FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

Sonicaid Freedom SF1-SL

MODEL NUMBER: SF1-SL

FCC ID: 2ABOQ-SF1SL
IC: 11744A-SF1SL

REPORT NUMBER: 7554936A

ISSUE DATE: April 17, 2014

Prepared for
Huntleigh Diagnostics
35 Portmanmoor Road
Cardiff
CF24 5HN, United Kingdom

Prepared by
UL VERIFICATION SERVICES INC.
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NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	April 17, 2014	Initial Issue	BM

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UL VERIFICATION SERVICES INC.
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: **Huntleigh Diagnostics**
35 Portmanmoor Road
Cardiff
CF24 5HN, United Kingdom

EUT DESCRIPTION: Wireless Fetal Monitoring Solution (Receiver Base Unit)

MODEL: SF1-SL

SERIAL NUMBER: Prototype

DATE TESTED: October 2013 to February 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out byUL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Michael Ferrer
EMC Engineer
UL Verification Services Inc.

Tested By:

Bartlomiej Mucha
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/1004140.htm.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 150

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Radiated Emissions	26-40GHz	Horn	7.02dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an Wireless Fetal Monitoring Solution. It consists of multiple parts of which each is covered by separate test report. This report applies to the receiver base unit 2.4GHz Near Field Communication Transceiver.

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	Output PK E-field Strength (dBuV/m)
2415	n/a	78.23 @ 3m

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an trace antenna

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was R840_E35_V1_U3 test1hi..

Test mode 7 was used to transmit at 2.415GHz
Test mode 6 was used to transmit at 2.446GHz

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power and by moving the antenna between horizontal and vertical positions.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	**Manufacturer**	**Model**	**Serial Number**
EUT - Receiver Base Unit	Huntleigh	SF1-SL	Prototype

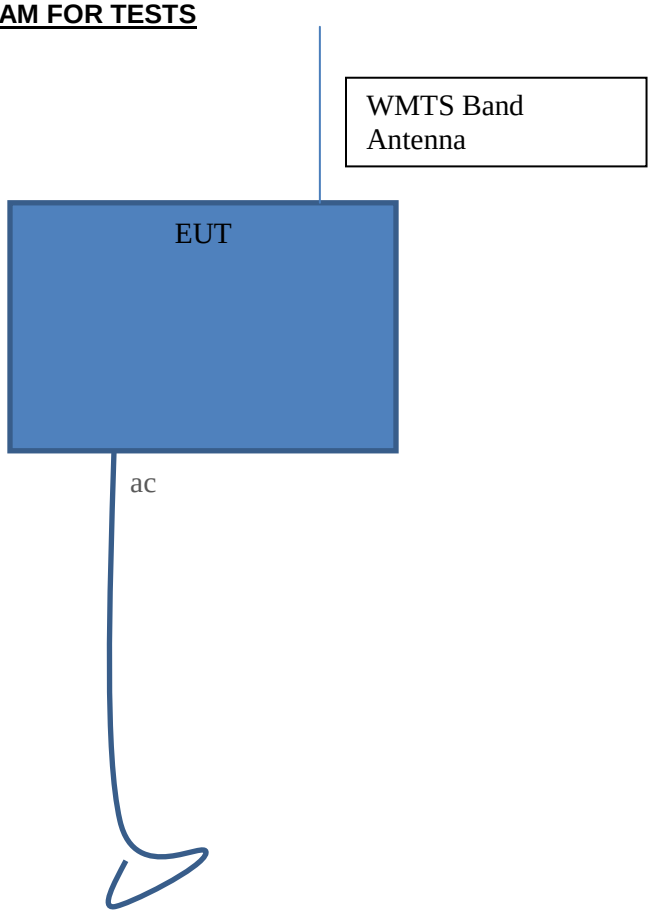
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
0	Encolsure	1	-	-	-	none
1	AC Input	1	AC	2 wire AC	1.5	none

TEST SETUP

The Transmitter is part of the WMTS receiver base.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Emissions – 10-Meter Chamber

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131227	20141231
Bicon Antenna	Chase	VBA6106A	EMC4078	20130213	20140228
Log-P Antenna	Chase	UPA6109	EMC4258	20131015	20141030
Log-P Antenna	Chase	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131226	20141231
Spectrum Analyzer	Agilent	N9030A (PXA)	EMC4360	20131221	20141221

Line Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 30, 2013	Dec 30, 2014
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	Jan 15, 2014	Jan 16, 2015
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 15, 2014	Jan 16, 2015

7. TEST RESULTS

7.1.1. 99% BANDWIDTH and 20dB BW

LIMITS

None; for reporting purposes only.

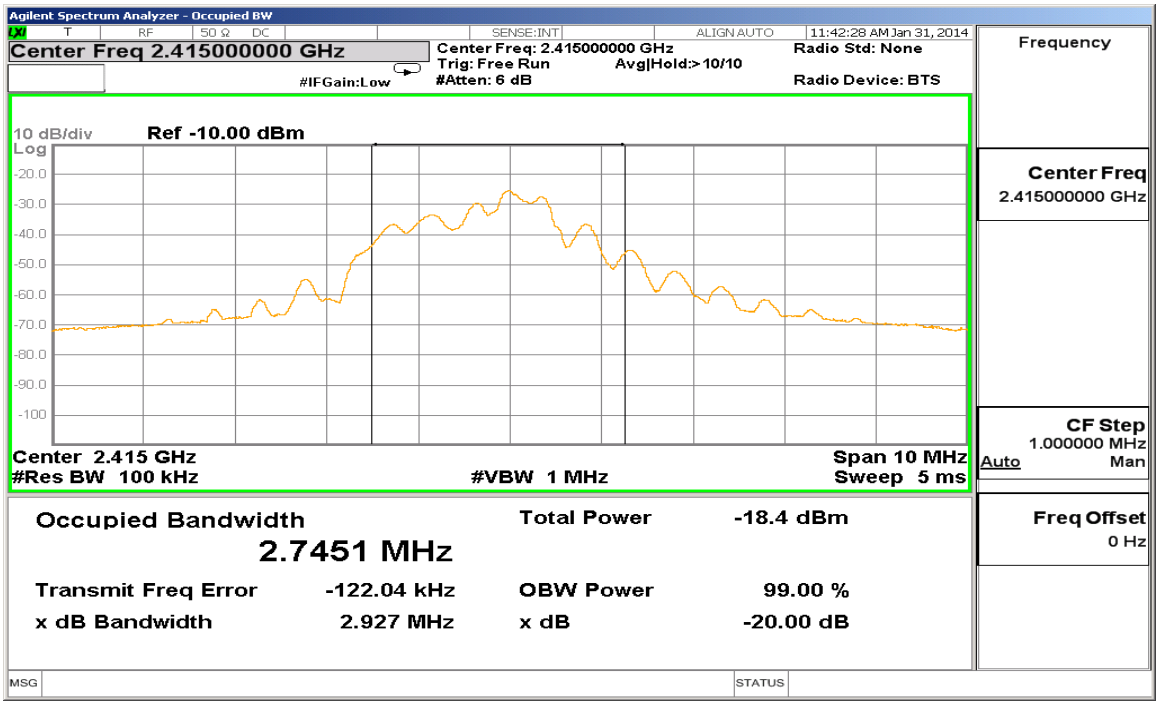
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

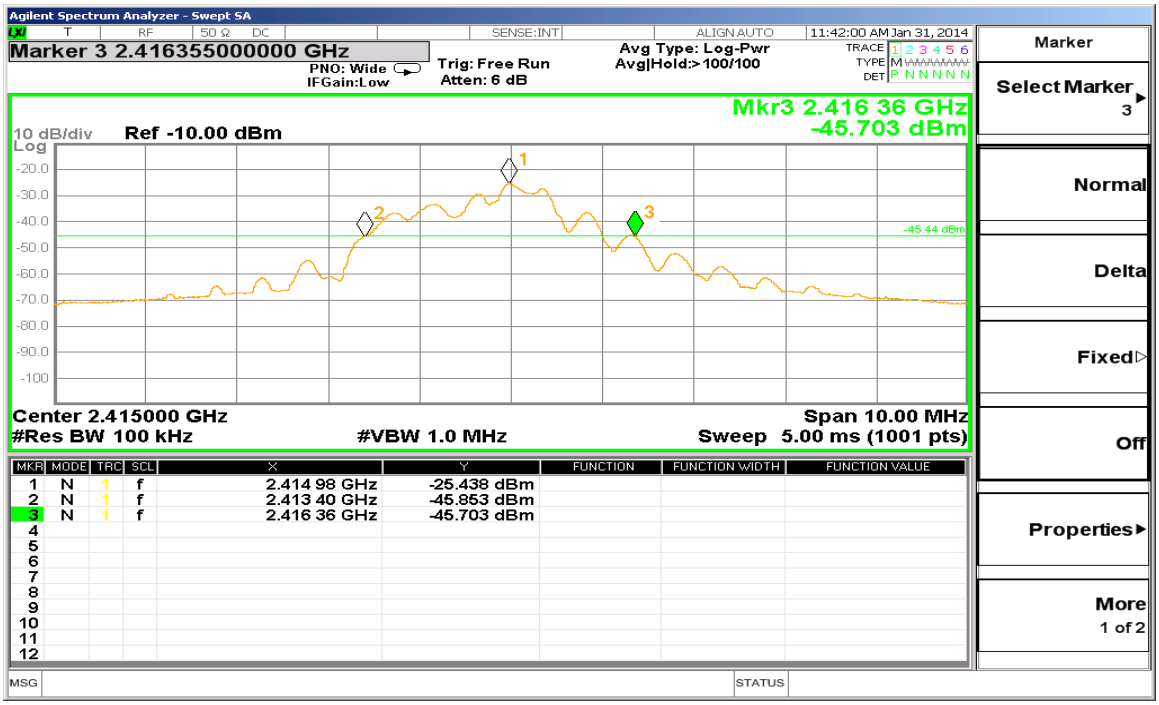
RESULTS

Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)
2415	2.7451	2.96
2446	1.7801	2.035

