FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT

FOR

Vital Connect Biosensor Platform

MODEL NUMBER: 600-00001-00

FCC ID: SPO-VCI-MODULE
IC: 11013A-VCIMODULE

REPORT NUMBER: 12CA65988A-2

ISSUE DATE: March 29, 2013
Revision Date: May 23, 2013

Prepared for
Vital Connect Inc.
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Campbell, CA 95008

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NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/29/13	Initial Issue	M.Ferrer
1	05/02/13	Updated Conducted Bandage plot, added MPE	M.Ferrer
2	05/23/13	Updated Conducted Spurious measurements	M.Ferrer

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Vital Connect Inc.
Suite 316
2105 S Bascom Ave.
Campbell, CA 95008

EUT DESCRIPTION: Vital Connect Biosensor Platform

MODEL: 600-00001-00

SERIAL NUMBER: Prototype

DATE TESTED: January 28, 2013 – May 23, 2013

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 LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 By:

Bart Mucha
Staff ENGINEER
UL

Tested By:

MICHAEL FERRER
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UL

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, RSS-210 Issue 8, and KDB 558074 DTS Meas Guidance v02

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60193, USA.
UL NBK is accredited by NVLAP, Laboratory Code 100414-0

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

Sample Calculations
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
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
Conducted Ant Port	30MHz-26GHz	Spectrum Analyzer	2.94dB
RF Power	dB	Power Meter	0.45dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The VitalConnect Platform sensor consisting of a Patch and Sensor Module (hereinafter referred to as VitalConnect Sensor) is a miniaturized, compact, ambulatory (mobile), battery-operated patch with integrated sensors, two (2) electrodes, a transceiver, an electronic bridge and server software. The sensor is worn on the torso to record heart rate, heart rate variability, breathing rate (respiration rate), skin temperature, electrocardiography (ECG), fall detection, step count and posture. The sensor continuously gathers vital signs and activity measurements, and transmits encrypted data via a bi-directional Relay to a Central Server, where the data is stored and analyzed.
The manufacturer has stated typical output power is 2.75dBm with Maximum of 4dBm

The EUT is an Bluetooth Low Energy 4.0 transceiver

The radio module is manufactured by Vital Connect.
Patch p/n: 545-00006-00
Module p/n: 600-00001-00

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402-2480	BLE 4.0	3.75	2.37

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a chip antenna, with a maximum gain of 0.2 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was rev. 0.7.6.6

The test utility software used during testing was SmartRF Studio 7, rev. 1.10.3.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y-Axis orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y-axis orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Programming Board	Neptune	10-0046	-	-
Serial to USB	Texas Instruments	CC Debugger	-	-
Phone	Apple	A1387	-	BCG-E2430A
PC	Lenovo	T420	-	-

I/O CABLES

None

TEST SETUP

The EUT is a wireless device that is battery powered. The Sensor module was programmed to transmit on Hi, Mid, and Low channels.

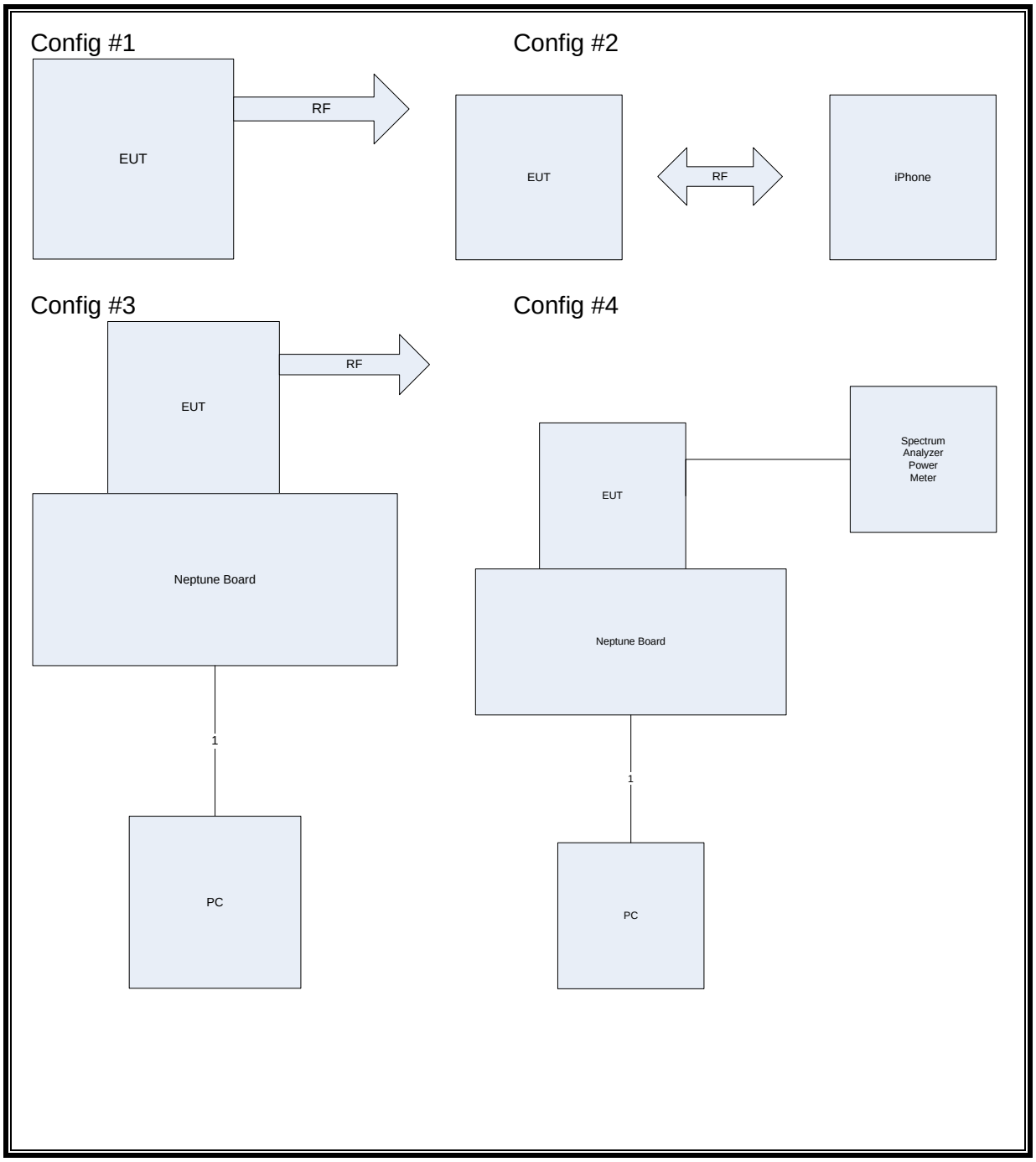
Config #1
In this configuration, the EUT was programmed to transmit continuously on a single channel.

Config #2
In this configuration, the EUT was transmitting and receiving data with an IPhone. The IPhone contained an app that displayed data readings

Config# 3
In this configuration, the EUT was placed in the Neptune Programming board. It was programmed to either transmit or receive on single channel.

Config# 4
In this configuration, the EUT was placed in the Neptune Programming board. It was programmed to either transmit or receive on single channel. The EUT contained a SMA antenna port connection for direct measurement.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List						
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**	**Test**
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20121227	20131231	RE, CP
Bicon Antenna	Chase	VBA6106A	EMC4078	20130213	20170228	RE, CP
Log-P Antenna	Chase	UPA6109	EMC4258	20121015	20131030	RE
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20121226	20131231	RE
Antenna Array	UL	BOMS	EMC4276	20111227	20131231	RE
EMI Test Receiver	Agilent	N9030A	EMC4360	20121226	20131226	OBW, PSD
Power Meter	Rohde & Schwarz	NRVD	EMC4074	20121027	20131027	AP
Power Sensor	Rohde & Schwarz	NRV-Z555	EMC4265	20121030	20131030	AP

RE: Radiated Emissions
CP: Conducted Antenna Peak Power, Spurious Emissions
CE: Conducted Emissions AC Mains
OBW: Occupied BW
PSD: Power Spectral Density
AP: Average Power

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

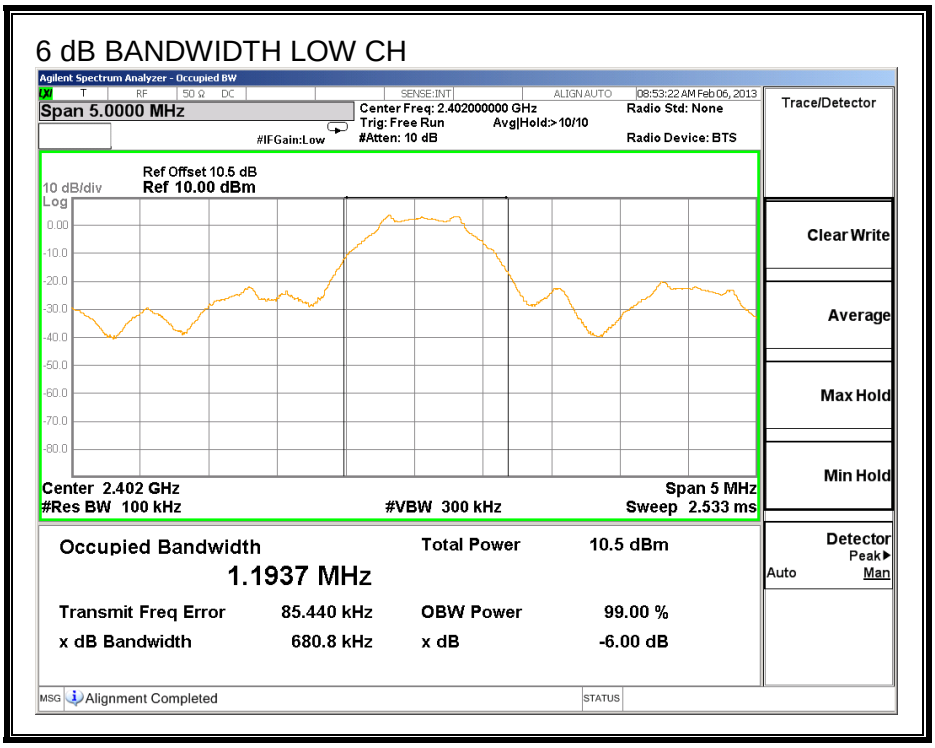
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

