.00	H	196	35.7	4.9	38.2	28.1	30.6	54.0	-23.4	
9618.00	H	201	38.0	5.8	37.1	24.4	31.1	54.0	-22.9	
Channel Middle										
4889.00	V	178	33.1	4.2	39.1	29.1	27.3	54.0	-26.7	
7335.00	V	186	36.1	5.0	38.1	28.1	31.0	54.0	-22.9	
9779.00	V	196	38.2	5.9	37.1	24.5	31.5	54.0	-22.5	
4889.00	H	189	33.1	4.2	39.1	29.5	27.7	54.0	-26.3	
7335.00	H	128	36.1	5.0	38.1	28.5	31.4	54.0	-22.5	
9779.00	H	166	38.2	5.9	37.1	24.6	31.6	54.0	-22.4	
Channel Upper										
4960.00	V	160	33.1	4.2	39.0	25.5	23.8	54.0	-30.1	
7440.00	V	210	36.3	5.0	38.0	28.7	32.1	54.0	-21.9	
9920.00	V	180	38.3	5.9	37.0	24.9	32.1	54.0	-21.9	
4960.00	H	215	33.1	4.2	39.0	30.5	28.8	54.0	-25.1	
7440.00	H	170	36.3	5.0	38.0	29.5	32.9	54.0	-21.1	
9920.00	H	149	38.3	5.9	37.0	24.1	31.3	54.0	-22.7	