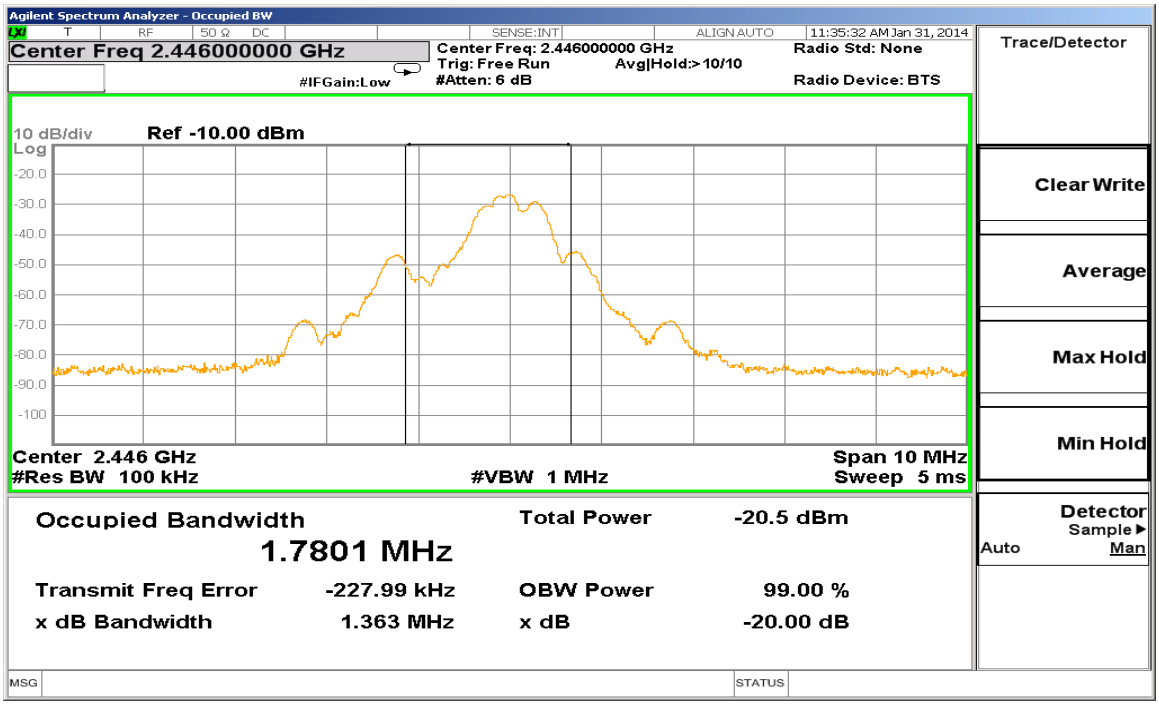
99% BANDWIDTH 2415MHz



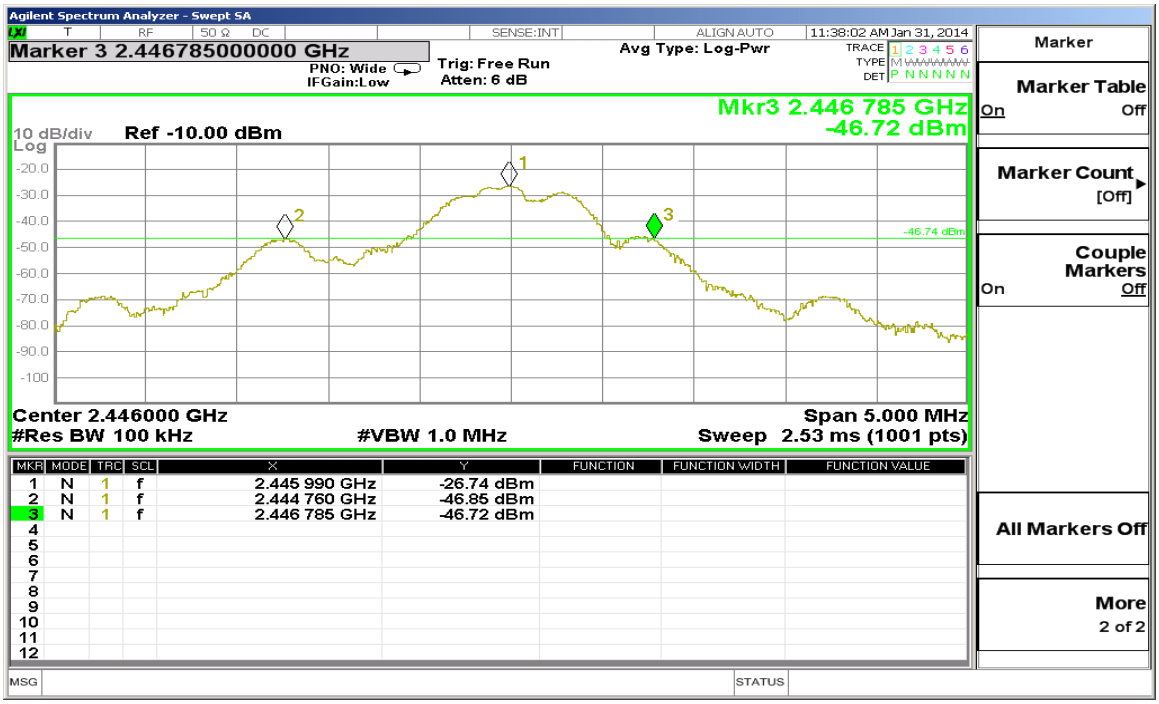
20dB BANDWIDTH 2415MHz



99% BANDWIDTH 2446MHz



20dB BANDWIDTH 2446MHz



7.1.2. Duty Cycle

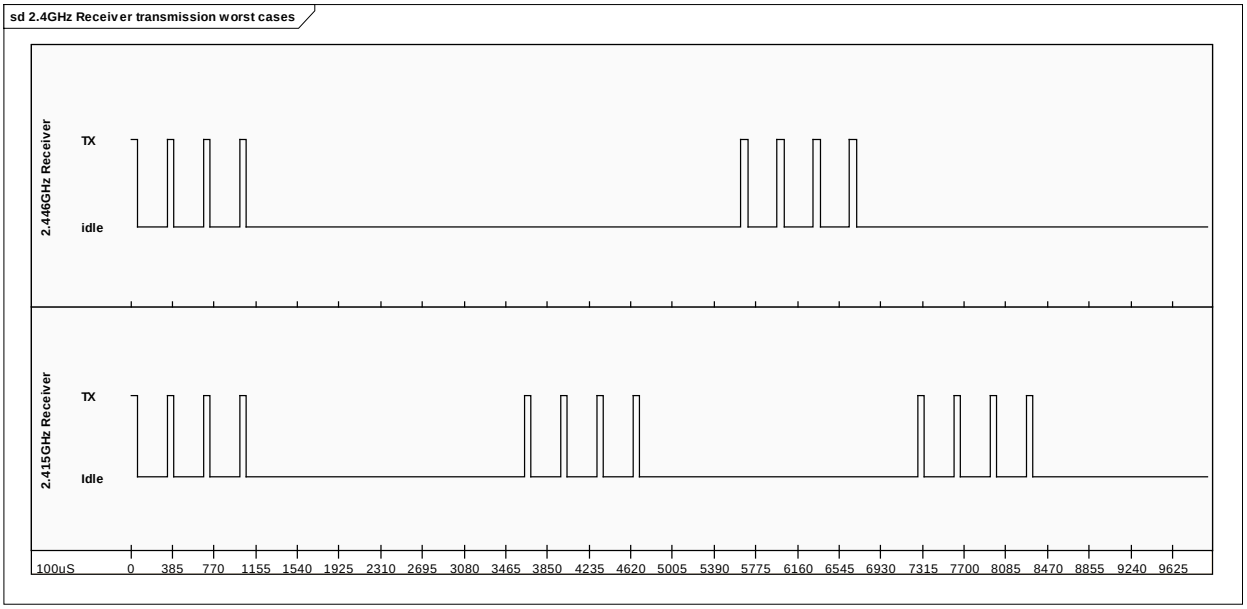
LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Duty cycle normally should be measured and reported. In this case the duty cycle was calculated based on information provided from the manufacturer since it was not possible to capture the worst case by doing measurements. Attempts to capture the duty cycle would show results from both the TOCO device and the WMTS Receiver base device and it would not represent the true number.