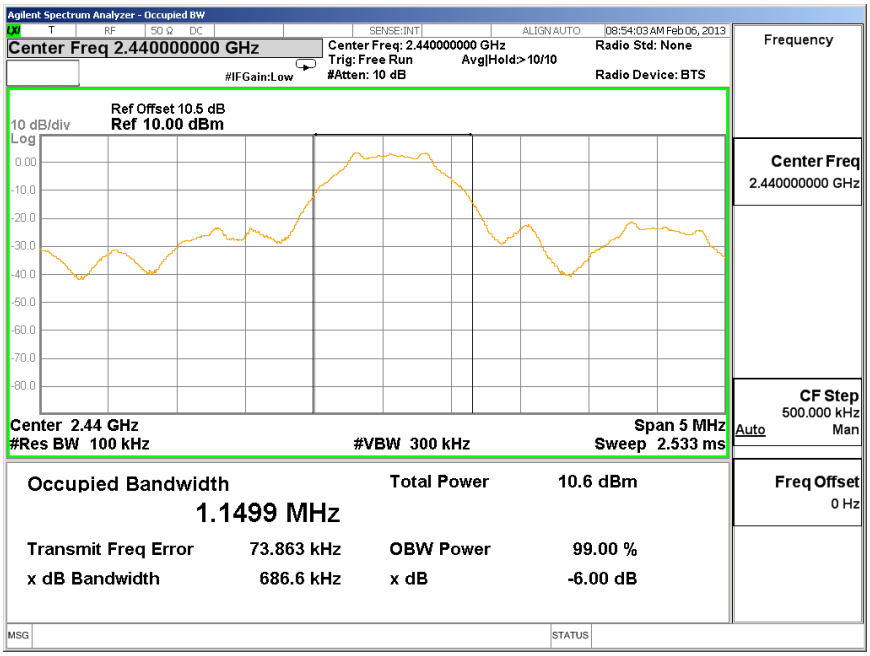
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6808	0.5
Middle	2440	0.6866	0.5
High	2480	0.6894	0.5

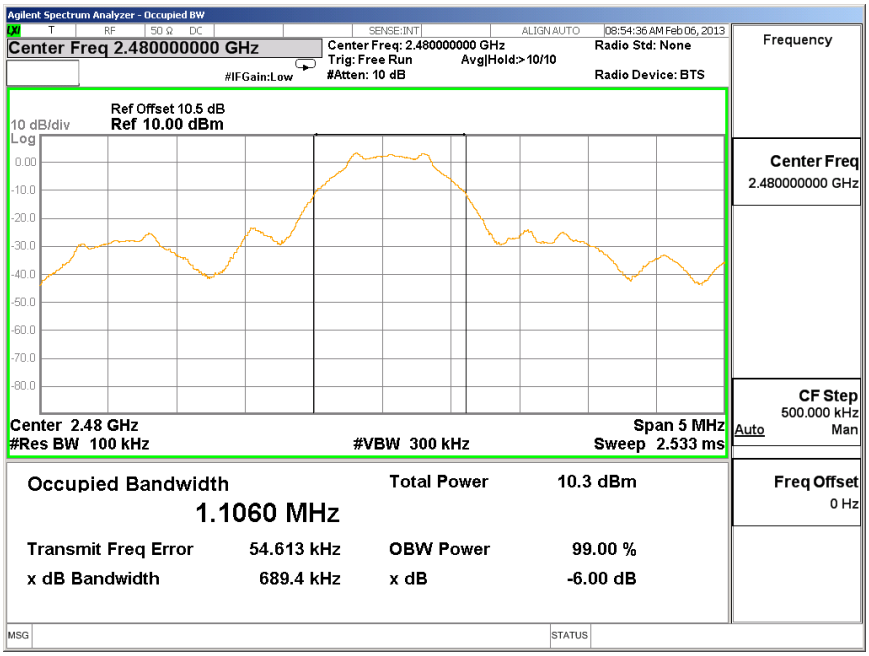
6 dB BANDWIDTH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH



7.2. 99% BANDWIDTH

LIMITS

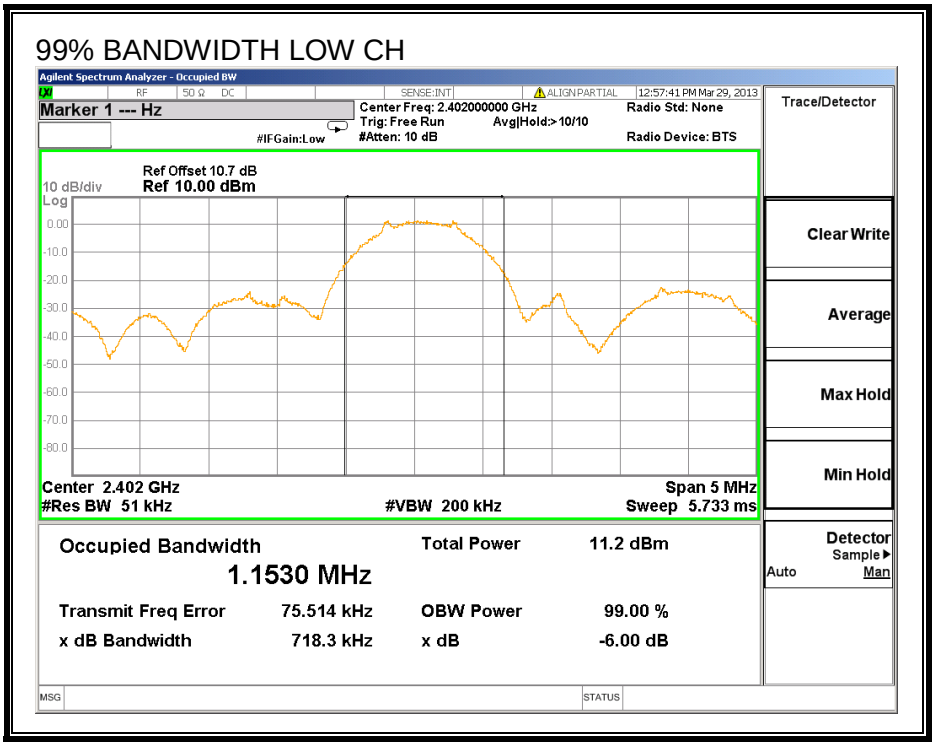
None; for reporting purposes only.

TEST PROCEDURE

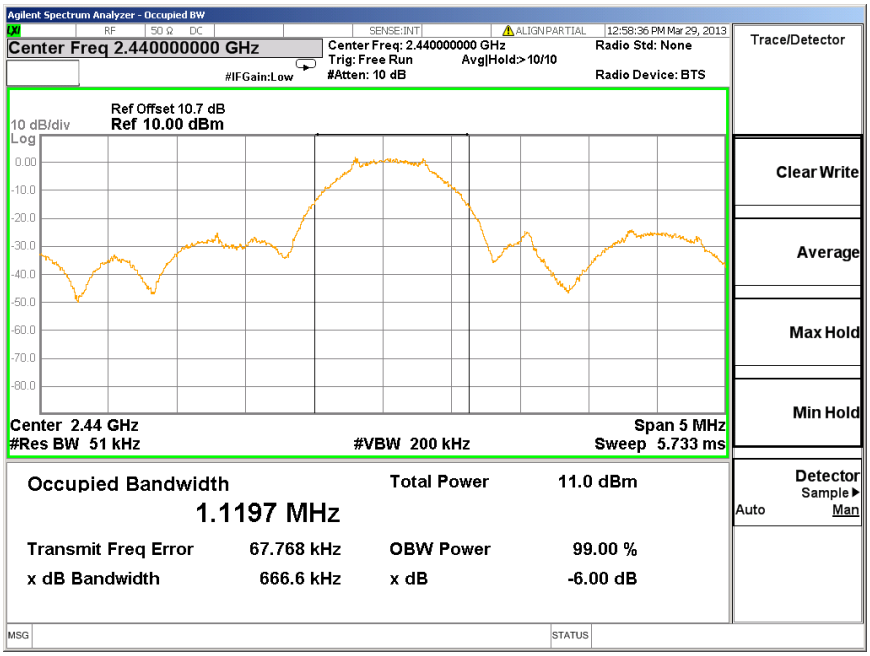
RSS-Gen
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.1530
Middle	2440	1.1197
High	2480	1.0789

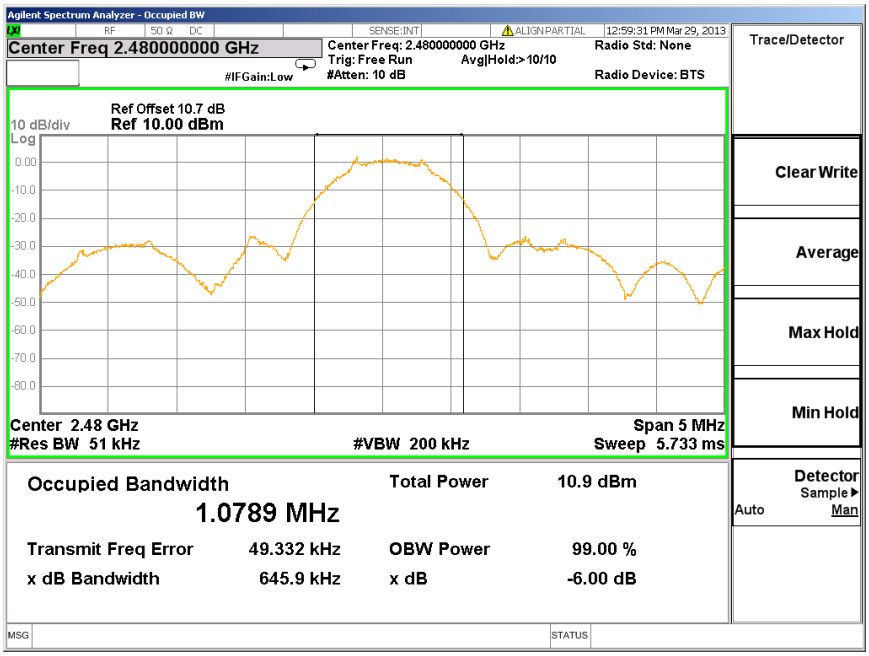
99% BANDWIDTH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