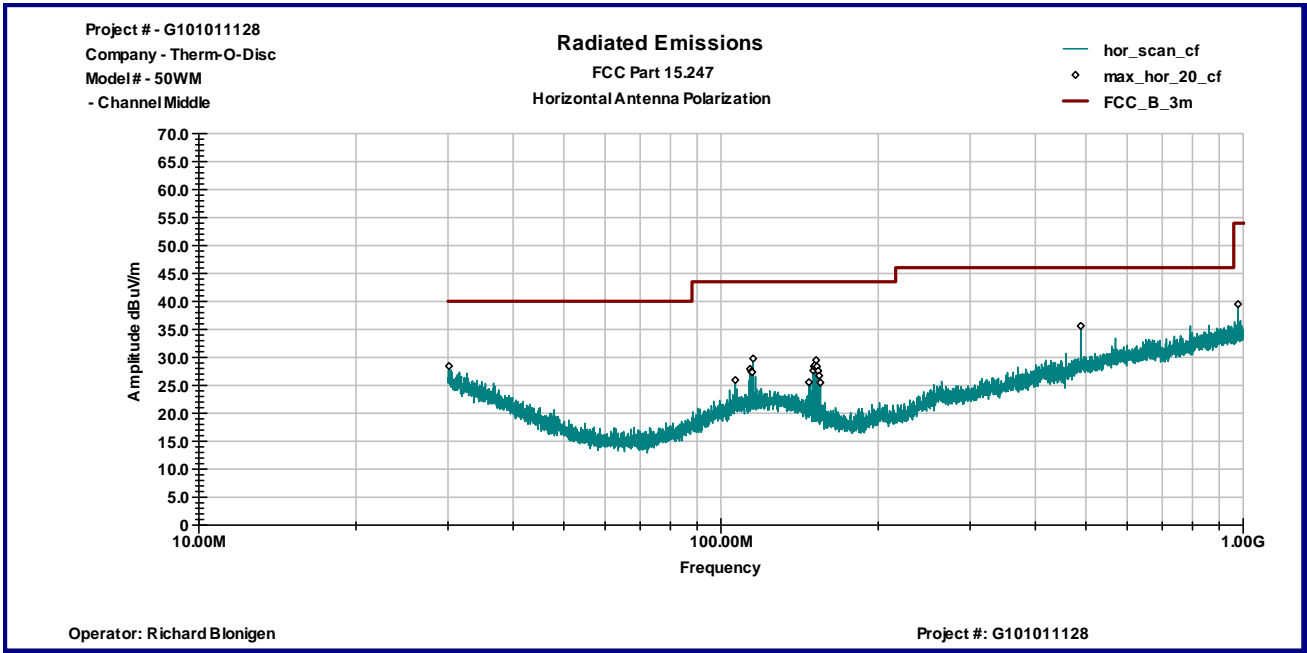
Graph 3.2.1



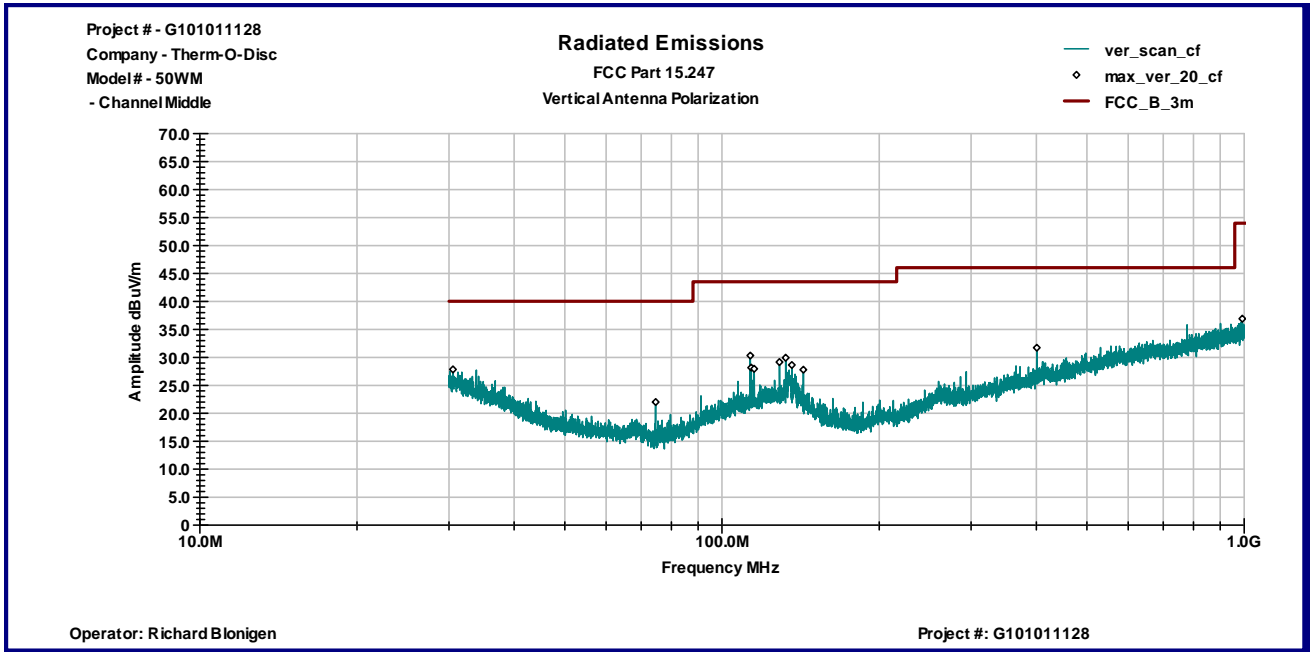
Graph 3.2.2



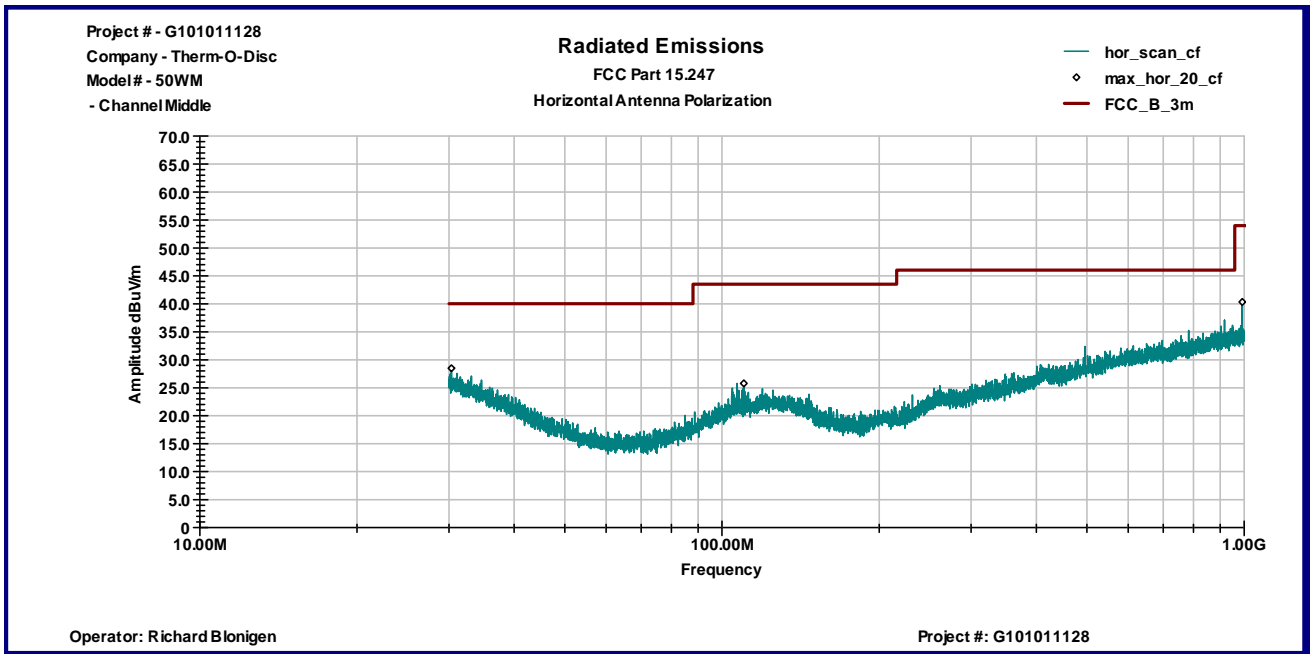
Graph 3.2.3



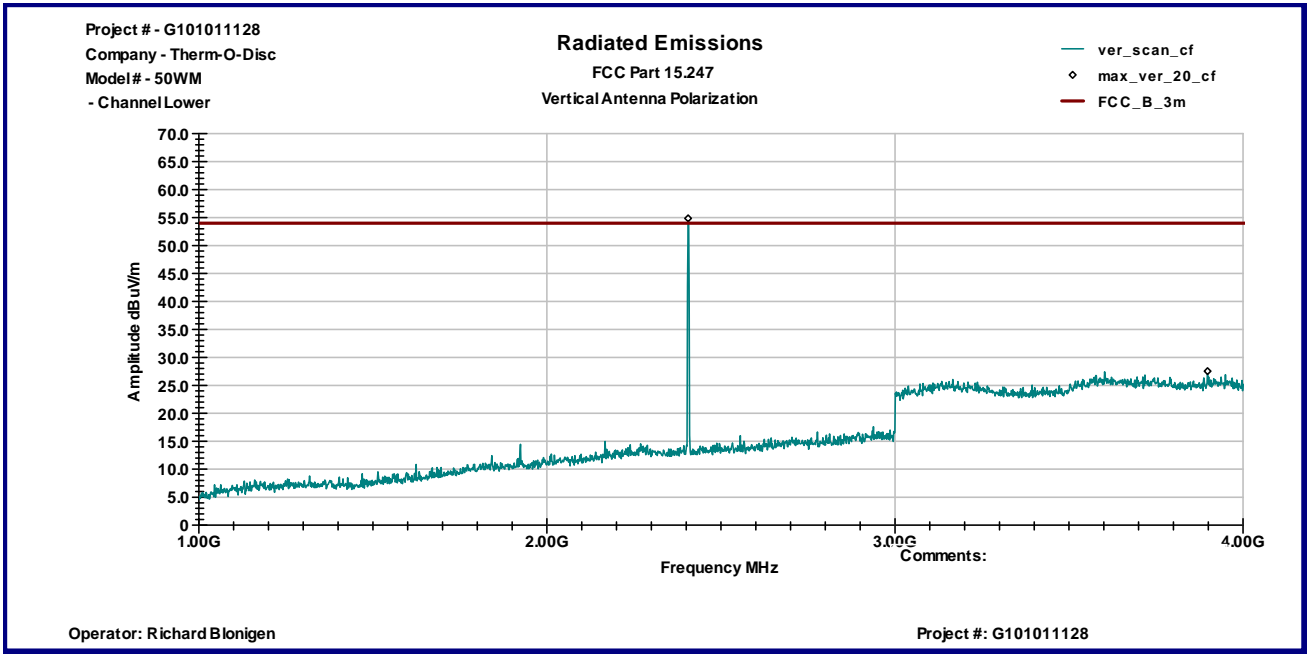
Graph 3.2.4



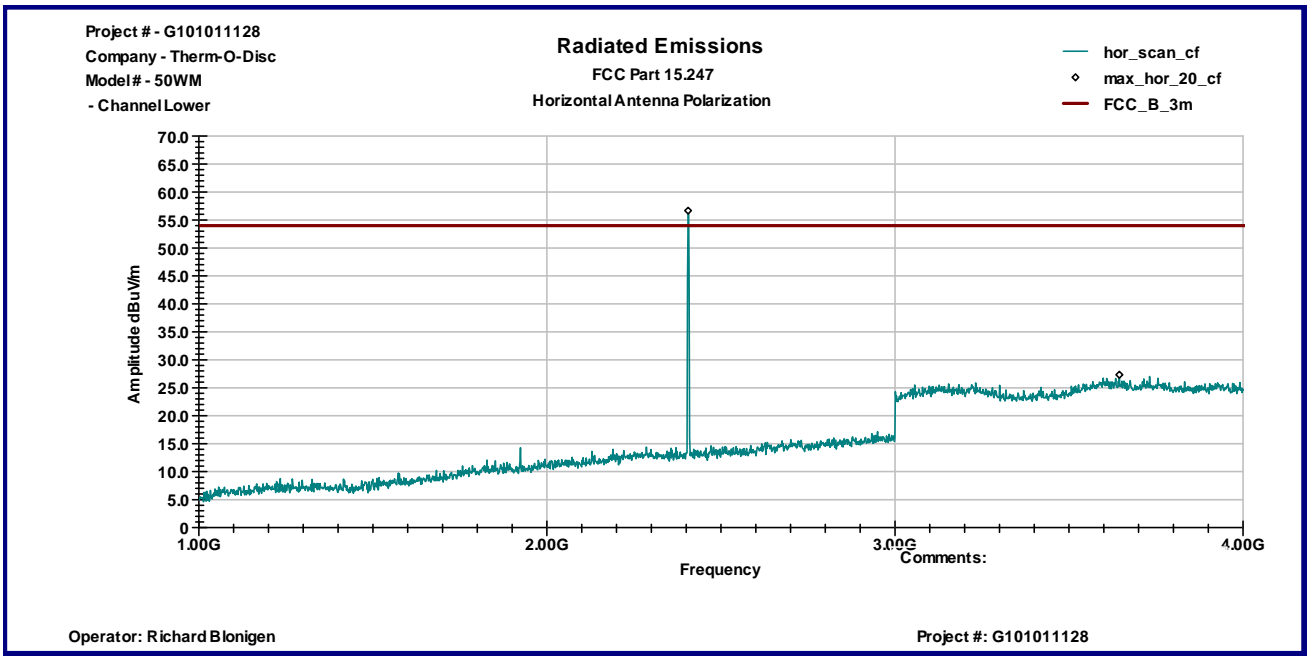
Graph 3.2.5



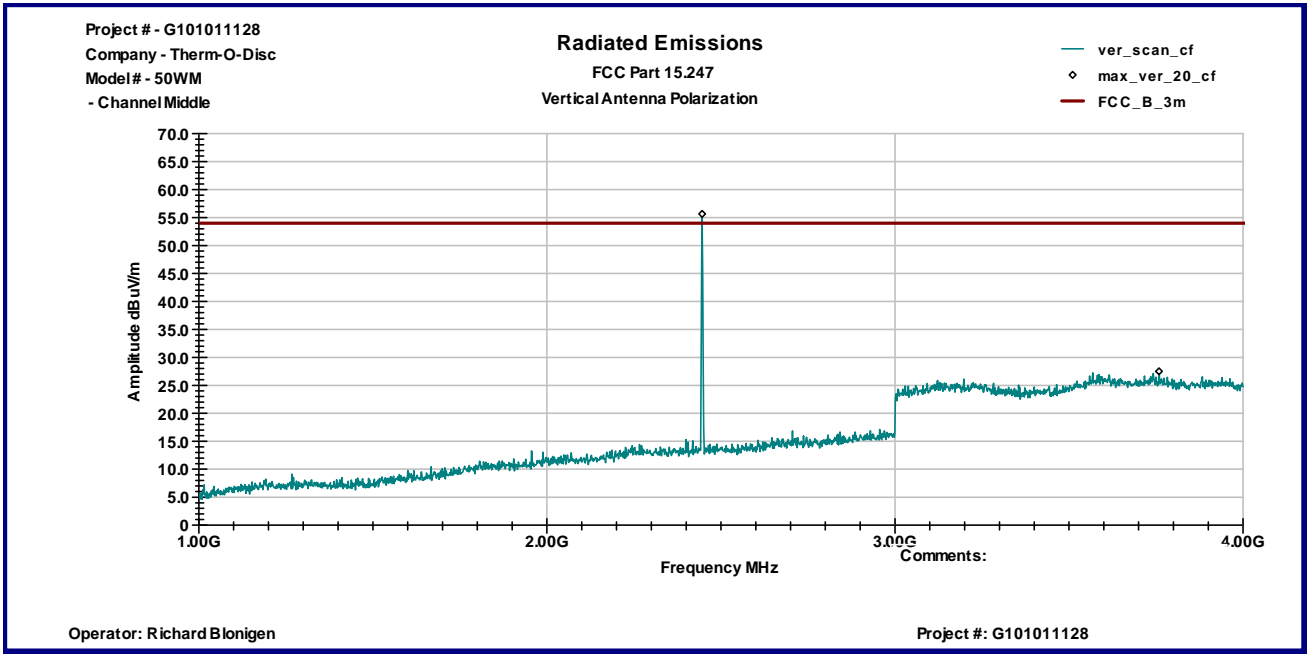