RESULTS



1. Receiver transmit at2.415GHz. 4 pulses of about 65uS in a 3.63mS window. See attached file Receiverworstcase. (Error mode, ACK response to id message)
    a. Duty cycle approx. 7.1%
    20xlog(OnTime/Period) = 20xLog((4x0.65)/3.63)) = -22.9dB
2. Receiver transmit at 2.446GHz. 4 pulses of about 65uS in a 5.63mS window. See attached file Receiverworstcase. (Error mode, ACK response to battery level message)
    a. Duty cycle approx. 4.8%
    20xlog(OnTime/Period) = 20xLog((4x0.65)/5.63)) = -26.7dB

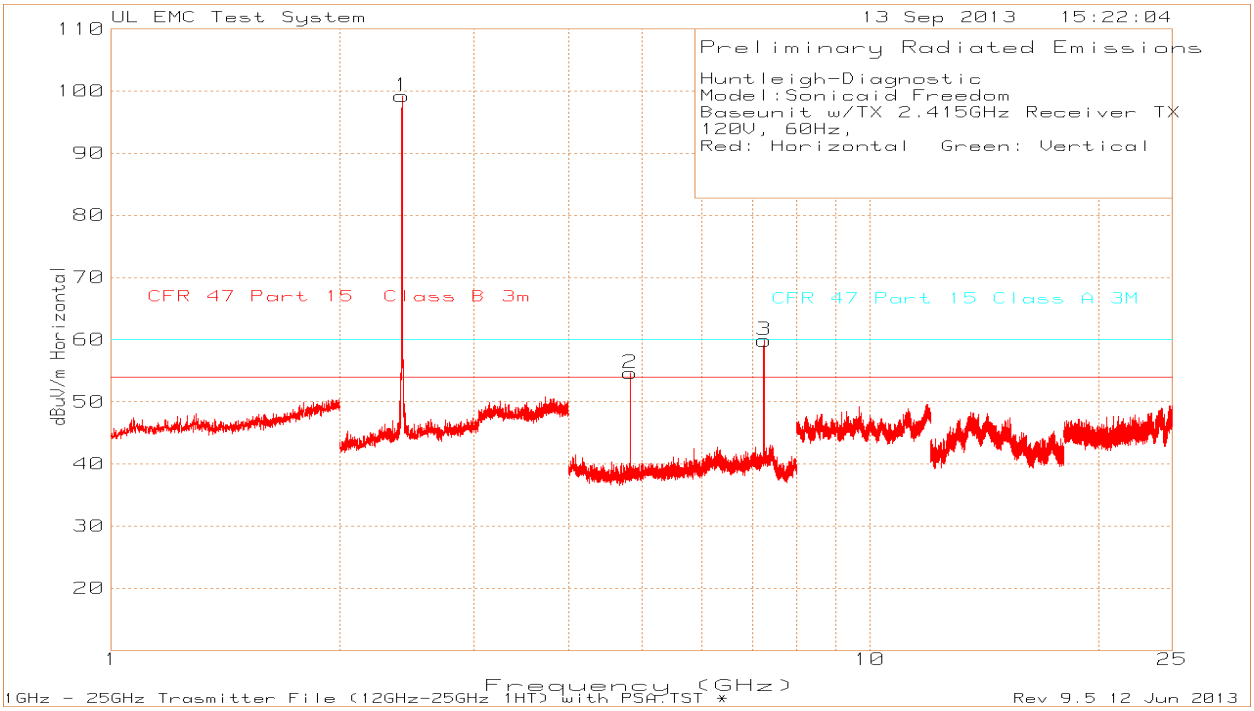
7.1.3. FUNDAMENTAL FREQUENCY RADIATED EMISSION

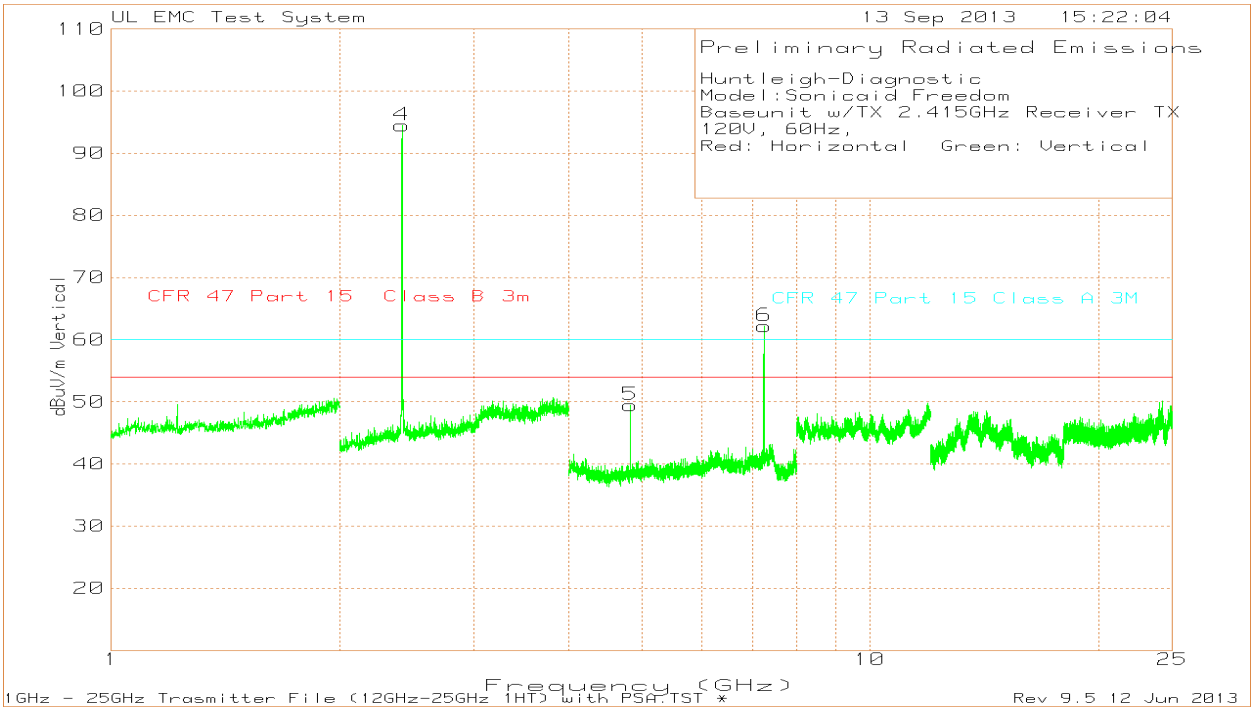
Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Peak Level dBuV/m	Peak Limit dBuV/m	Margin dB	Duty Cycle Factor dB	Average Level dBuV/m	Average Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
2.4158	74.82	PK	21.8	4.51	101.13	104	-2.87	-22.9	78.23	94	-15.77	157	100	H
2.4157	64.45	PK	21.8	4.51	90.76	104	-13.24	-22.9	67.86	94	-26.14	103	100	V

Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Peak Level dBuV/m	Peak Limit dBuV/m	Margin dB	Duty Cycle Factor dB	Average Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
2.4455	72.63	PK	21.9	4.53	99.06	104	-4.94	-26.7	72.36	94	-21.64	13	100	H
2.4454	71.14	PK	21.9	4.53	97.57	104	-6.43	-26.7	70.87	94	-23.13	337	100	V

7.1.4. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

2415MHz 1GHz-25GHz Prescan

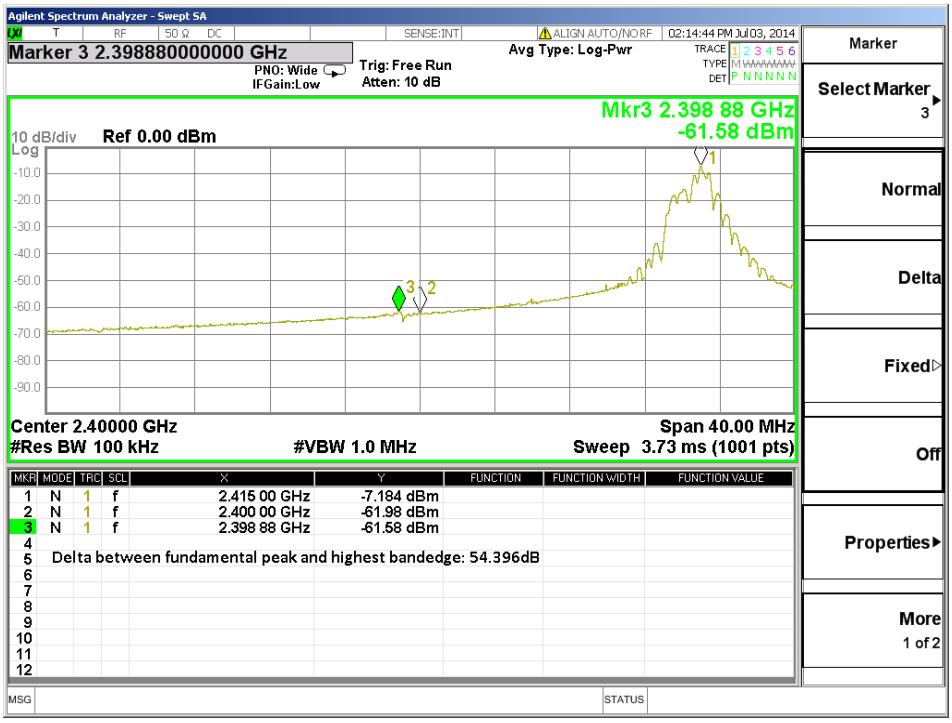




2415MHz 1GHz-25GHz Tabular Data

Huntleigh-Diagnostic															
Model:Sonicaid Freedom															
Baseunit w/TX 2.415GHz Receiver TX															
120V, 60Hz,															
Red: Horizontal Green: Vertical															
	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Peak Level dBuV/m	Peak Limit dBuV/m	Peak Margin	Duty Cycle Factor dB	Average Level dBuV/m	Average Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	2.4158	74.82	PK	21.8	4.51	101.13	104	-2.87	-22.9	78.23	94	-15.77	157	100	H
2	4.8303	79.17	PK	27.7	-50.26	56.61	74	-17.39	-22.9	33.71	54	-20.29	196	100	H
3	7.2434	82.99	PK	30	-46.19	66.8	74	-7.2	-22.9	43.9	54	-10.1	222	100	H
4	2.4157	64.45	PK	21.8	4.51	90.76	104	-13.24	-22.9	67.86	94	-26.14	103	100	V
5	4.8304	75.48	PK	27.7	-50.26	52.92	74	-21.08	-22.9	30.02	54	-23.98	16	100	V
6	7.2434	85.36	PK	30	-46.19	69.17	74	-4.83	-22.9	46.27	54	-7.73	66	100	V