7.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

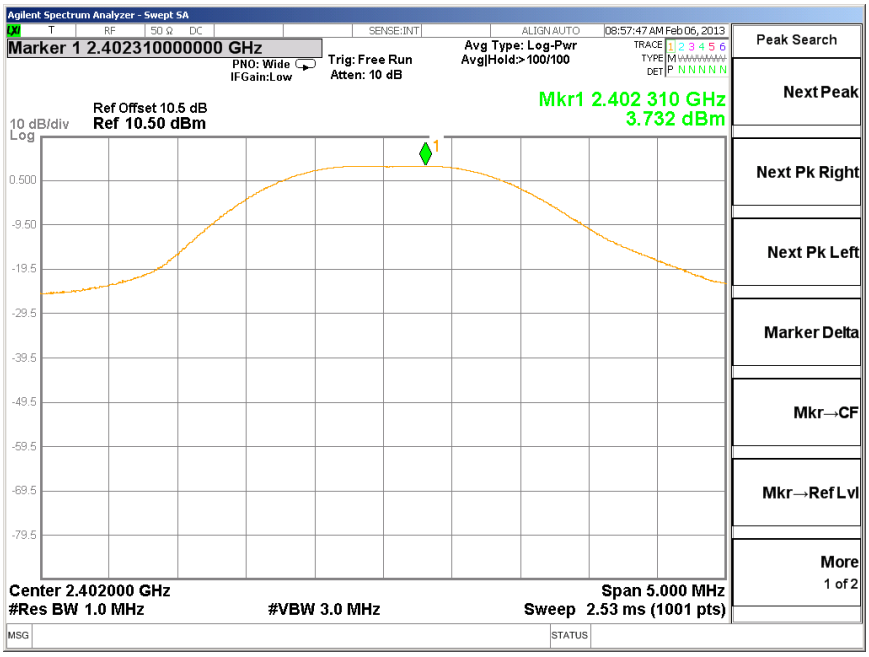
Peak Power is measured using procedure from KDB 558074 DTS Meas Guidance v02 Section 8.1.1 Option 1

RESULTS

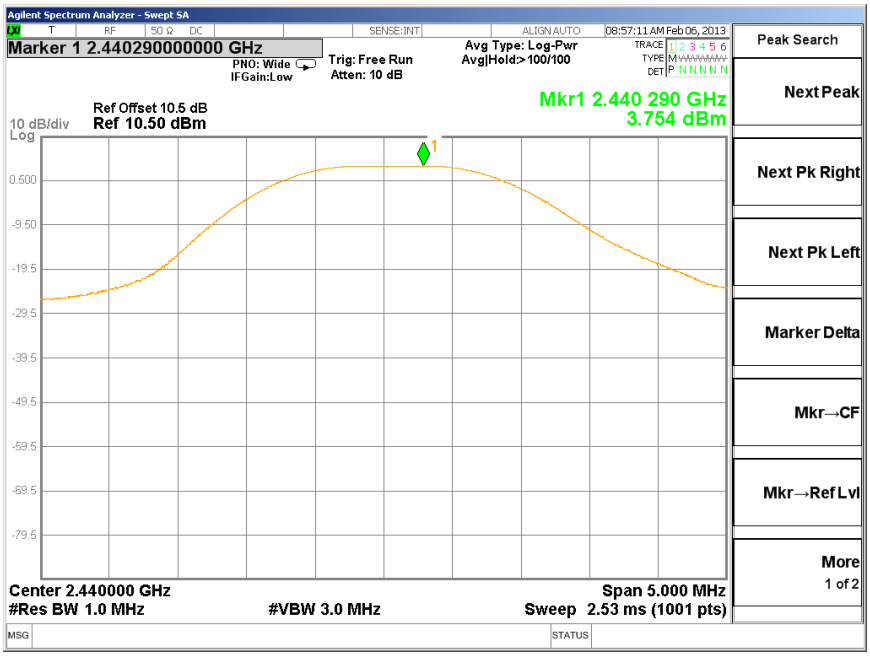
Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.732	30	-26.268
Middle	2440	3.754	30	-26.246
High	2480	3.466	30	-26.534

OUTPUT POWER

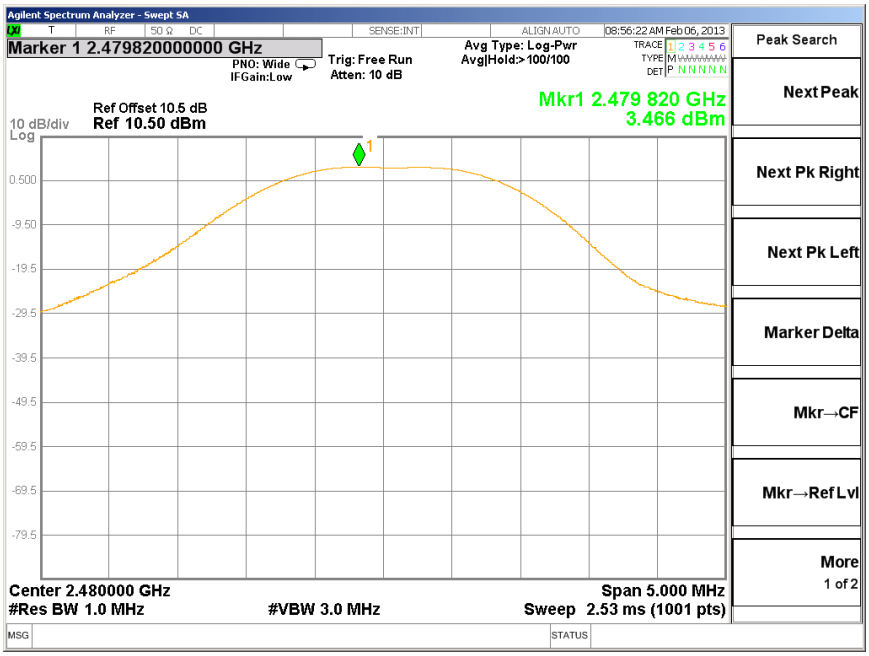
OUTPUT POWER LOW CH



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



7.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.80 dB (including 10 dB pad and 1.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.75
Middle	2440	3.5
High	2480	2.33

Average data above used a different measuring device from Output power measurements. But measurements are within MU for peak and average to be the roughly the same.

7.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

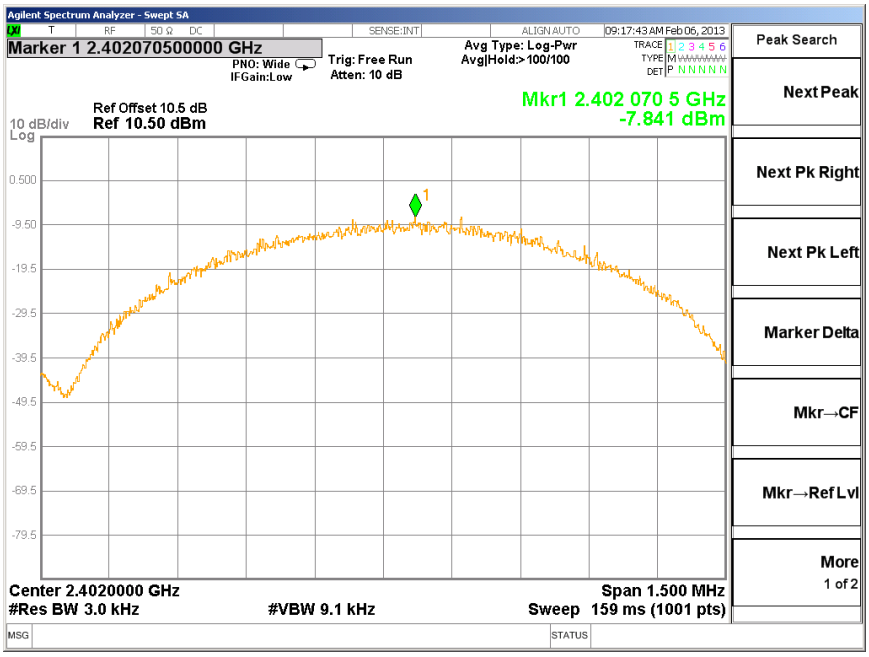
PSD Procedure used from KDB 558074 DTS Meas Guidance v02 Section 9.1 Option 1

RESULTS

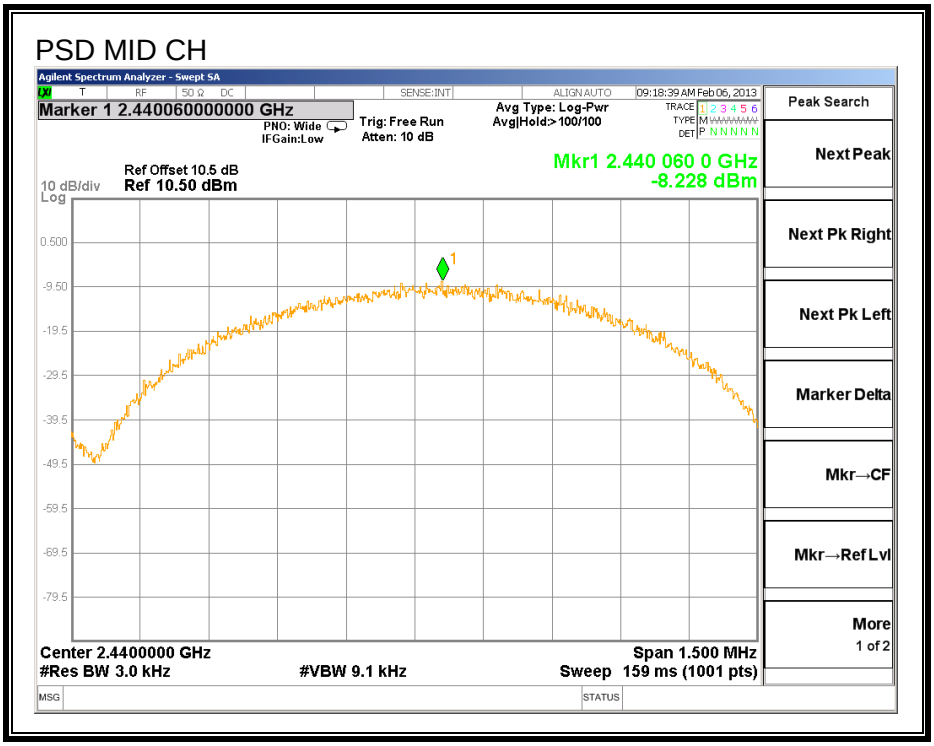
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-7.84	8	-15.84
Middle	2440	-8.23	8	-16.23
High	2480	-9.57	8	-17.57