Graph 3.2.6



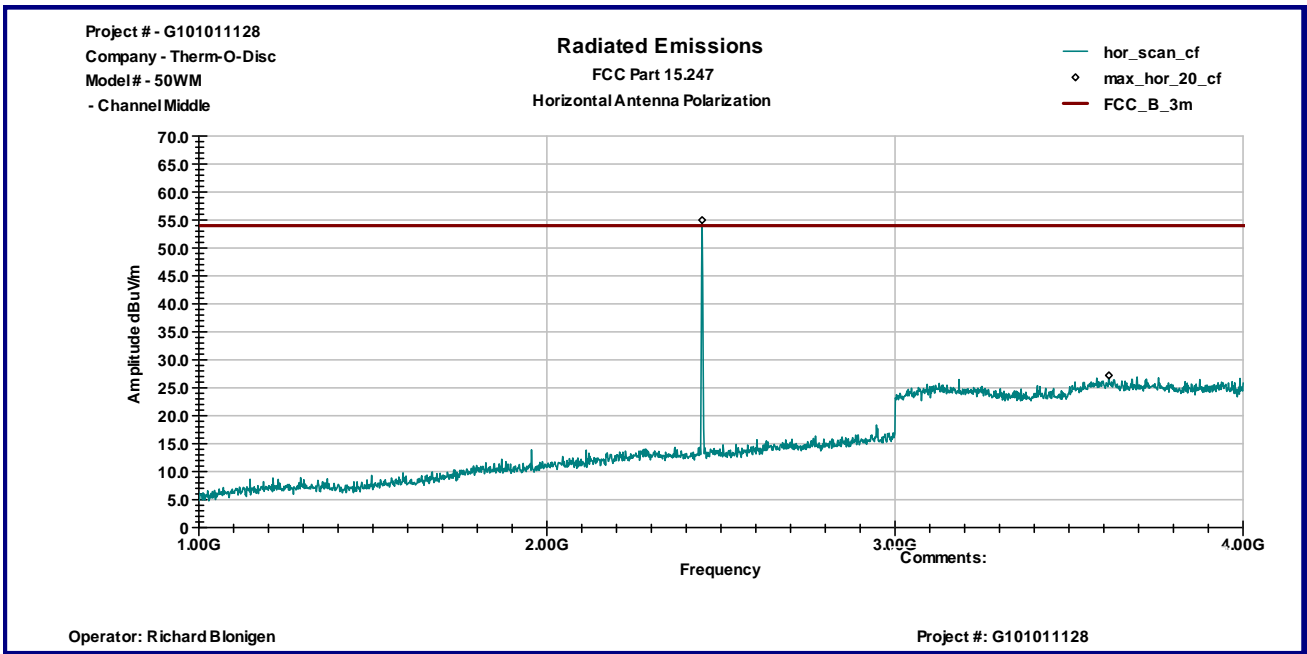
Graph 3.2.7



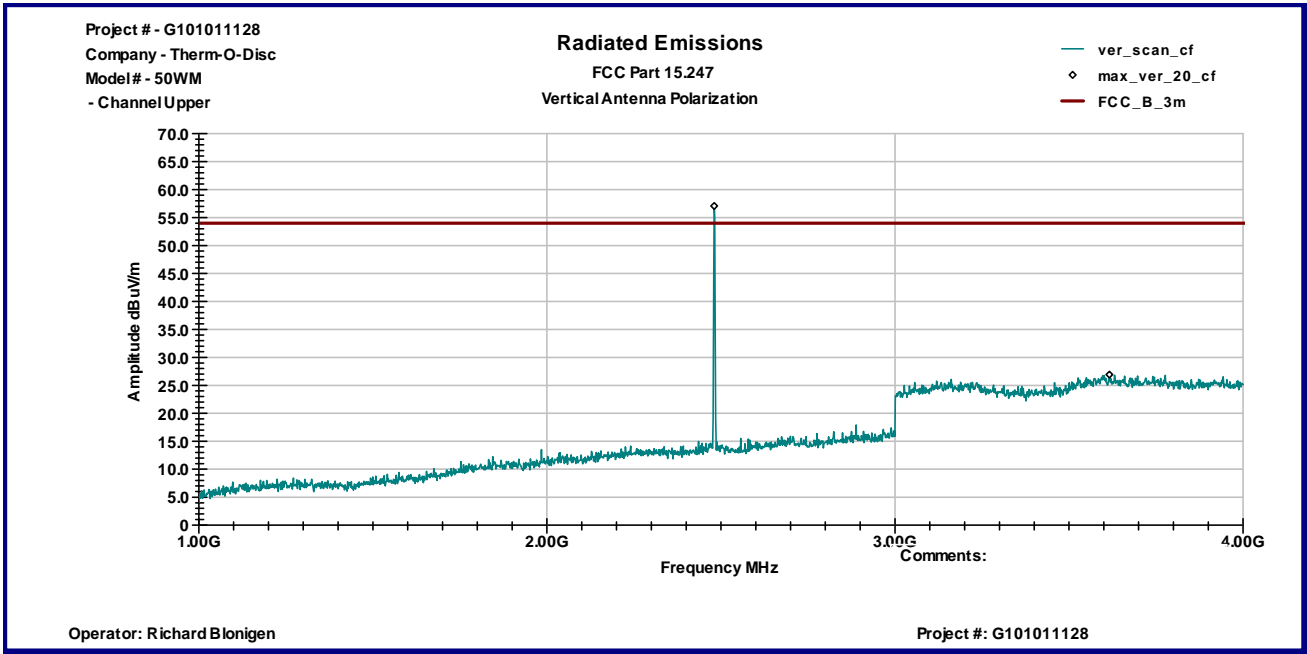
Graph 3.2.8



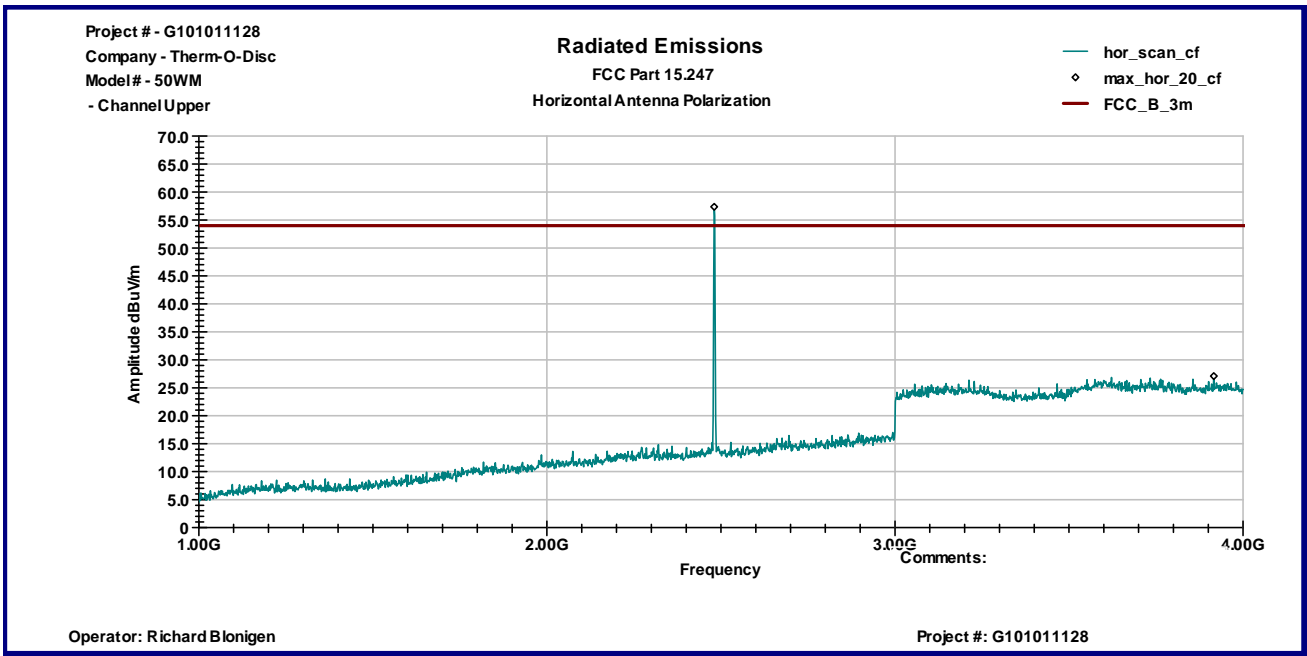
Graph 3.2.9



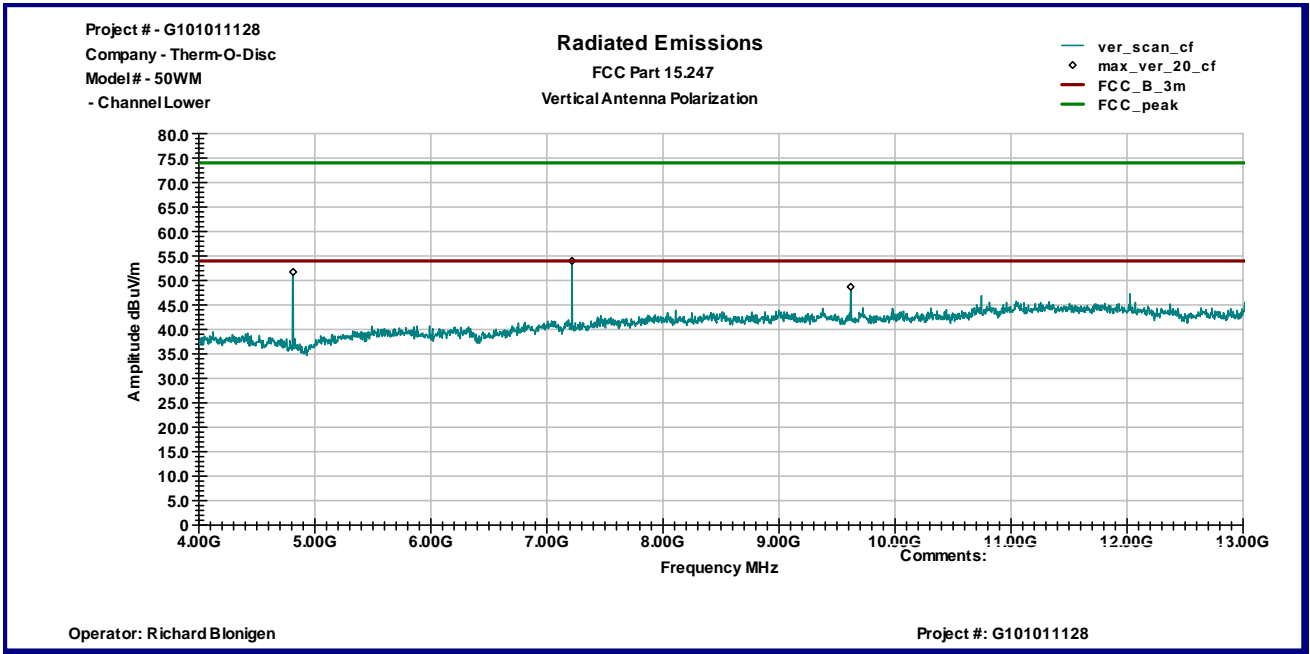
Graph 3.2.10



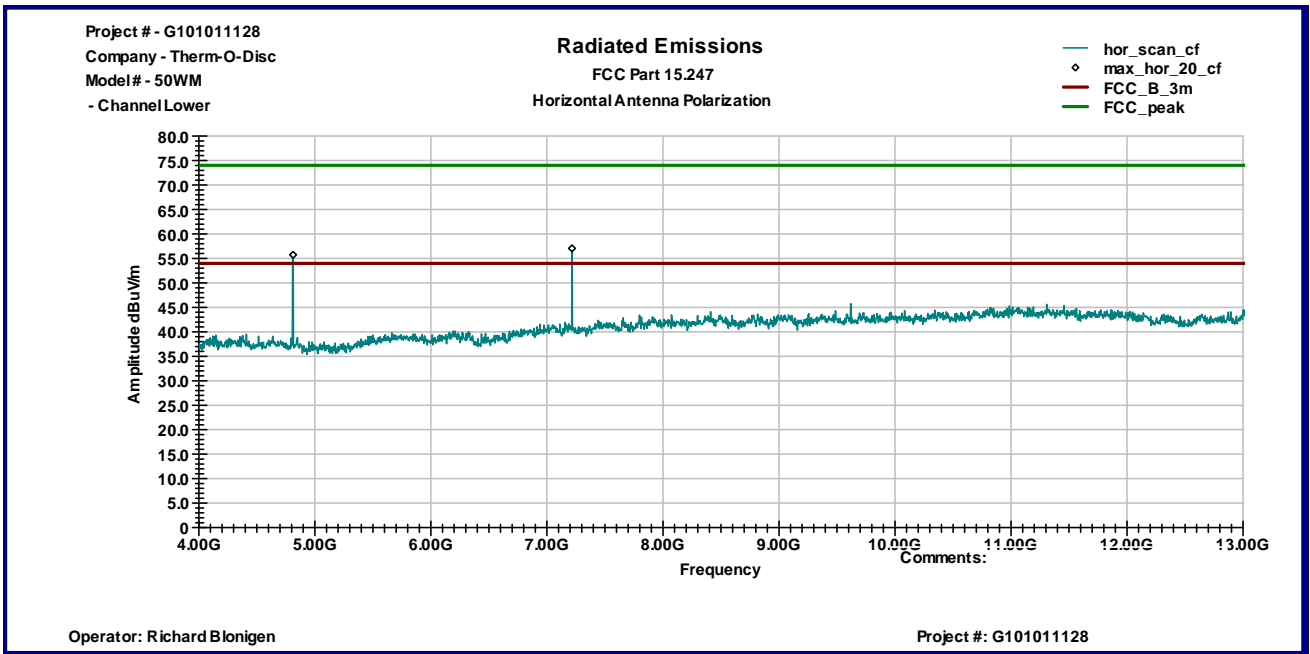
Graph 3.2.11