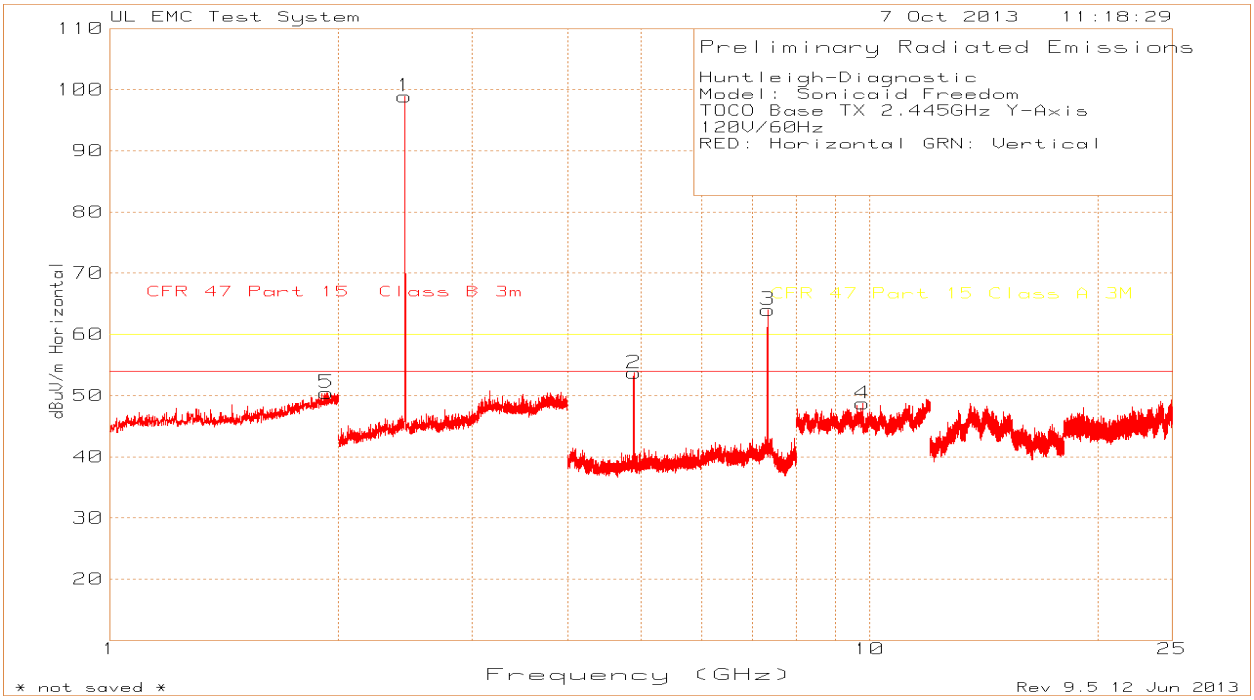
2415MHz Lower Band Edge Compliance

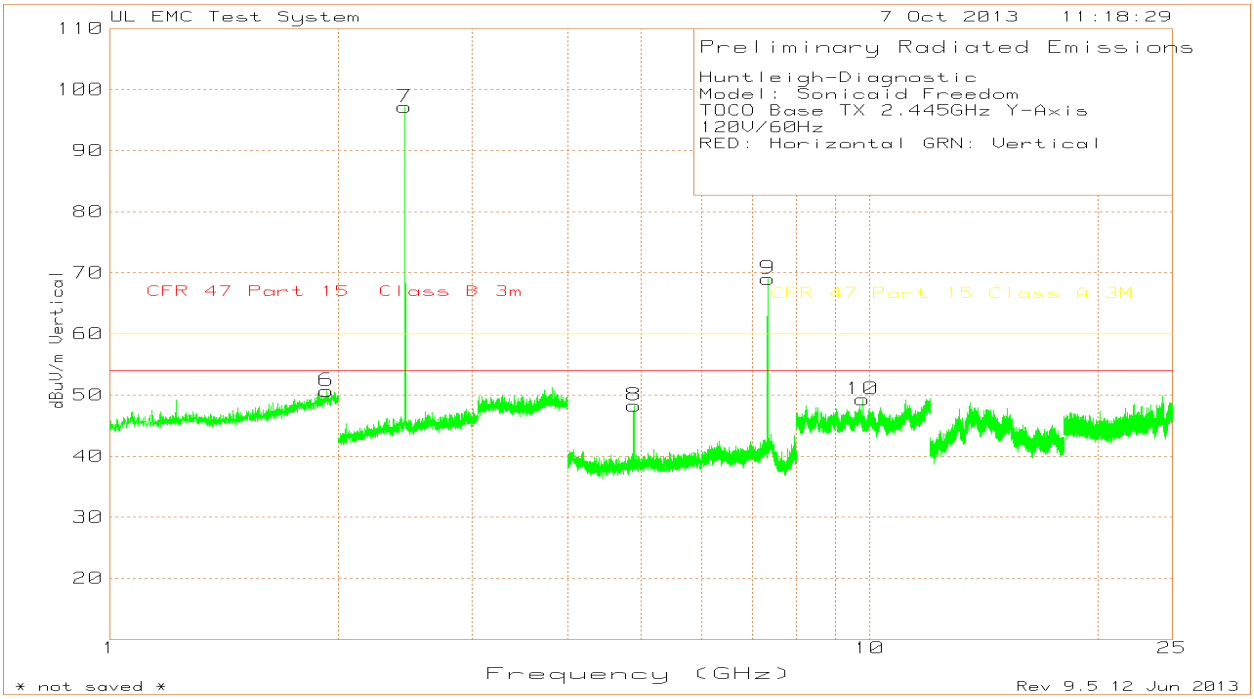


Calculated Worst Case Peak Level at Lower Band Edge based on above relative measurement and Maximum Peak Field Strength:
Peak Level: (101.13dBuV/m – 54.396dB) = 46.73dBuV/m, Limit: 74dBuV/m, Margin: -27.26dB

Calculated Worst Case Average Level at Lower Band Edge based on above relative measurement and Maximum Average Filed Strength:
Average Level: (46.73dBuV/m peak level – 22.9dB DC Factor) = 23.83dBuV/m, Limit: 54dBuV/m, Margin: -30.16

2446MHz 1GHz-25GHz Prescan

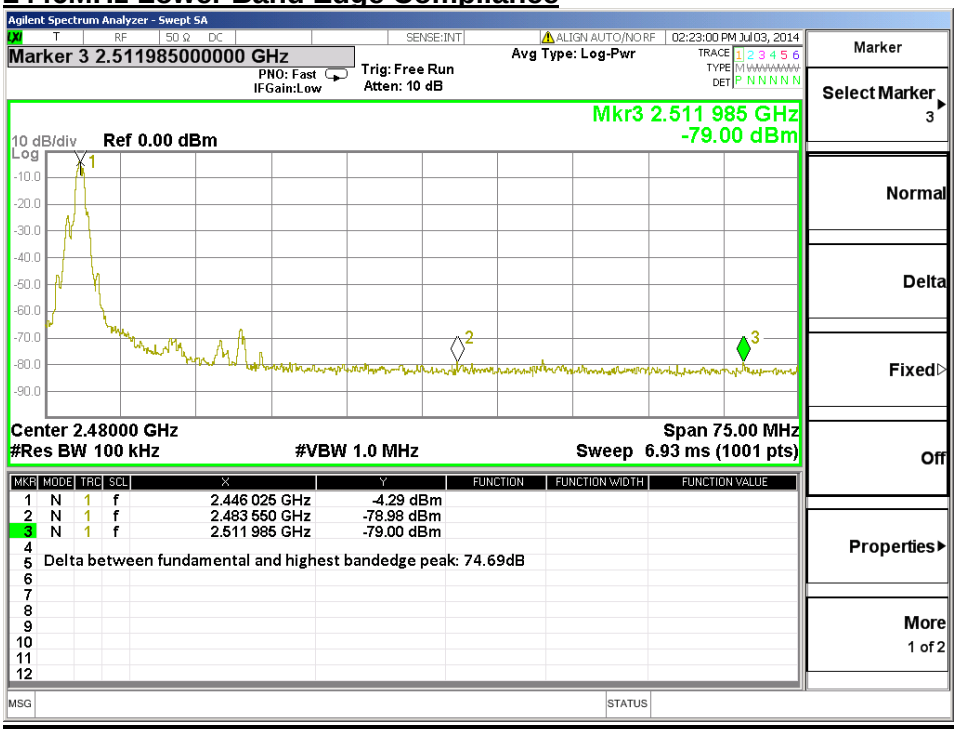




2446MHz 1GHz-25GHz Tabular Data

Huntleigh-Diagnostic															
Model: Sonicaid Freedom															
TOCO Base TX 2.445GHz Y-Axis															
120V/60Hz															
RED: Horizontal GRN: Vertical															
Trace Markers															
Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Peak Level dBuV/m	Peak Limit dBuV/m	Peak Margin	Duty Cycle Factor dB	Average Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
5	1.928	19.06	PK	27.3	4.07	50.43	54	-3.57	0	50.43	54	-3.57	0-360	149	H
1	2.4455	72.63	PK	21.9	4.53	99.06	104	-4.94	-26.7	72.36	94	-21.64	13	100	H
2	4.8919	78.47	PK	27.7	-50.15	56.02	74	-17.98	-26.7	29.32	54	-24.68	75	100	H
3	7.3376	80.71	PK	30.7	-45.75	65.66	74	-8.34	-26.7	38.96	54	-15.04	117	100	H
4	9.784	61.3	PK	36.4	-49.01	48.69	74	-25.31	-26.7	21.99	54	-32.01	0-360	100	H
6	1.929	19.3	PK	27.3	4.07	50.67	54	-3.33	0	50.67	54	-3.33	0-360	100	V
7	2.4454	71.14	PK	21.9	4.53	97.57	104	-6.43	-26.7	70.87	94	-23.13	337	100	V
8	4.8917	75.5	PK	27.7	-50.15	53.05	74	-20.95	-26.7	26.35	54	-27.65	16	106	V
9	7.3379	85.13	PK	30.7	-45.75	70.08	74	-3.92	-26.7	43.38	54	-10.62	222	101	V
10	9.784	61.87	PK	36.4	-49.01	49.26	74	-24.74	-26.7	22.56	54	-31.44	0-360	100	V