POWER SPECTRAL DENSITY

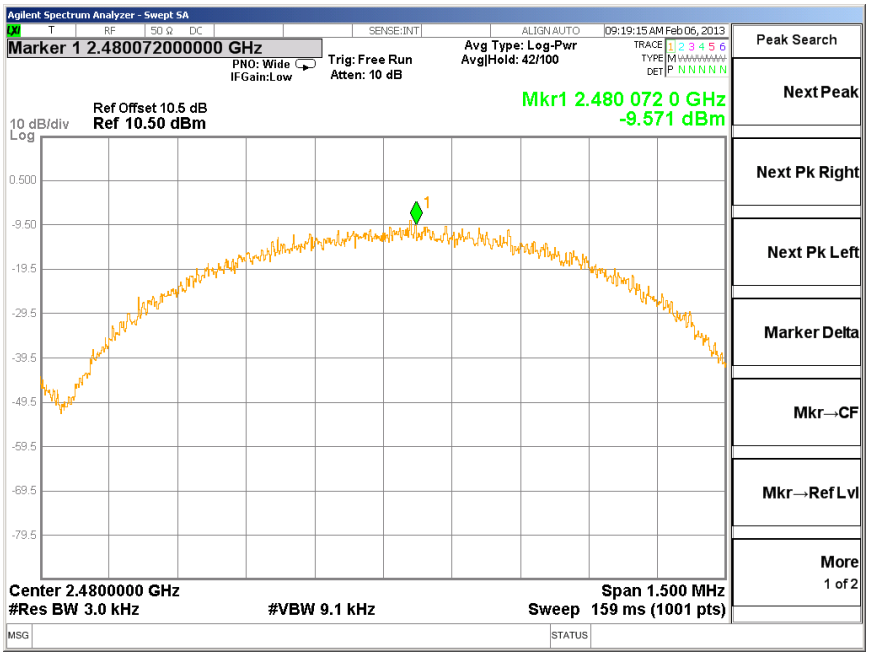
PSD LOW CH



PSD MID CH



PSD HIGH CH



7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

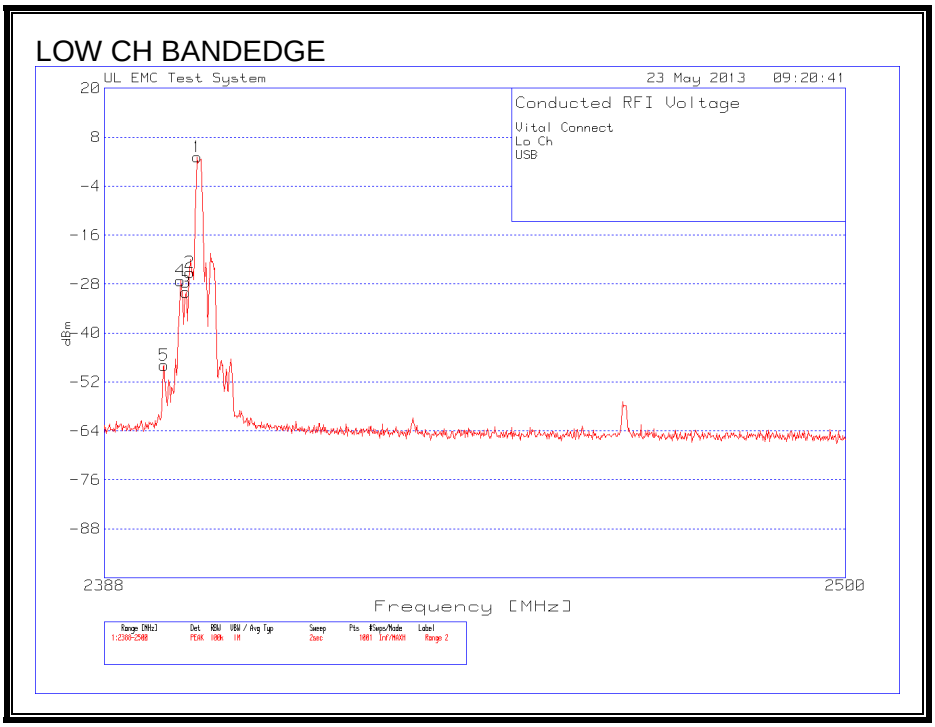
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 1 MHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

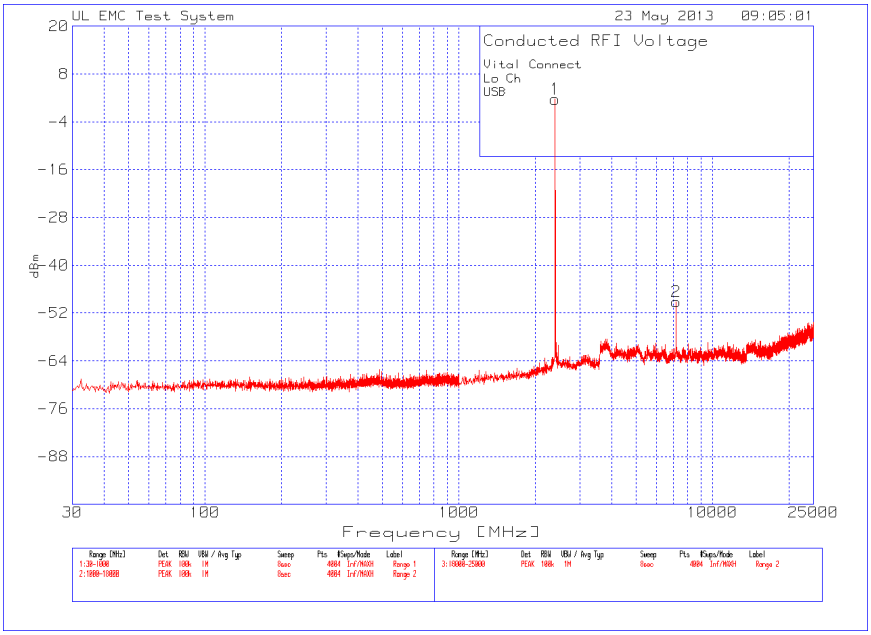
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



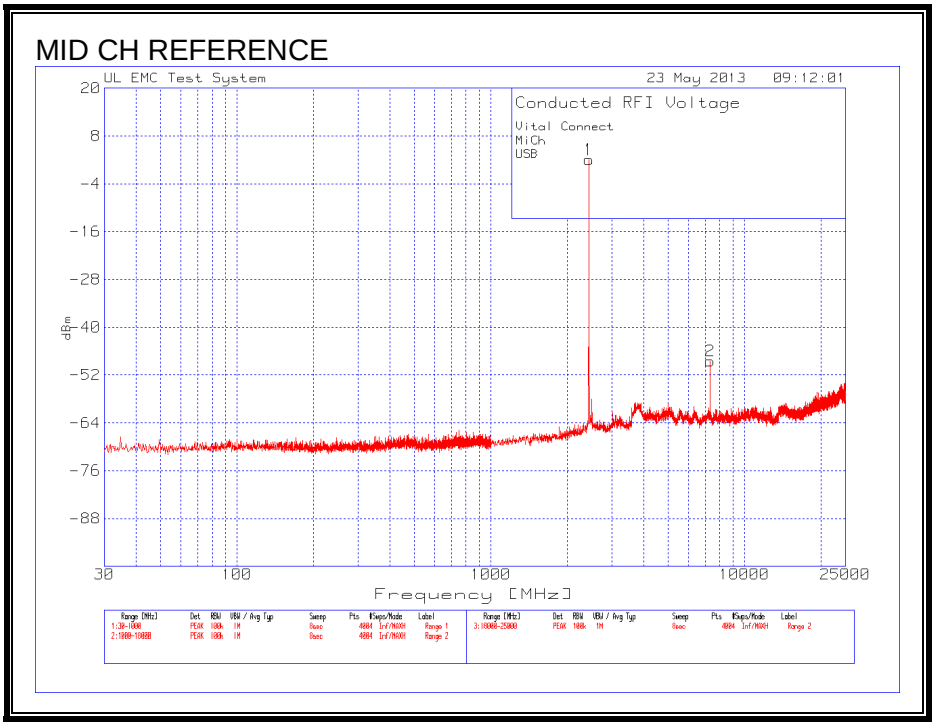
Vital Connect						
Lo Ch						
USB						
Range 2 2388 - 2500MHz						
Marker No.	Test Frequency	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2401.776	99.66	PK	-107	10.5	3.16
2	2400.656	71.33	PK	-107	10.5	-25.17
3	2400.096	66.54	PK	-107	10.5	-29.96
4	2399.312	69.34	PK	-107	10.5	-27.16
5	2396.848	48.59	PK	-107	10.5	-47.91
PK - Peak detector						

LOW CH SPURIOUS



Vital Connect						
Lo Ch						
USB						
Range 2 1000 - 18000MHz						
Marker No.	Test Frequency	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2401.449	98.18	PK	-107	10.5	1.68
2	7204.597	46.94	PK	-107	10.9	-49.16
PK - Peak detector						

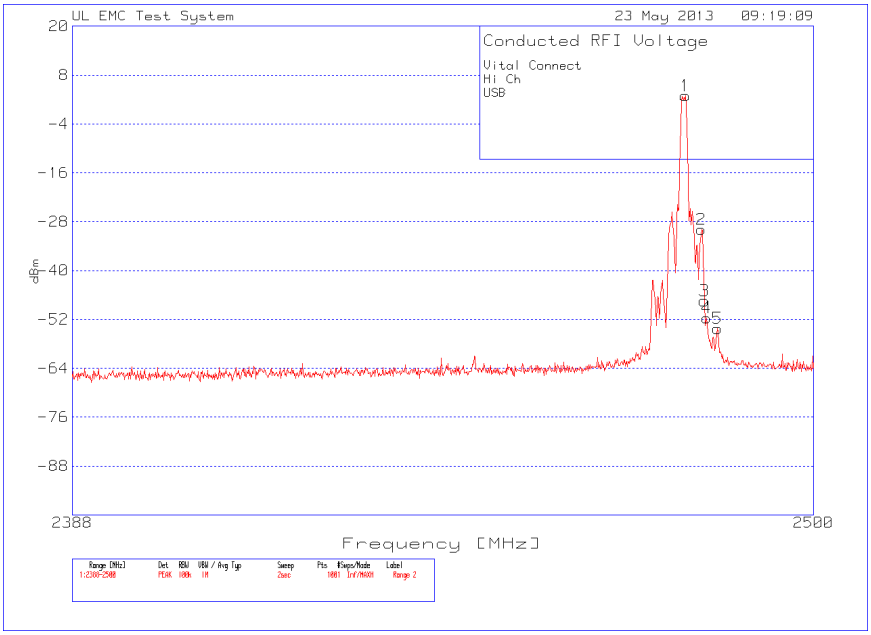
SPURIOUS EMISSIONS, MID CHANNEL



Vital Connect						
MiCh						
USB						
Range 2 1000 - 18000MHz						
Marker No.	Test Frequency	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2439.67	98.58	PK	-107	10.5	2.08
2	7319.261	47.5	PK	-107	11	-48.5
PK - Peak detector						