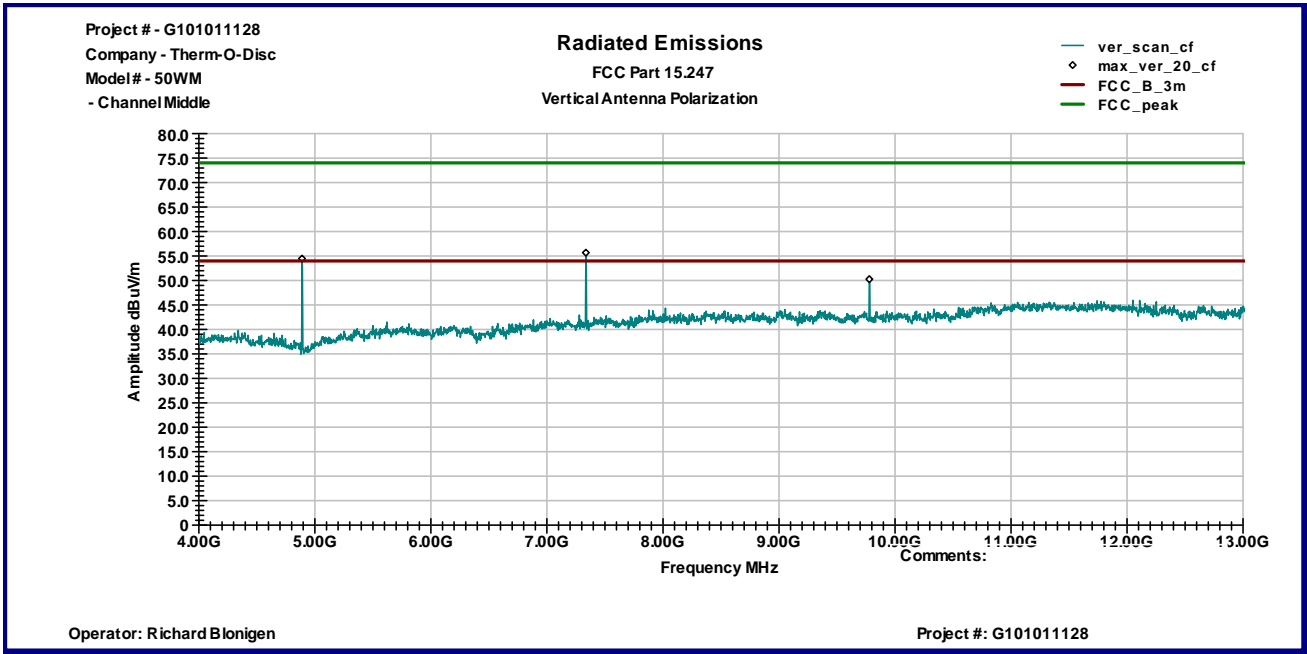
Graph 3.2.12



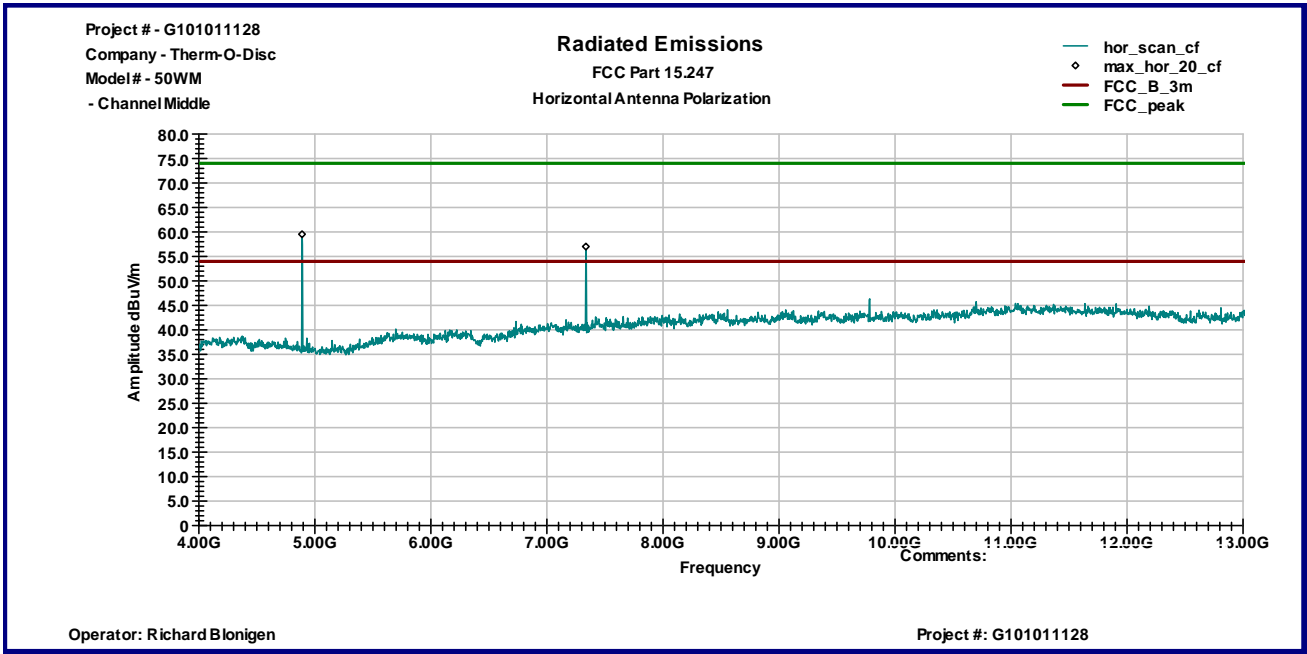
Graph 3.2.13



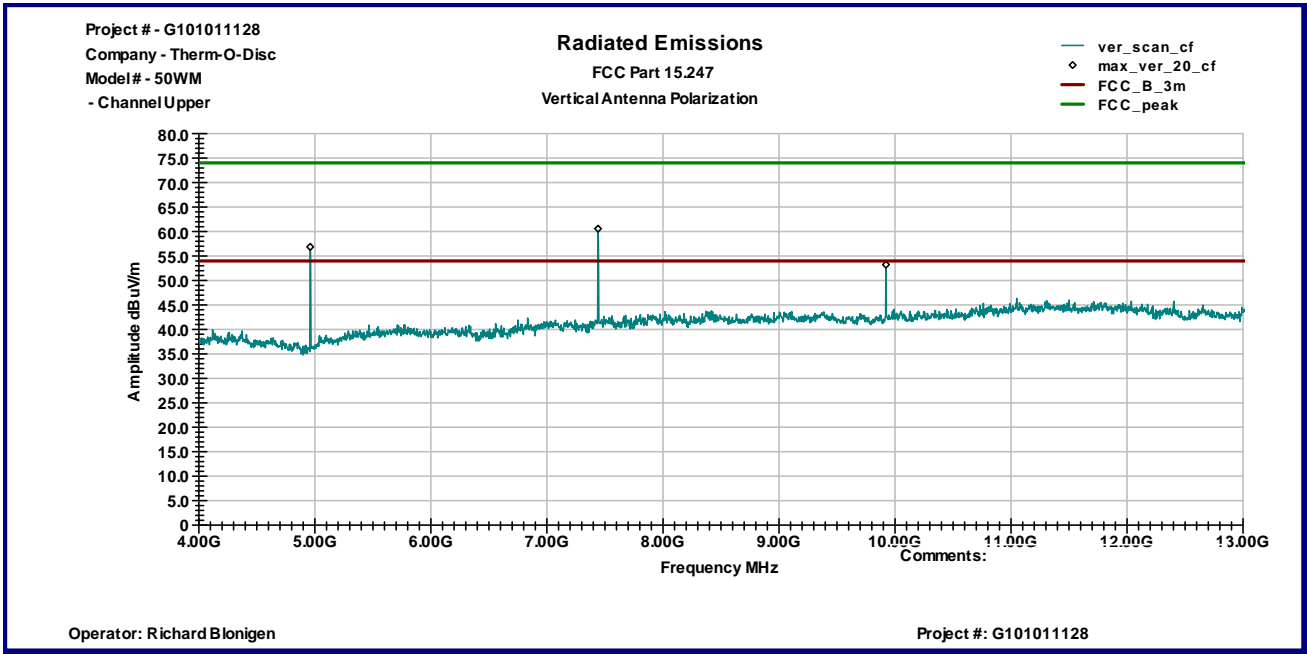
Graph 3.2.14



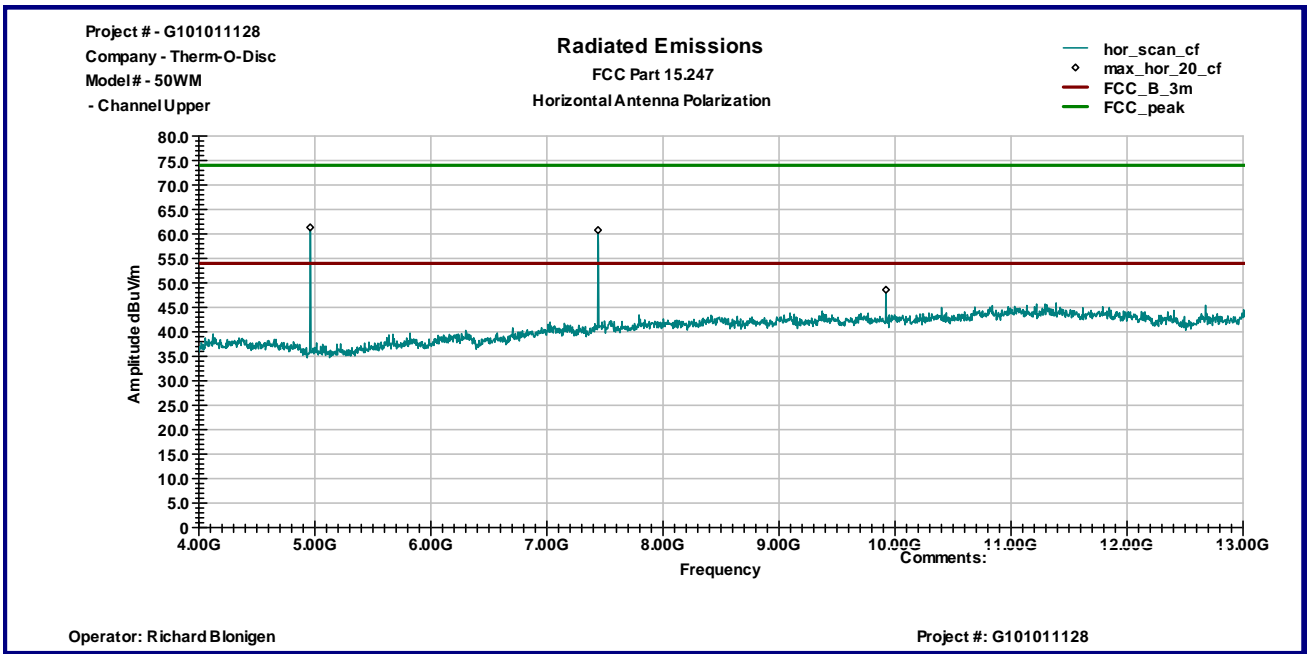
Graph 3.2.15



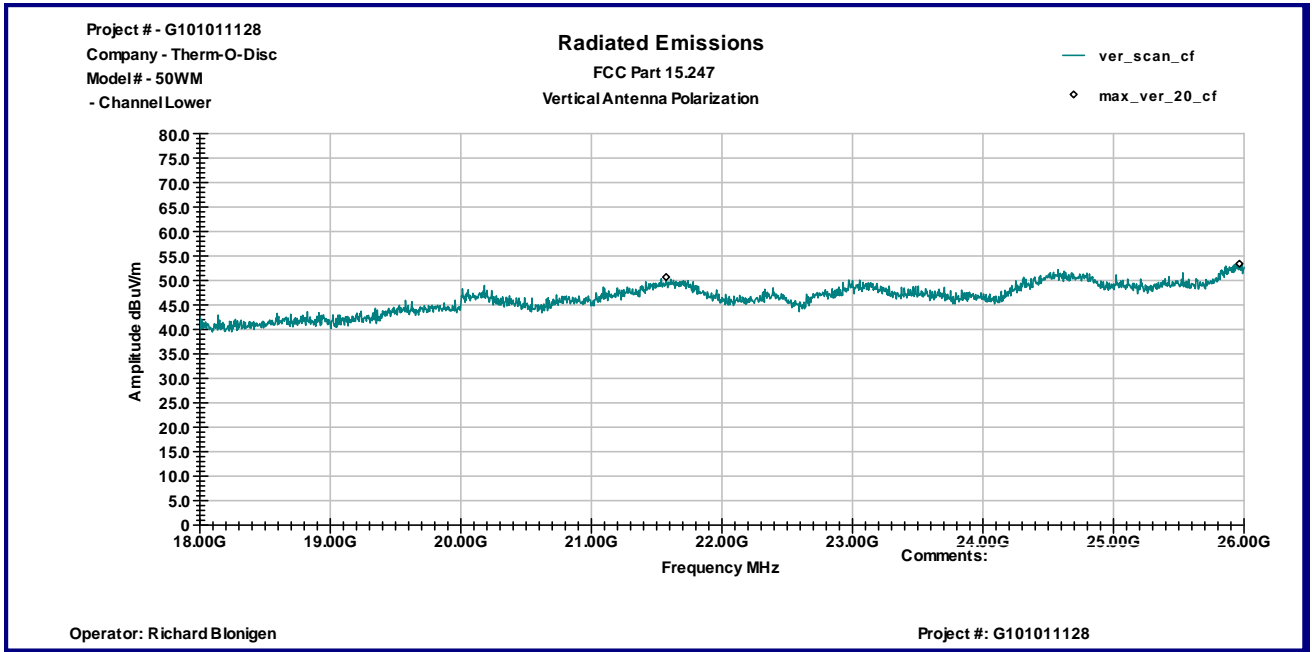
Graph 3.2.16



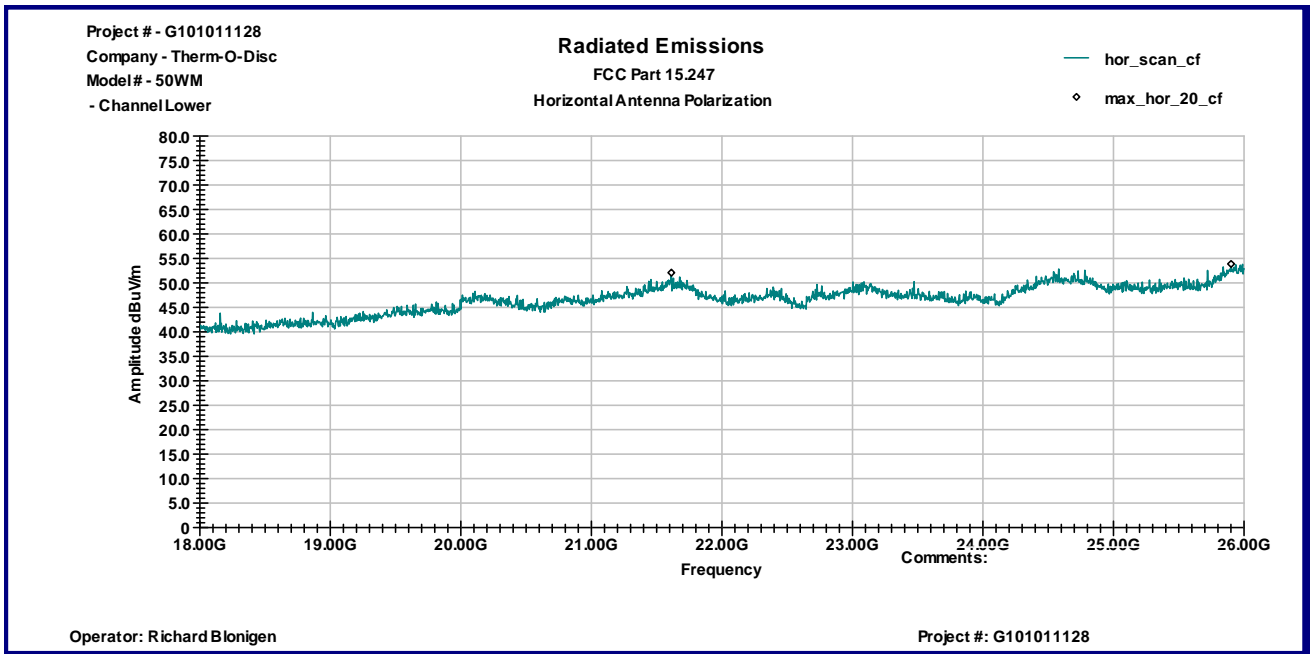