2446MHz Lower Band Edge Compliance

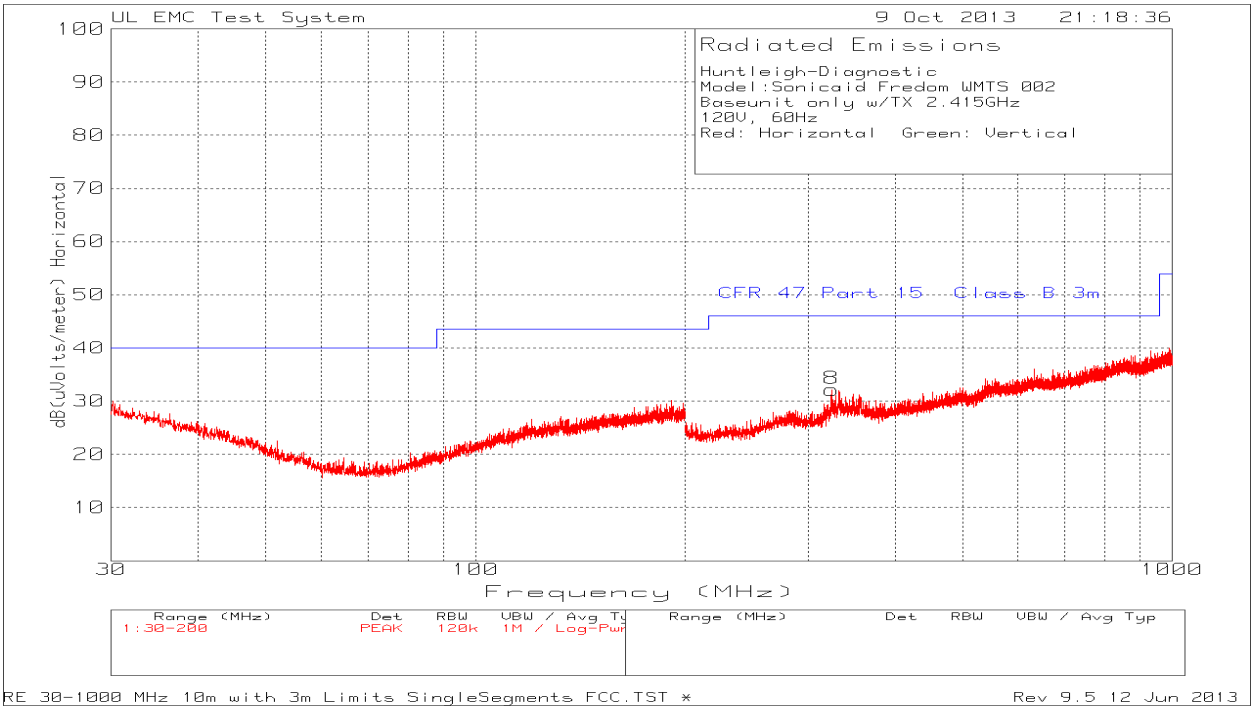


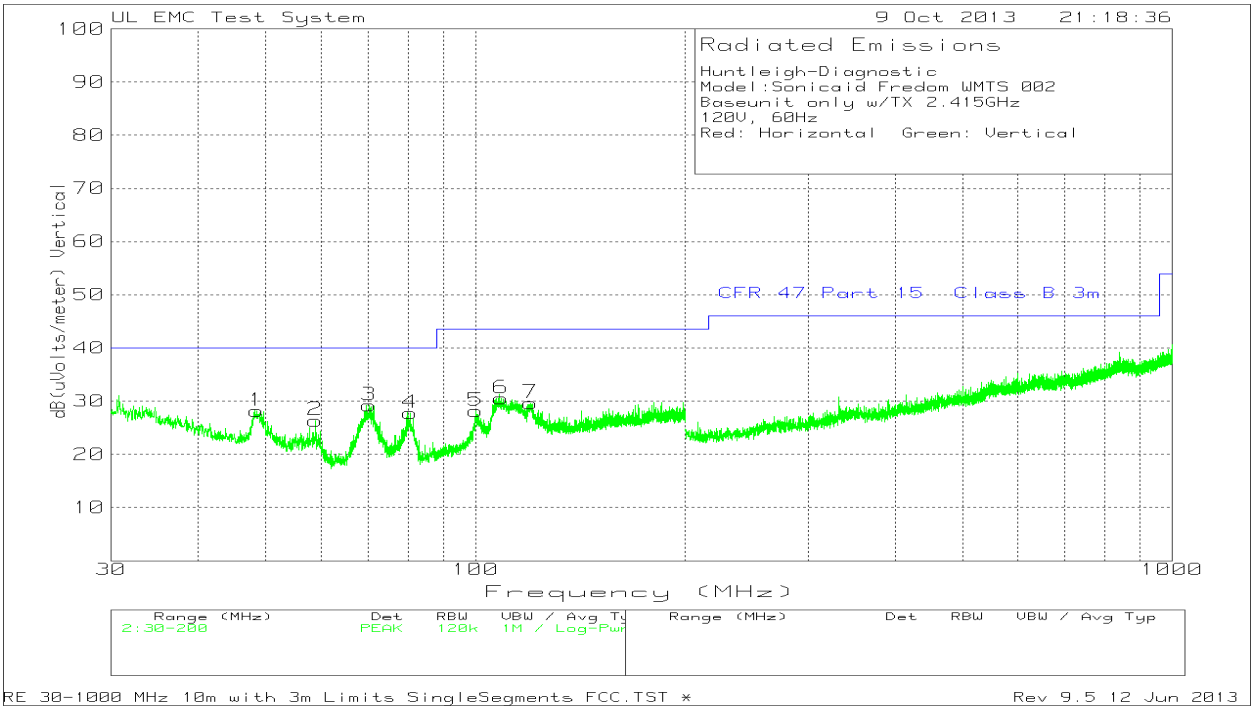
Calculated Worst Case Peak Level at Upper Band Edge based on above relative measurement and Maximum Peak Field Strength:
Peak Level: (99.06dBuV/m – 74.69dB) = 24.37dBuV/m, Limit: 74dBuV/m, Margin: -49.63dB

Calculated Worst Case Average Level at Upper Band Edge based on above relative measurement and Maximum Average Filed Strength:
Average Level: (24.37dBuV/m – 26.7dB DC Factor) = -2.33dBuV/m, Limit: 54dBuV/m, Margin: -56.33