SPURIOUS EMISSIONS, HIGH CHANNEL

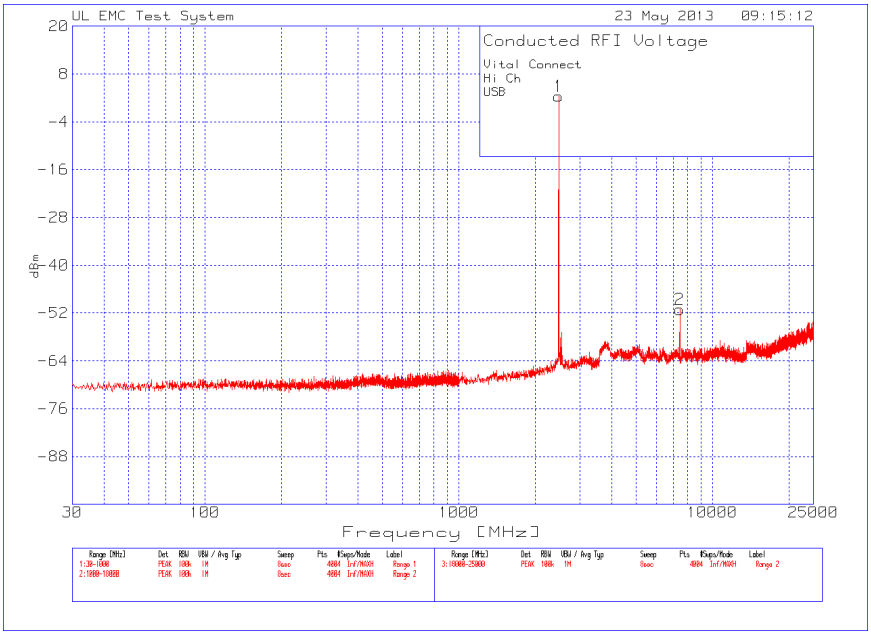
HIGH CH BANDEDGE



Plot is mislabeled, should be Hi CH.

Vital Connect						
Hi Ch						
USB						
Range 2 2388 - 2500MHz						
Marker No.	Test Frequency	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2480.288	99.47	PK	-107	10.5	2.97
2	2482.752	66.6	PK	-107	10.5	-29.9
3	2483.2	49.1	PK	-107	10.5	-47.4
4	2483.536	44.9	PK	-107	10.5	-51.6
5	2485.216	42.15	PK	-107	10.6	-54.25
PK - Peak detector						

HIGH CH SPURIOUS



Vital Connect						
Hi Ch						
USB						
Range 2 1000 - 18000MHz						
Marker No.	Test Frequency	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2477.892	98.91	PK	-107	10.5	2.41
2	7438.171	45.01	PK	-107	10.9	-51.09
PK - Peak detector						

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 1 Hz for average measurements.

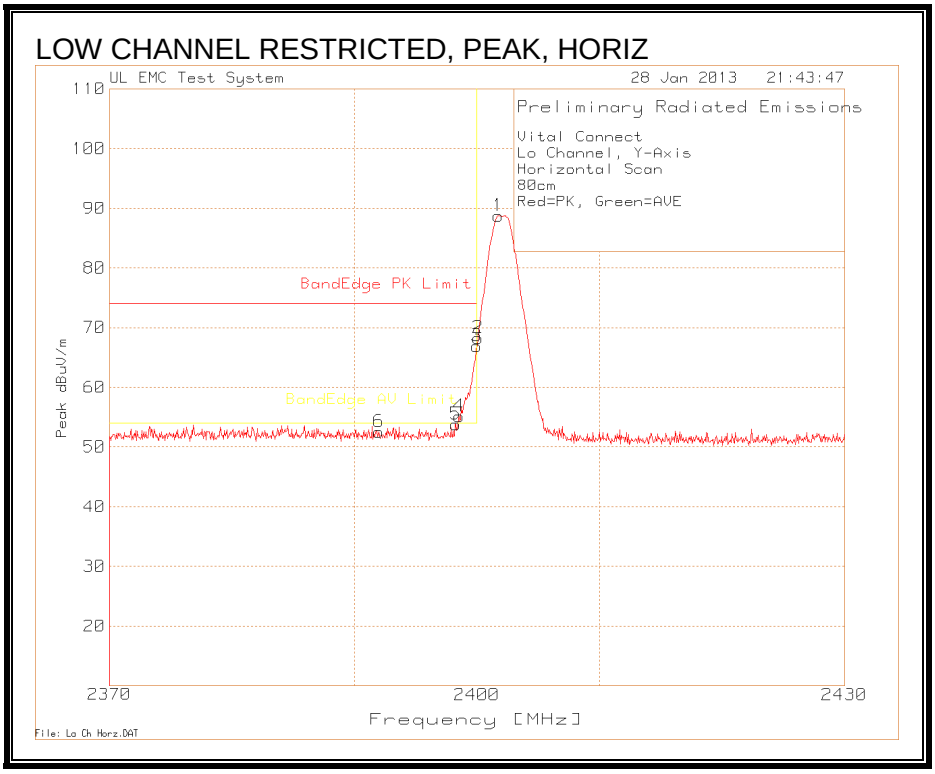
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

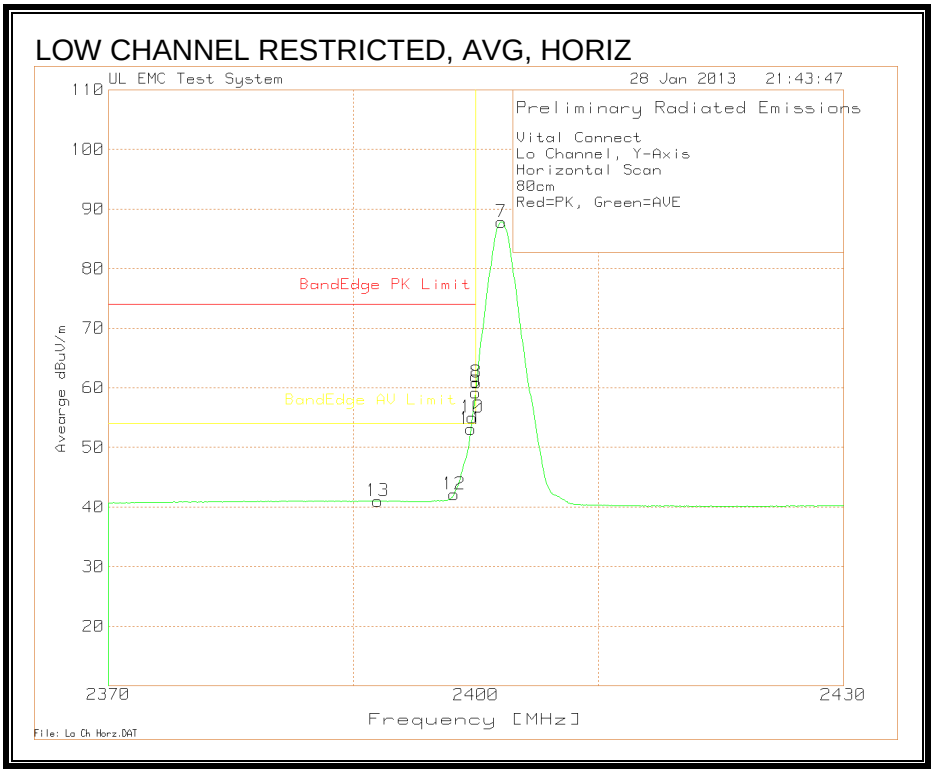
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TX ABOVE 1 GHz FOR BLUETOOTH LOW ENERGY MODE IN THE 2.4 GHz BAND

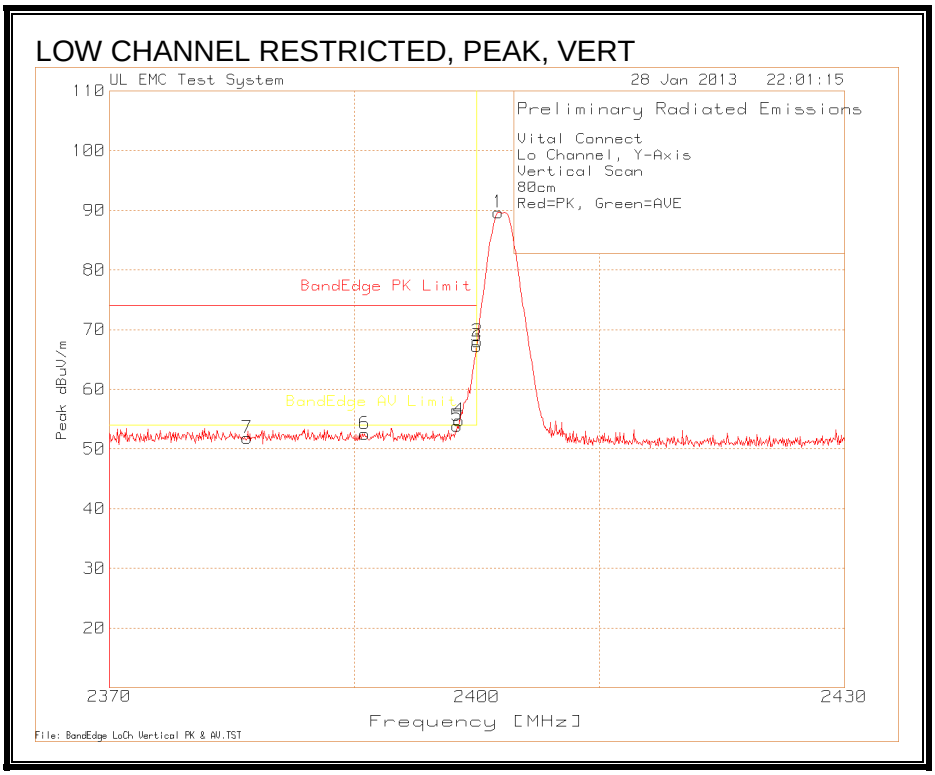
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