Graph 3.2.17



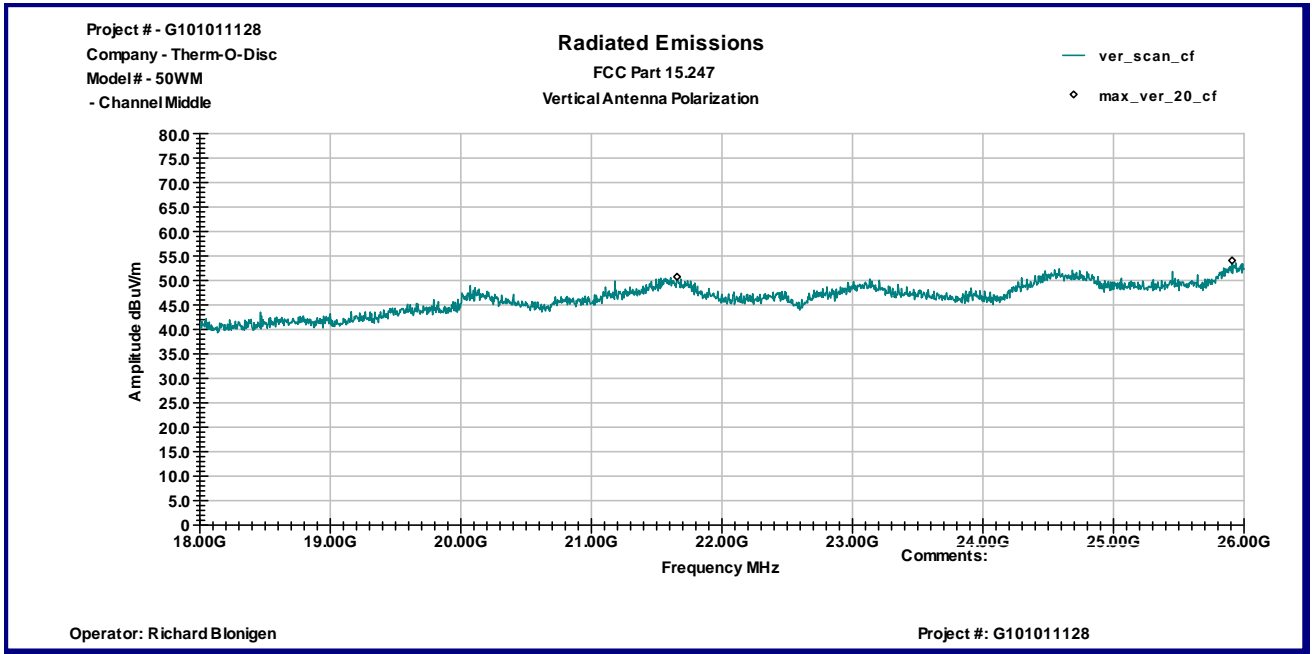
Graph 3.2.18



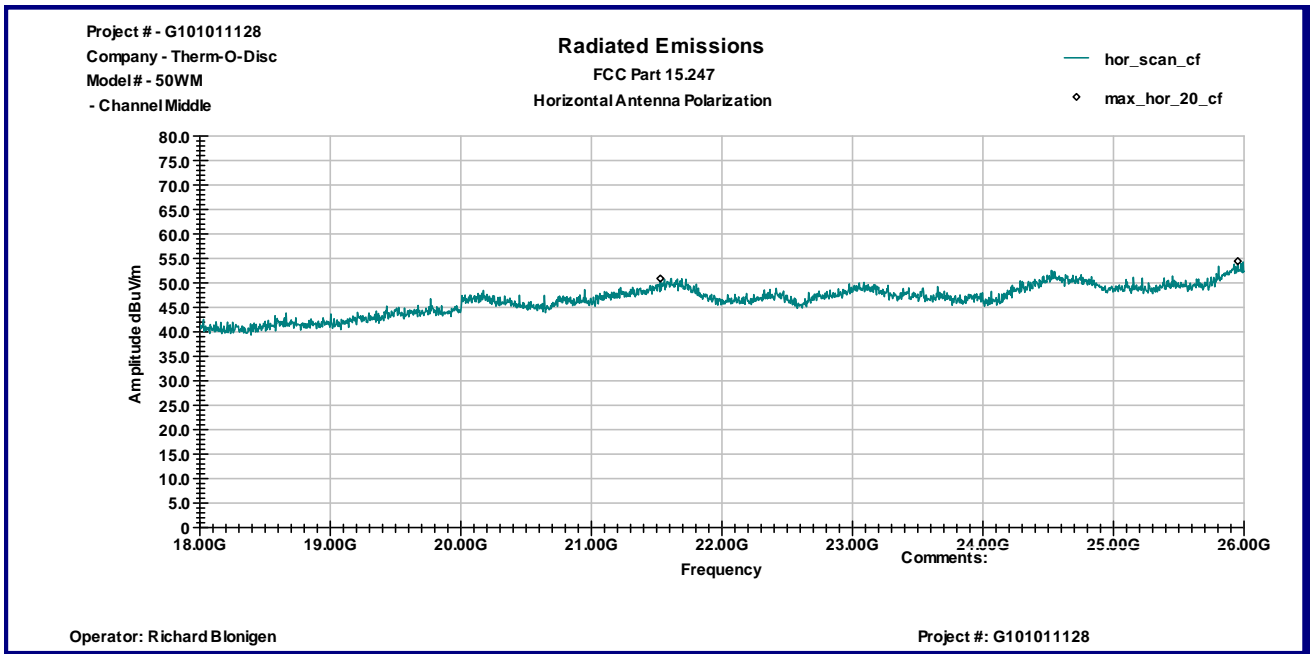
Graph 3.2.19



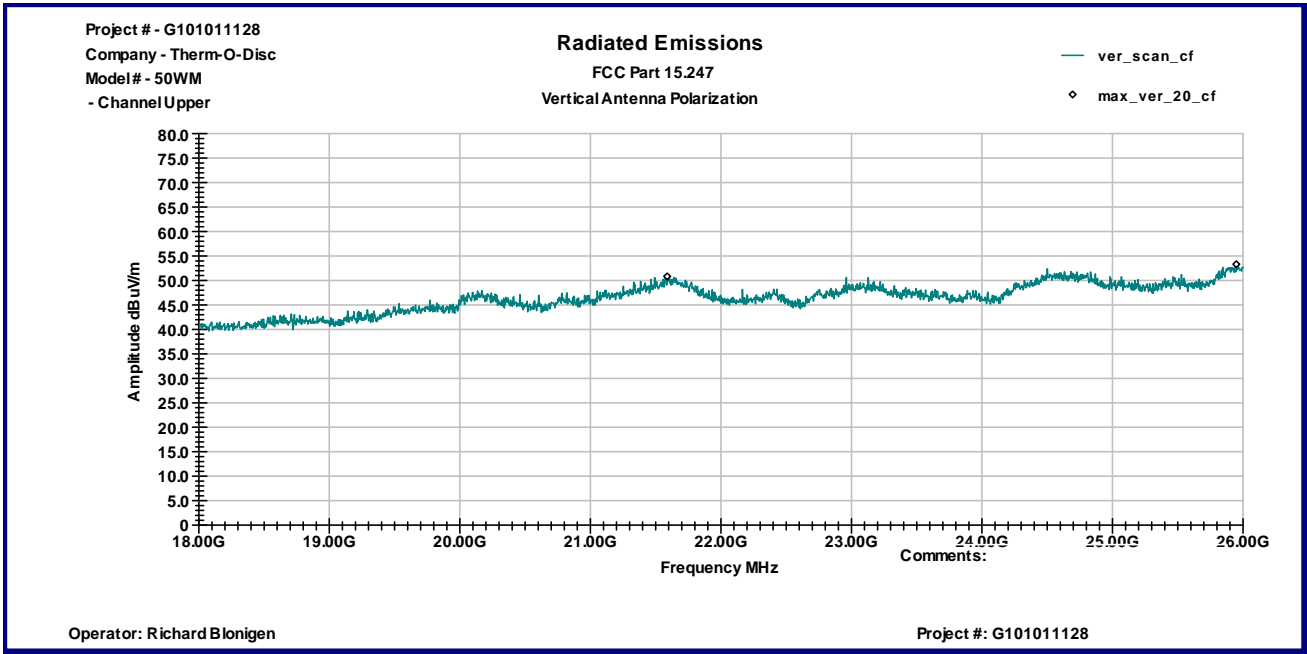
Graph 3.2.20



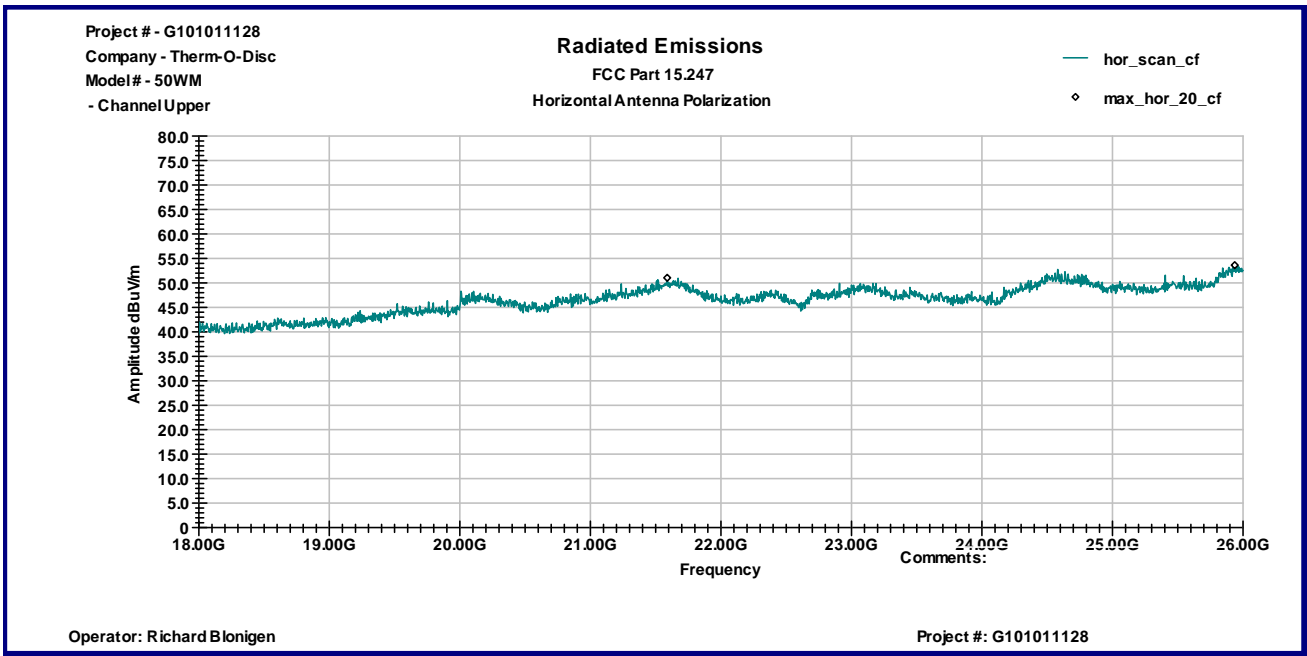
Graph 3.2.21



Graph 3.2.22



Graph 3.2.23



Graph 3.2.24



3.3 RF Exposure Compliance

The maximum measured antenna conducted power, P is 7.84dBm

The antenna gain, G is 2dBi

The maximum EIRP power = P + G
ERP = 7.84 + 2 = 9.84dBm, or 0.01W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is 1mW/cm², or 10W/m²

S = 10W/m²

The Power Density is related to EIRP with the equation:
S = EIRP / 4πD², or 10 = 0.01 / 4πD²,

The minimum safe separation distance, D = 0.89cm, which is below 20cm, or
RF Exposure at 20cm distance is 0.000002W/m²



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/09/2013	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	05/16/2013	<input checked="" type="checkbox"/>
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/07/2013	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/01/2013	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/01/2013	<input checked="" type="checkbox"/>
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	<input checked="" type="checkbox"/>