7.1.5. WORST-CASE BELOW 1 GHz

2415MHz Prescan Data





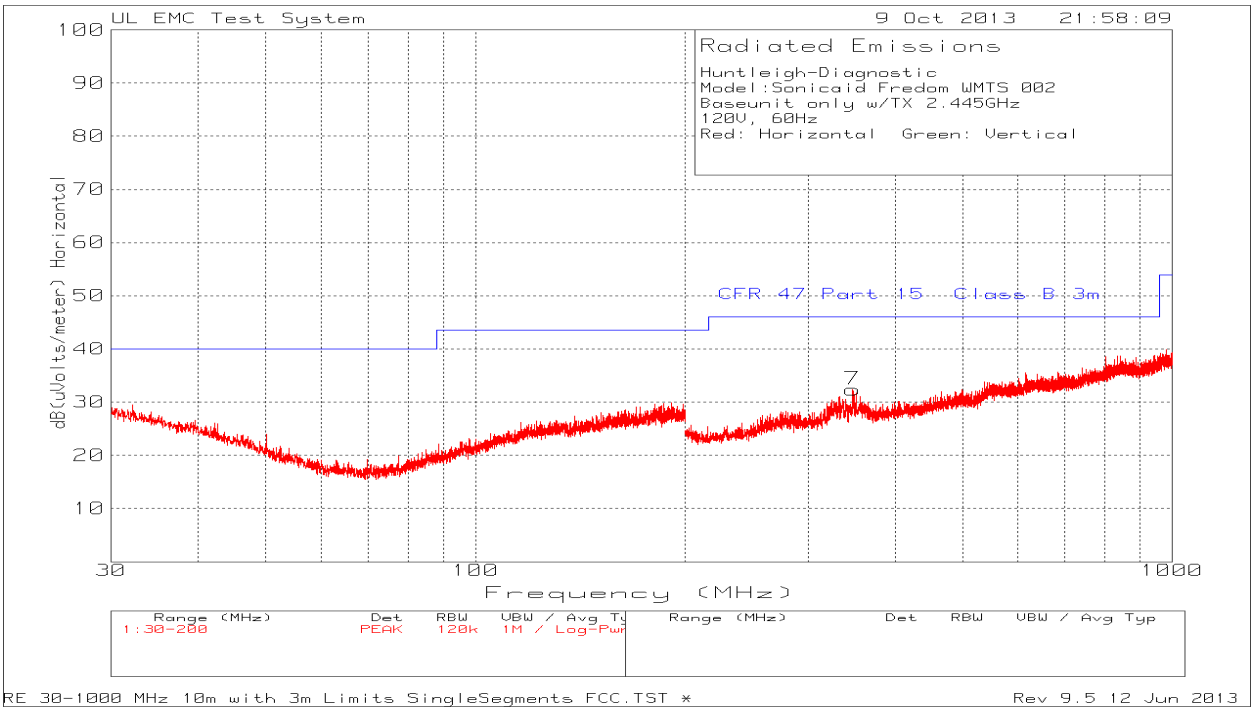
2415MHz Tabular Data

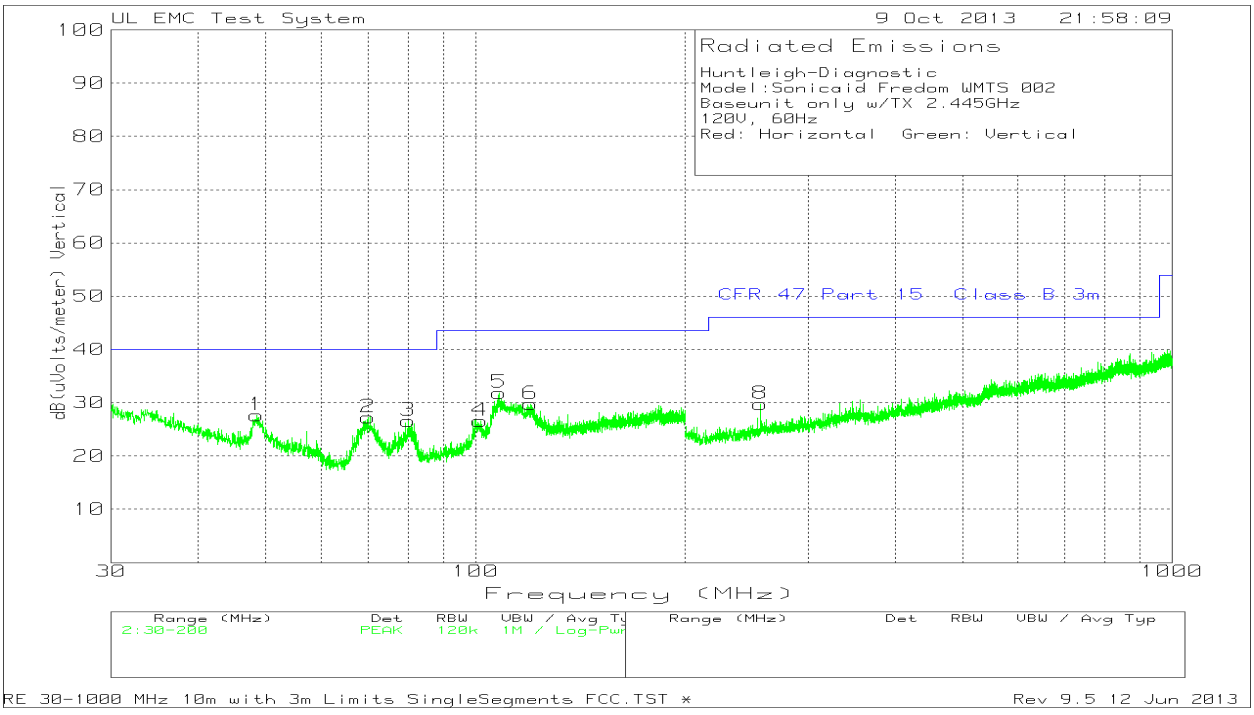
Huntleigh-Diagnostic
Model:Sonicaid Fredom WMTS 002
Baseunit only w/TX 2.415GHz
120V, 60Hz
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Facotr dB	Path Factor dB	10m to 3m dB	Level dBuV/m	CFR 47 Part 15 Class B 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	48.4875	37.08	PK	10.7	-30.1	10.5	28.18	40	-11.82	0-360	99	V
2	58.8575	39	PK	7	-30.1	10.5	26.4	40	-13.6	0-360	249	V
3	70.375	42.39	PK	6.2	-29.9	10.5	29.19	40	-10.81	0-360	99	V
4	80.5325	39.95	PK	7.2	-29.9	10.5	27.75	40	-12.25	0-360	400	V
5	100.21	37.01	PK	10.6	-29.9	10.5	28.21	43.52	-15.31	0-360	99	V
6	108.795	37.81	PK	12	-29.8	10.5	30.51	43.52	-13.01	0-360	99	V
7	119.845	35.78	PK	13.2	-29.8	10.5	29.68	43.52	-13.84	0-360	99	V
8	324.8	33.68	PK	13.9	-25.9	10.5	32.18	46.02	-13.84	0-360	299	H

PK - Peak detector

2446MHz Prescan Data





2446MHz Tabular Data

Huntleigh-Diagnostic
Model:Sonicaid Fredom WMTS 002
Baseunit only w/TX 2.445GHz
120V, 60Hz
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Facotr dB	Path Factor dB	10m to 3m dB	Level dBuV/m	CFR 47 Part 15 Class B 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	48.4875	36.49	PK	10.7	-30.1	10.5	27.59	40	-12.41	0-360	99	V
2	70.035	40.42	PK	6.2	-29.9	10.5	27.22	40	-12.78	0-360	249	V
3	80.0225	38.94	PK	7.1	-29.9	10.5	26.64	40	-13.36	0-360	400	V
4	101.5275	34.97	PK	10.9	-29.8	10.5	26.57	43.52	-16.95	0-360	99	V
5	108.115	39.46	PK	11.8	-29.9	10.5	31.86	43.52	-11.66	0-360	99	V
6	120.1	35.83	PK	13.2	-29.8	10.5	29.73	43.52	-13.79	0-360	99	V
7	348	32.71	PK	15	-25.8	10.5	32.41	46.02	-13.61	0-360	300	H
8	256.2667	33.01	PK	12.7	-26.5	10.5	29.71	46.02	-16.31	0-360	300	V

PK - Peak detector

8. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207 (a)
IC RSS-GEN, Section 7.2.2

Frequency of emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50
* Decreases with the logarithm of the frequency.		