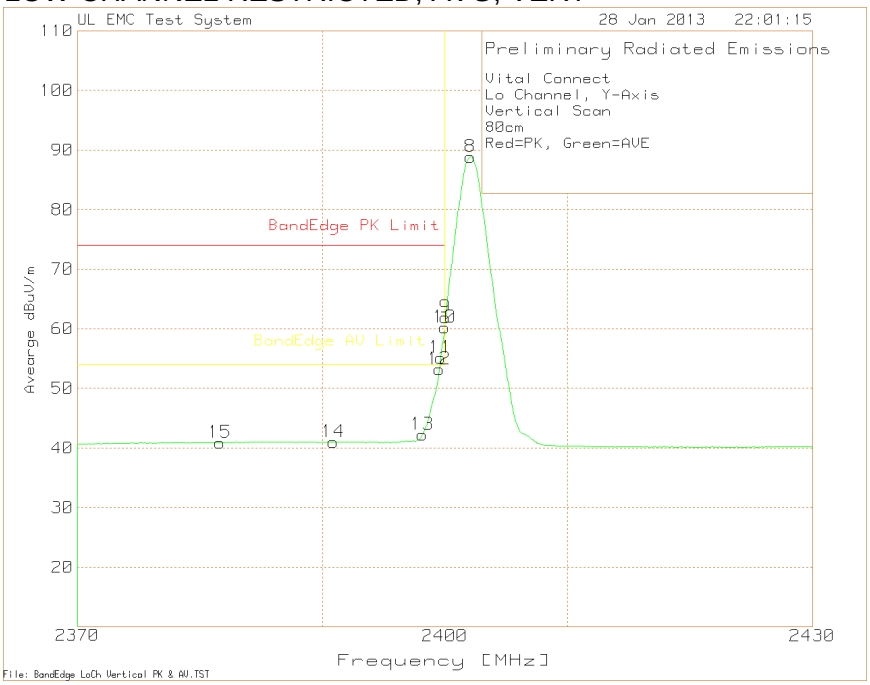


Vital Connect										
Lo Channel, Y-Axis										
Horizontal Scan										
80cm										
Red=PK, Green=AVE										
Peak 2370 - 2430MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	Height [cm]	Polarity
1	2401.772	62.68	PK	21.8	4.27	88.75	-	-	100	Horz
2	2400.09	42.11	PK	21.8	4.31	68.22	-	-	100	Horz
3	2399.97	40.83	PK	21.8	4.31	66.94	74	-7.06	100	Horz
4	2398.529	29.03	PK	21.8	4.35	55.18	74	-18.82	100	Horz
5	2398.288	27.61	PK	21.8	4.35	53.76	74	-20.24	100	Horz
6	2391.982	26.27	PK	21.8	4.51	52.58	74	-21.42	100	Horz
Avearge 2370 - 2430MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge AV Limit	Margin	Height [cm]	Polarity
7	2402.102	61.82	AV	21.8	4.26	87.88	-	-	100	Horz
8	2400.03	34.84	AV	21.8	4.31	60.95	-	-	100	Horz
9	2399.97	33.08	AV	21.8	4.31	59.19	-	-	100	Horz
10	2399.73	28.94	AV	21.8	4.32	55.06	-	-	100	Horz
11	2399.61	26.97	AV	21.8	4.32	53.09	-	-	100	Horz
12	2398.228	15.93	AV	21.8	4.36	42.09	-	-	100	Horz
13	2391.982	14.71	AV	21.8	4.51	41.02	54	-12.98	100	Horz

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

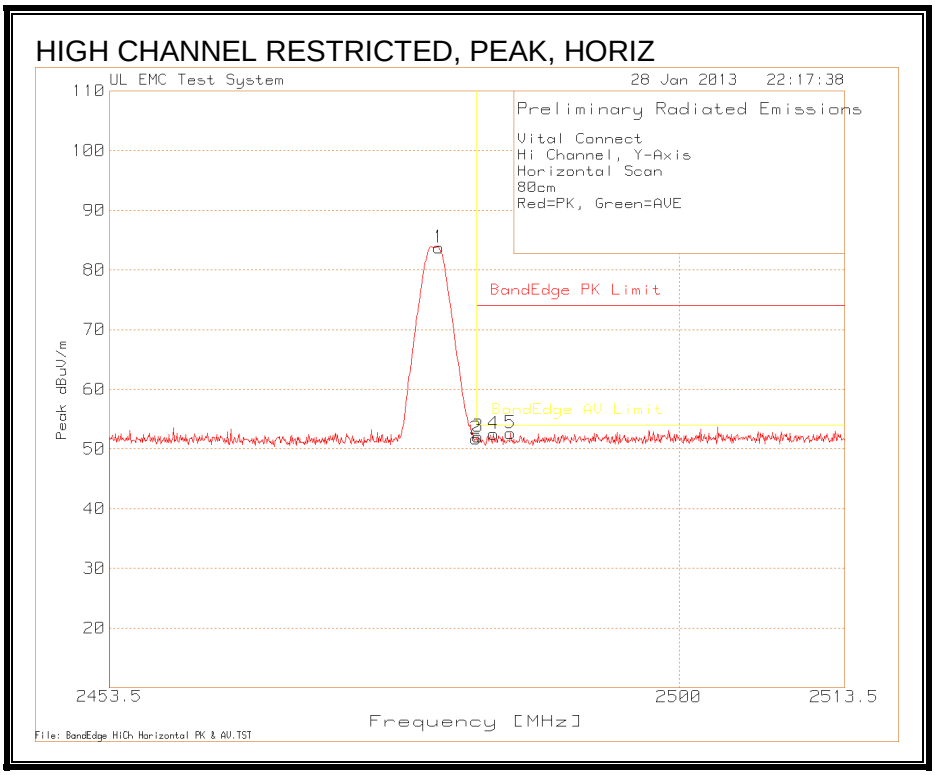


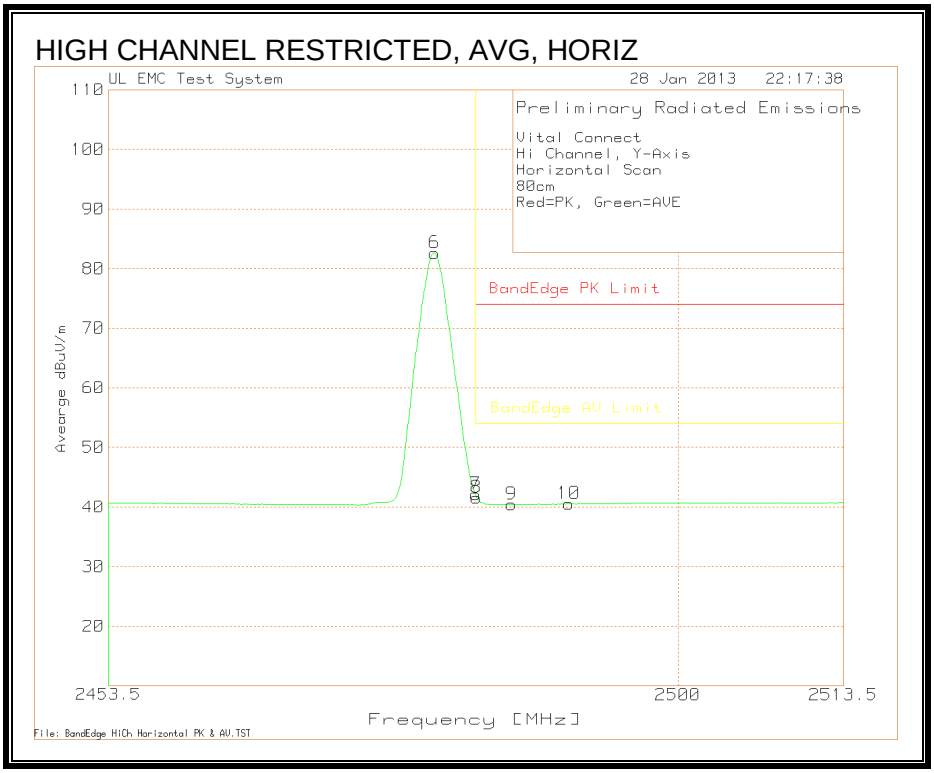
LOW CHANNEL RESTRICTED, AVG, VERT



Vital Connect										
Lo Channel, Y-Axis										
Vertical Scan										
80cm										
Red=PK, Green=AVE										
Peak 2370 - 2430MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	Height [cm]	Polarity
1	2401.772	63.56	PK	21.8	4.27	89.63	999	-909.37	100	Vert
2	2400.03	41.89	PK	21.8	4.31	68	999	-931	100	Vert
3	2399.97	41.17	PK	21.8	4.31	67.28	74	-6.72	100	Vert
4	2398.529	28.62	PK	21.8	4.35	54.77	74	-19.23	100	Vert
5	2398.408	27.69	PK	21.8	4.35	53.84	74	-20.16	100	Vert
6	2390.841	26.25	PK	21.8	4.5	52.55	74	-21.45	100	Vert
7	2381.231	25.71	PK	21.8	4.33	51.84	74	-22.16	150	Vert
Avearge 2370 - 2430MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge AV Limit	Margin	Height [cm]	Polarity
8	2402.102	62.81	AV	21.8	4.26	88.87	-	-	100	Vert
9	2400.03	35.81	AV	21.8	4.31	61.92	-	-	100	Vert
10	2399.97	34.15	AV	21.8	4.31	60.26	-	-	100	Vert
11	2399.67	29.07	AV	21.8	4.32	55.19	-	-	100	Vert
12	2399.55	27.07	AV	21.8	4.32	53.19	-	-	100	Vert
13	2398.168	16.05	AV	21.8	4.36	42.21	-	-	100	Vert
14	2390.901	14.71	AV	21.8	4.5	41.01	-	-	100	Vert
15	2381.652	14.8	AV	21.8	4.34	40.94	54	-13.06	100	Vert

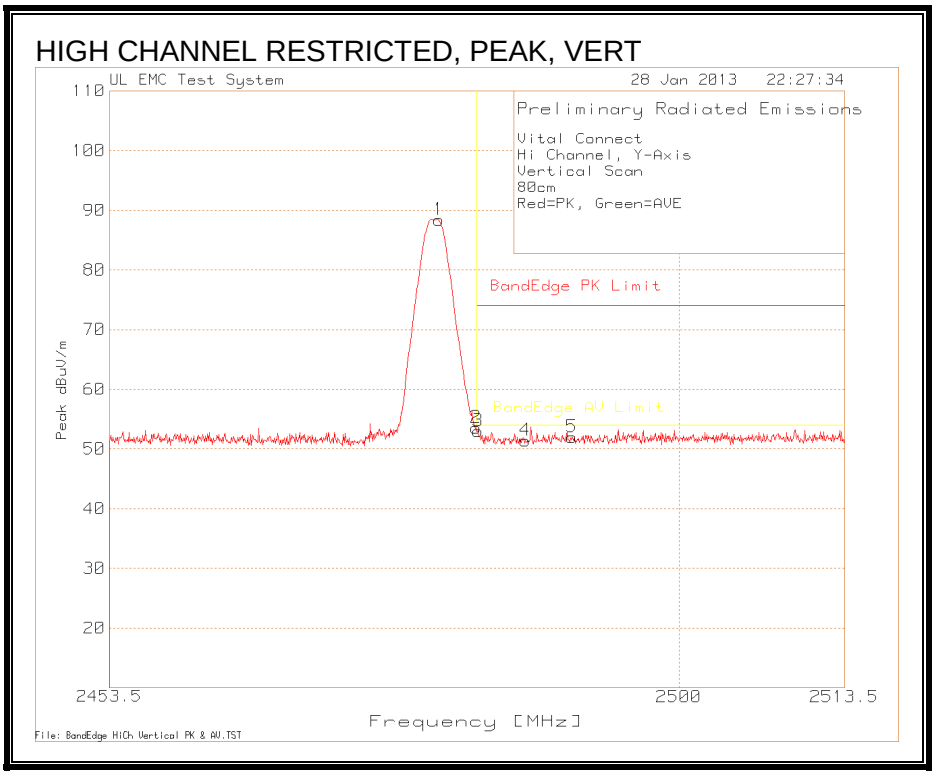
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



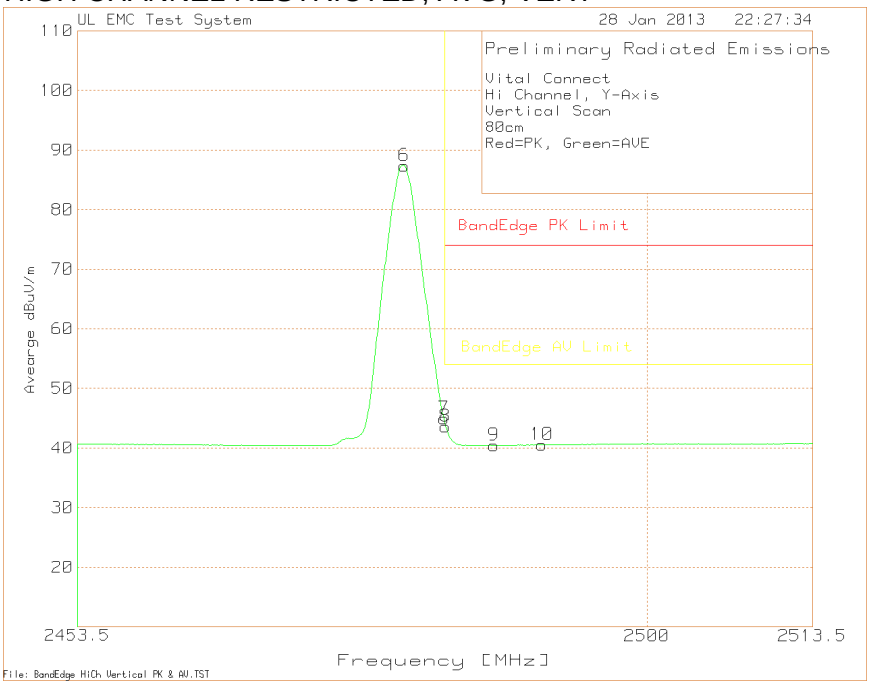


Vital Connect										
Hi Channel, Y-Axis										
Horizontal Scan										
80cm										
Red=PK, Green=AVE										
Peak 2453.5 - 2513.5MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	Height [cm]	Polarity
1	2480.407	57.99	PK	22	3.77	83.76	-	-	99	Horz
2	2483.41	25.86	PK	22.1	3.77	51.73	-	-	99	Horz
3	2483.59	26.27	PK	22.1	3.77	52.14	74	-21.86	150	Horz
4	2484.851	26.64	PK	22.1	3.77	52.51	74	-21.49	150	Horz
5	2486.233	26.83	PK	22.1	3.77	52.7	74	-21.3	150	Horz
Avearge 2453.5 - 2513.5MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2480.107	56.83	AV	22	3.77	82.6	-	-	100	Horz
7	2483.47	16.22	AV	22.1	3.77	42.09	-	-	100	Horz
8	2483.53	15.75	AV	22.1	3.77	41.62	54	-12.38	100	Horz
9	2486.413	14.58	AV	22.1	3.77	40.45	54	-13.55	150	Horz
10	2491.068	14.6	AV	22.1	3.82	40.52	54	-13.48	150	Horz