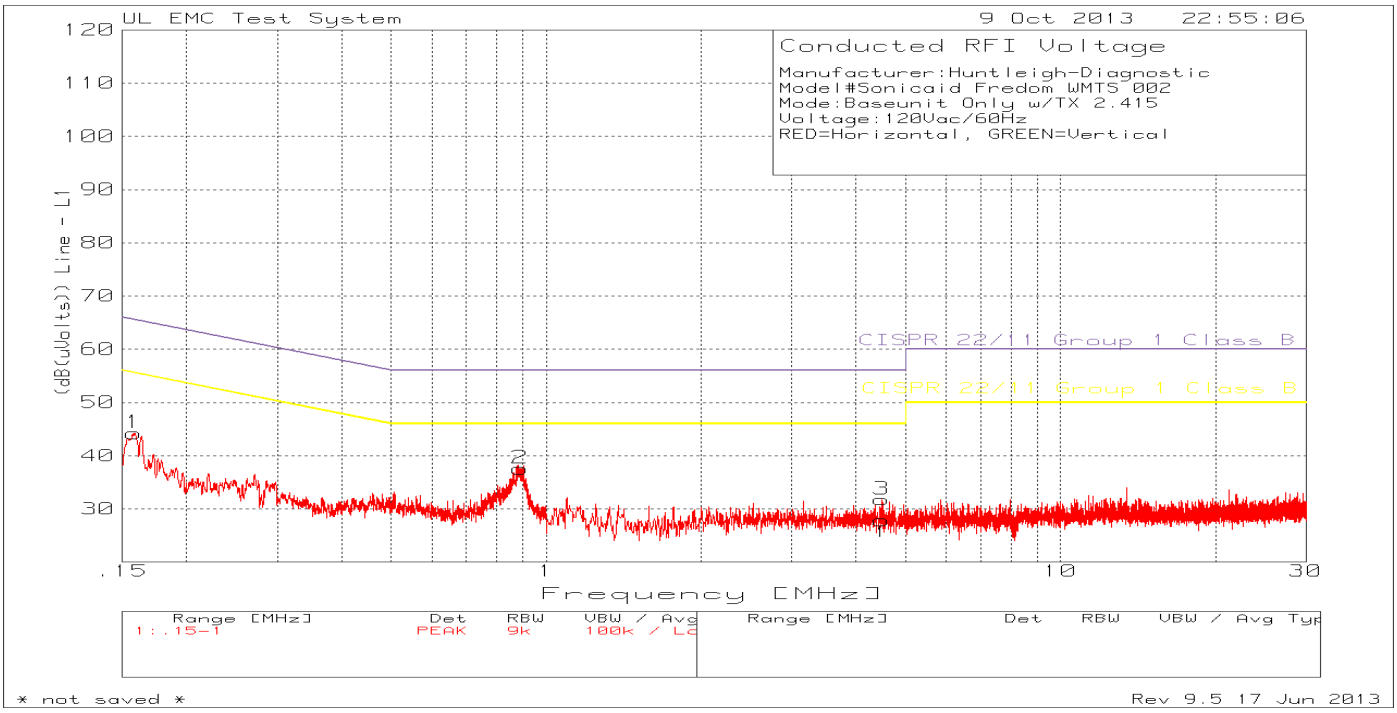
TEST PROCEDURE

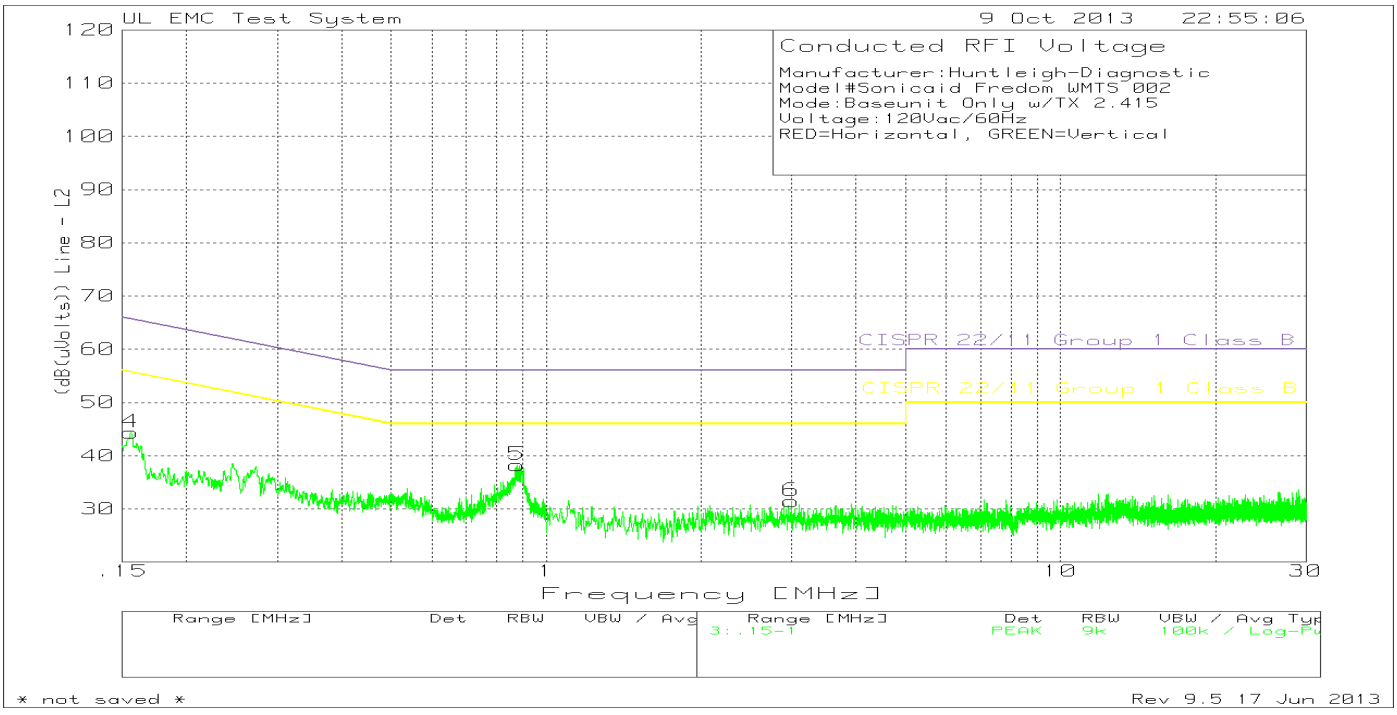
ANSI C63.4

RESULTS

No non-compliance noted:

TX 2415MHz





Manufacturer:Huntleigh-Diagnostic
Model#Sonicaid Fredom WMTS 002
Mode:Baseunit Only w/TX 2.415
Voltage:120Vac/60Hz
RED=Horizontal, GREEN=Vertical

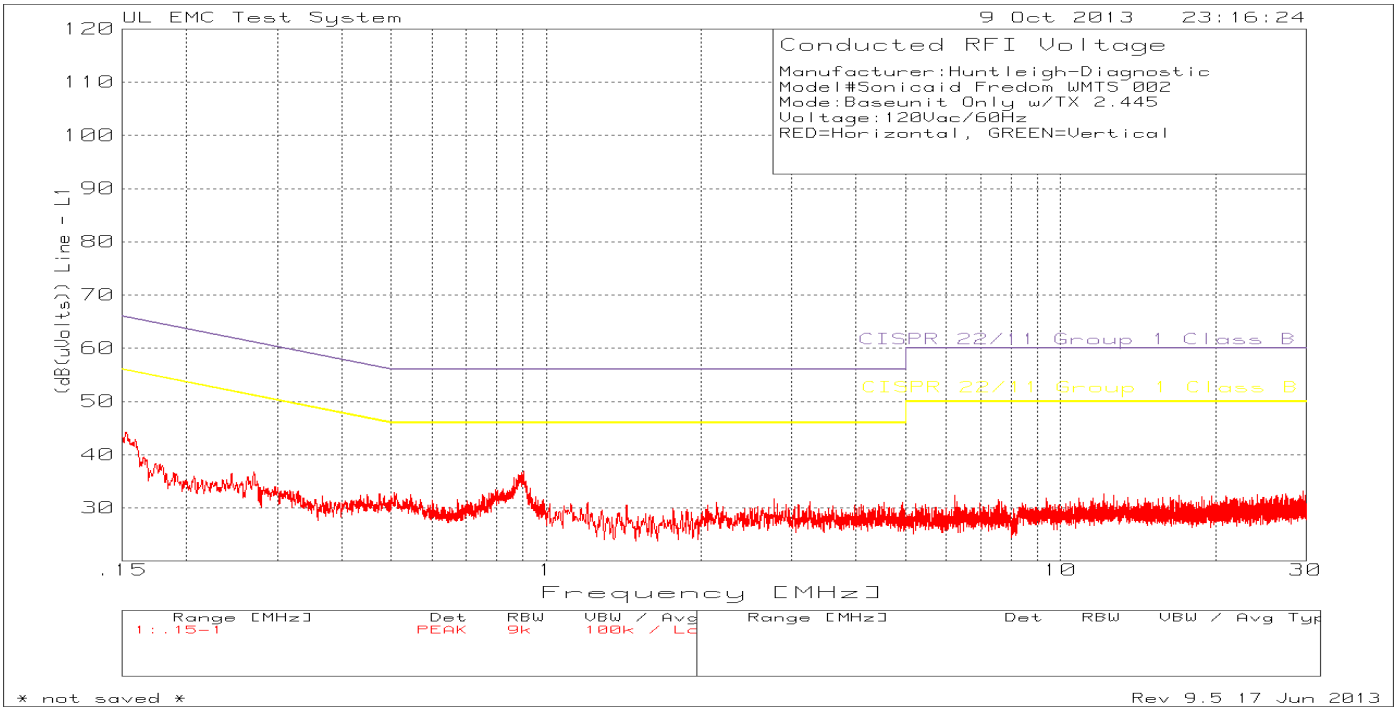
Trace Markers

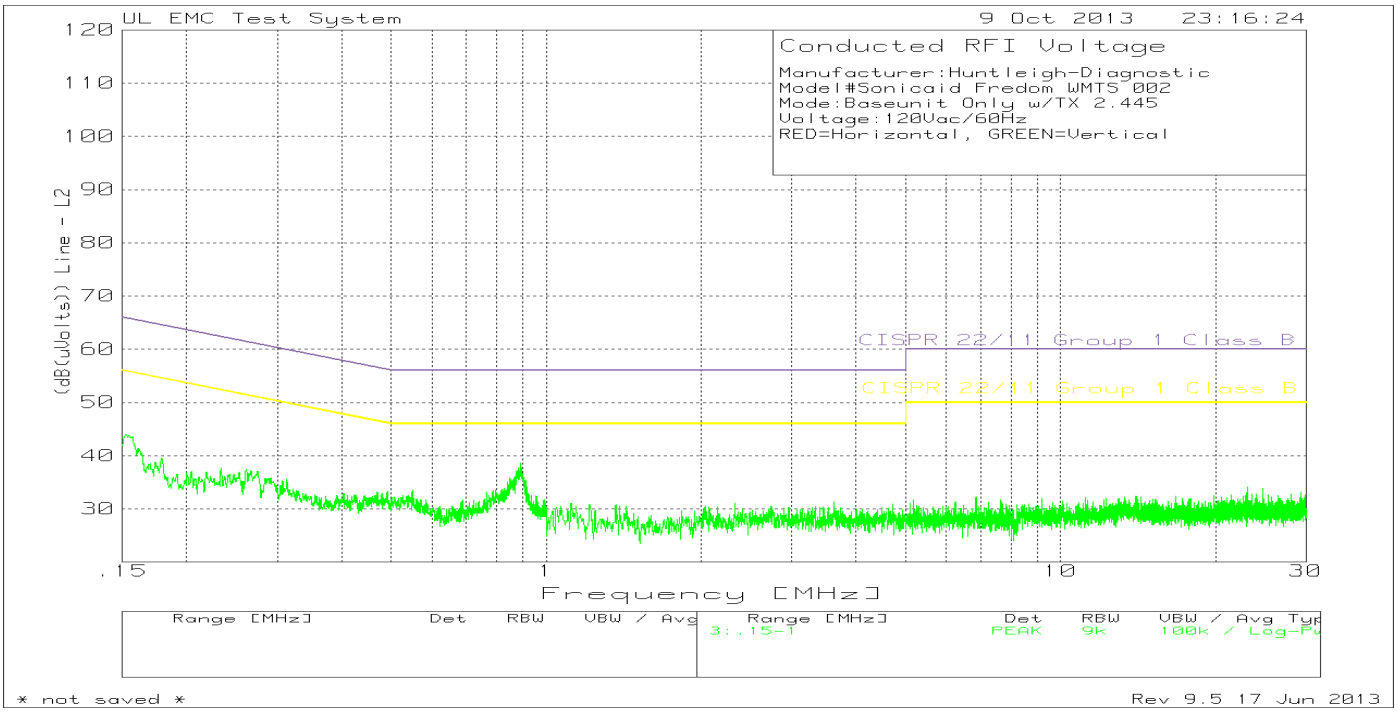
No.	Test Frequency [MHz]	Meter Reading	Transducer Factor [dB]	Gain/Loss Factor [dB]	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1 .15 - 1MHz											
1	.15828	30.11dBuV PK	.1	14	44.21	-	-	65.55	55.55	-	-
				Margin [dB]		-	-	-21.34	-11.34	-	-
2	.89234	26.84dBuV PK	.1	10.6	37.54	-	-	56	46	-	-
				Margin [dB]		-	-	-18.46	-8.46	-	-
Line - L1 1 - 30MHz											
3	4.48782	21dBuV PK	.1	10.7	31.8	-	-	56	46	-	-
				Margin [dB]		-	-	-24.2	-14.2	-	-
Line - L2 .15 - 1MHz											
4	.15595	30.03dBuV PK	.1	14.2	44.33	-	-	65.68	55.68	-	-
				Margin [dB]		-	-	-21.35	-11.35	-	-
5	.87642	27.56dBuV PK	.1	10.6	38.26	-	-	56	46	-	-
				Margin [dB]		-	-	-17.74	-7.74	-	-
Line - L2 1 - 30MHz											
6	2.99563	20.79dBuV PK	.1	10.6	31.49	-	-	56	46	-	-
				Margin [dB]		-	-	-24.51	-14.51	-	-

LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

PK - Peak detector

TX 2446MHz

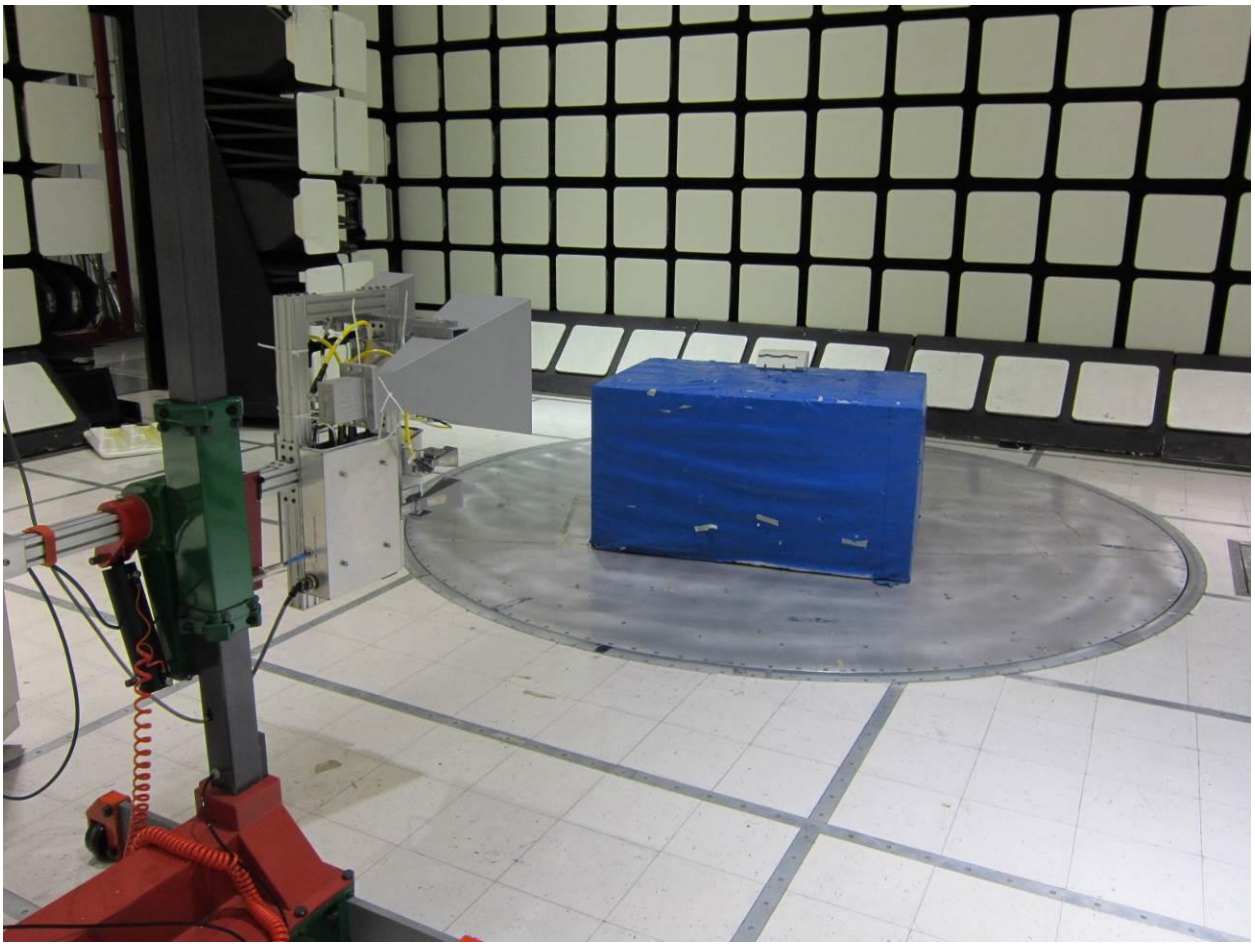




* All emissions at least 6dB below the limit.

9. SETUP PHOTOS

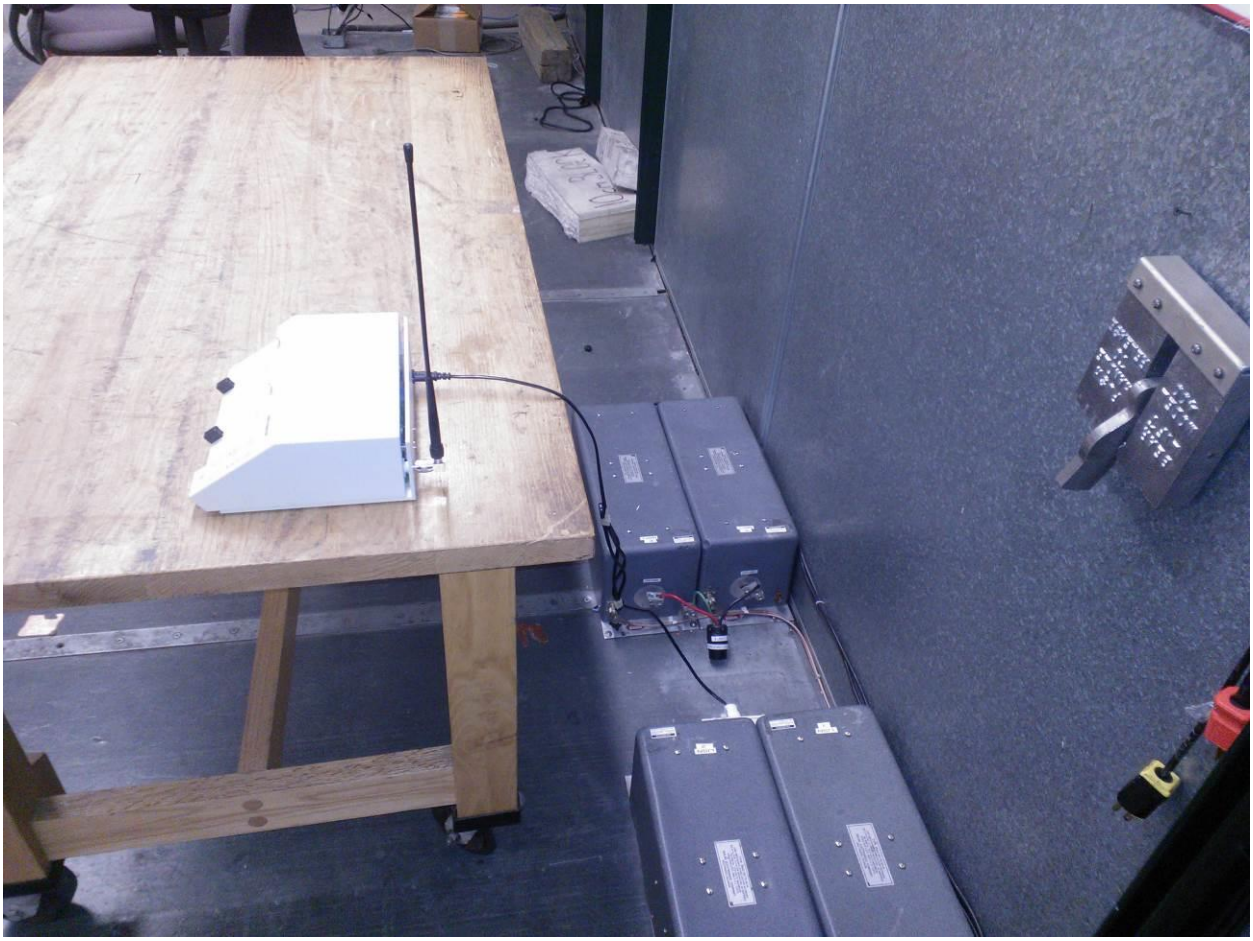
Radiated Emissions



Radiated Emissions – Antenna Vertical (Not used for 2.4GHz Testing)

UL VERIFICATION SERVICES INC.
333 Pfingsten Road, Northbrook, IL 60062 TEL: (847) 272-8800

Line Conducted Emissions



END OF REPORT

UL VERIFICATION SERVICES INC.
333 Pfingsten Road, Northbrook, IL 60062 TEL: (847) 272-8800