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

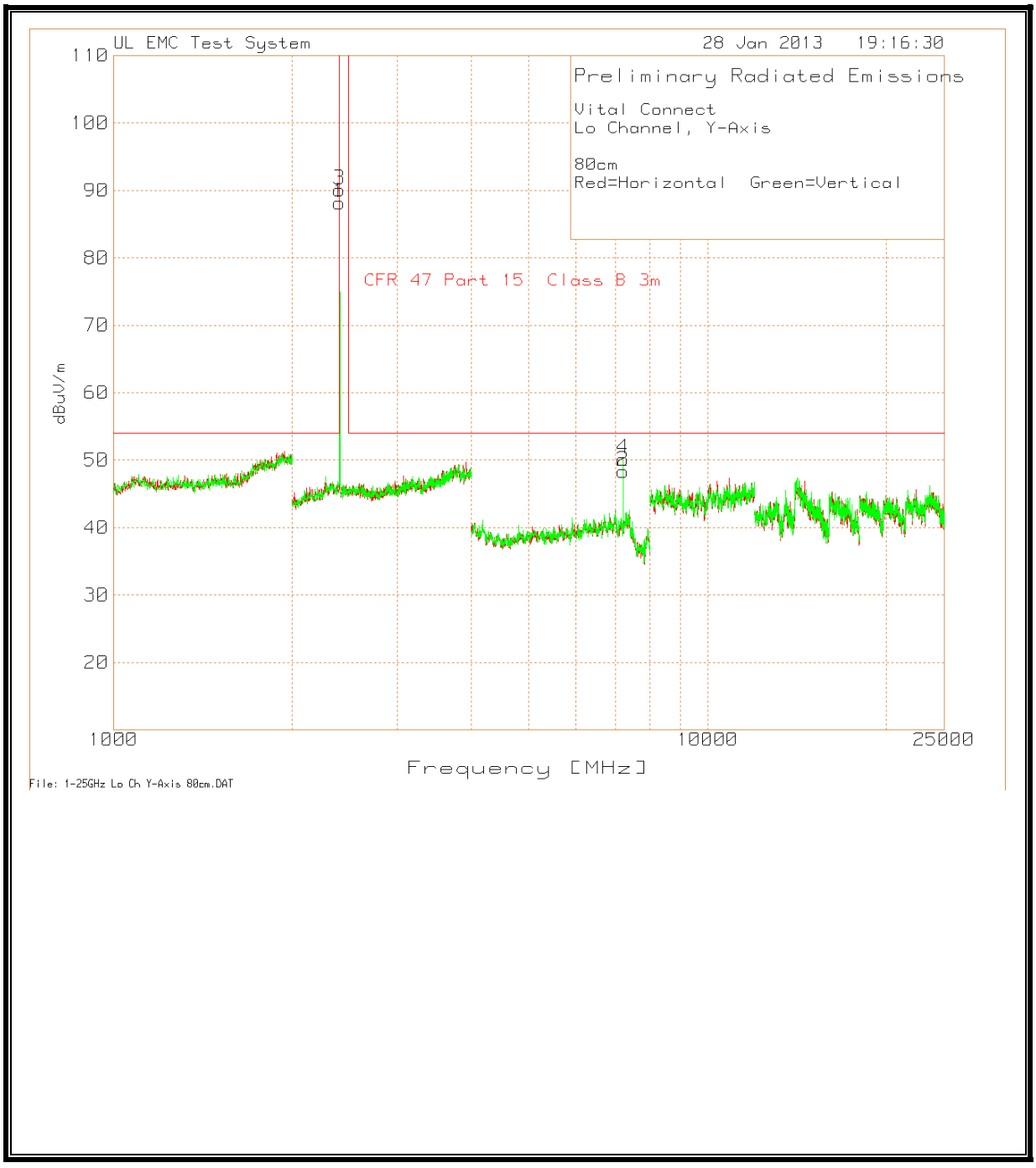


HIGH CHANNEL RESTRICTED, AVG, VERT

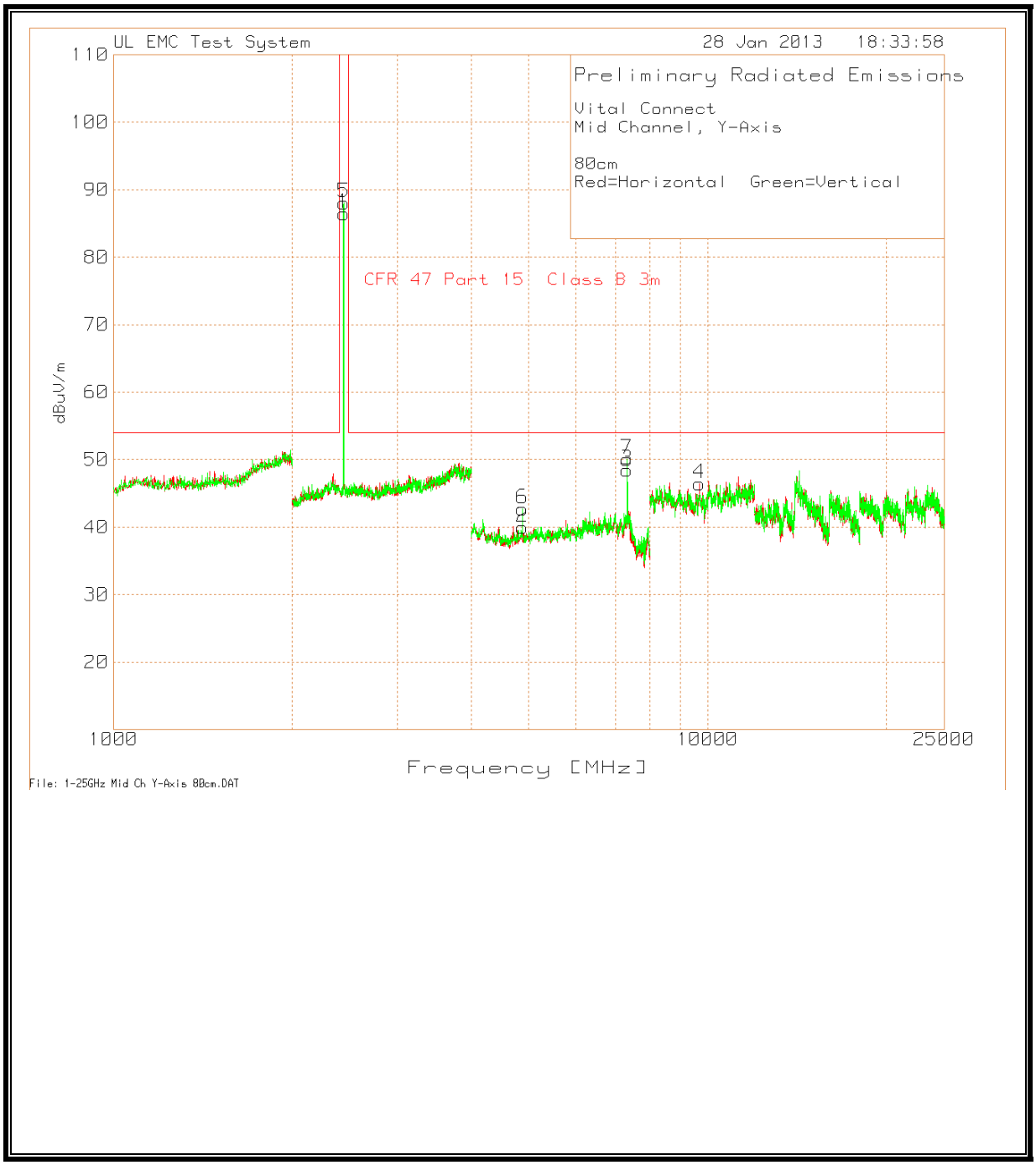


Vital Connect										
Hi Channel, Y-Axis										
Vertical Scan										
80cm										
Red=PK, Green=AVE										
Peak 2453.5 - 2513.5MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	Height [cm]	Polarity
1	2480.407	62.59	PK	22	3.77	88.36	-	-	100	Vert
2	2483.41	27.64	PK	22.1	3.77	53.51	-	-	150	Vert
3	2483.59	27.1	PK	22.1	3.77	52.97	74	-21.03	150	Vert
4	2487.434	25.51	PK	22.1	3.77	51.38	74	-22.62	100	Vert
5	2491.278	26.09	PK	22.1	3.83	52.02	74	-21.98	100	Vert
Avearge 2453.5 - 2513.5MHz										
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2480.167	61.66	AV	22	3.77	87.43	-	-	100	Vert
7	2483.41	19.13	AV	22.1	3.77	45	-	-	100	Vert
8	2483.53	17.78	AV	22.1	3.77	43.65	54	-10.35	100	Vert
9	2487.494	14.59	AV	22.1	3.77	40.46	54	-13.54	100	Vert
10	2491.398	14.62	AV	22.1	3.83	40.55	54	-13.45	100	Vert

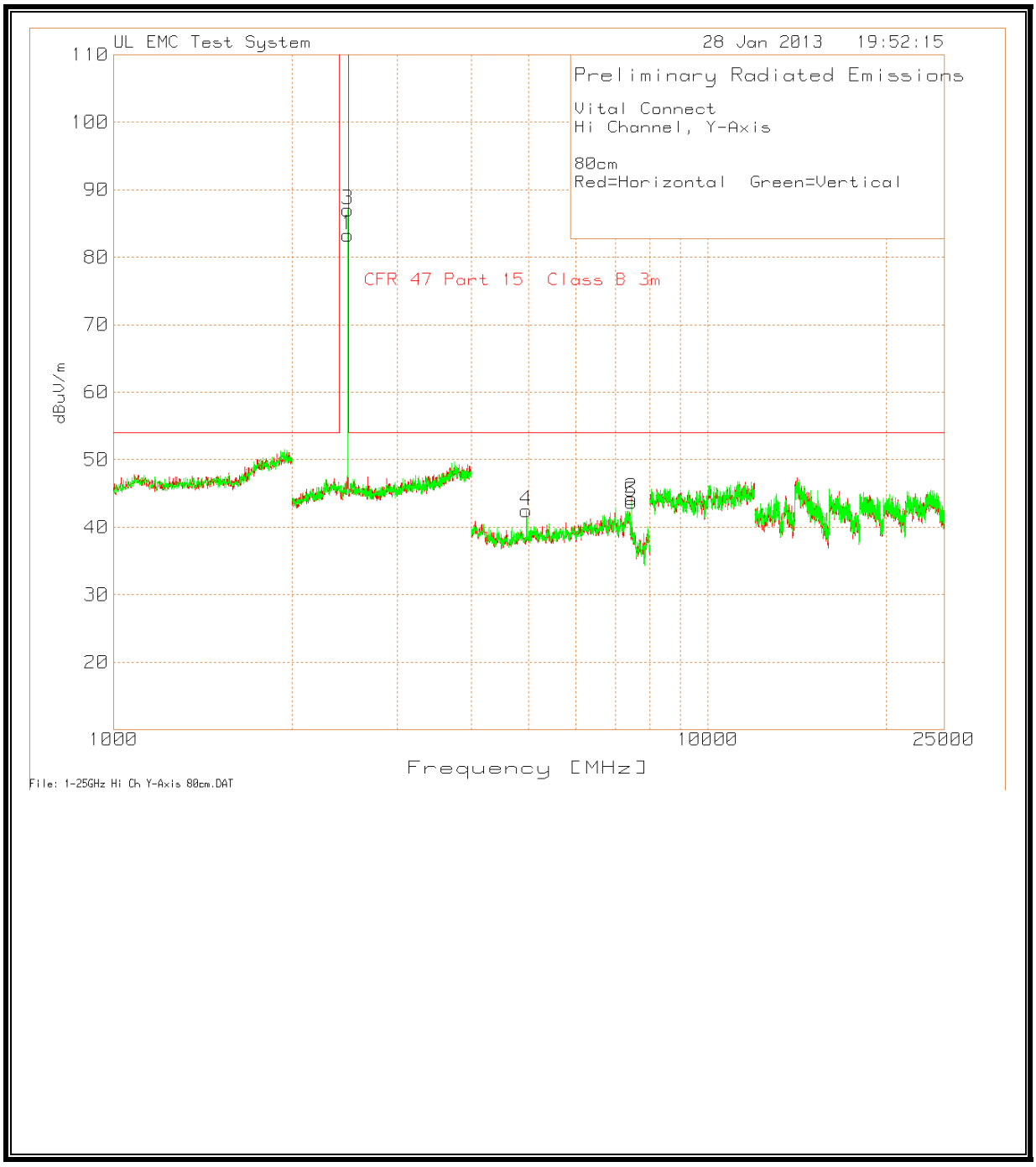
HARMONICS AND SPURIOUS EMISSIONS



Vital Connect										
Lo Channel, Y-Axis										
80cm										
Red=Horizontal Green=Vertical										
Marker No.	Test Frequency	Meter Reading	Detector	Antenna Factor	BOMS Factor (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
1	2402.402	62.08	PK	21.8	4.25	88.13	-	-	100	Horz
2	7207.207	65.95	PK	29.8	-47.45	48.3	54	-5.7	100	Horz
3	2400.4	64	PK	21.8	4.3	90.1	-	-	100	Vert
4	7207.207	67.81	PK	29.8	-47.45	50.16	54	-3.84	100	Vert
Test Frequency	Meter Reading	Detector	Antenna Factor	BOMS Factor [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Azimuth [Degs]	Height [cm]	Polarity
7205.4499	69.4	PK	29.7	-47.37	51.73	54	-2.27	75	100	Horz
7205.9669	62.97	LnAv	29.7	-47.39	45.28	54	-8.72	75	100	Horz
7206.7665	70.38	PK	29.8	-47.43	52.75	54	-1.25	22	100	Vert
7206.0752	64.48	LnAv	29.7	-47.4	46.78	54	-7.22	22	100	Vert
PK - Peak detector										
LnAv - Linear Average detector										



Vital Connect										
Mid Channel, Y-Axis										
80cm										
Red=Horizontal Green=Vertical										
Marker No.	Test Frequency	Meter Reading	Detector	Antenna Factor	BOMS Factor (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
1	2440.44	60.27	PK	21.9	4.25	86.42	999	-912.58	100	Horz
2	4880.881	63.53	PK	27.7	-51.26	39.97	54	-14.03	100	Horz
3	7319.319	64.1	PK	30.6	-46.25	48.45	54	-5.55	100	Horz
4	9677.678	58.53	PK	36.4	-48.52	46.41	54	-7.59	150	Horz
5	2440.44	61.86	PK	21.9	4.25	88.01	999	-910.99	100	Vert
6	4876.877	66.21	PK	27.7	-51.16	42.75	54	-11.25	100	Vert
7	7323.323	65.63	PK	30.6	-46.23	50	54	-4	100	Vert
Test Frequency	Meter Reading	Detector	Antenna Factor	BOMS Factor [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Azimuth [Degs]	Height [cm]	Polarity
7319.4078	66.37	PK	30.6	-46.25	50.72	54	-3.28	80	100	Horz
7319.8587	58.57	LnAv	30.6	-46.24	42.93	54	-11.07	80	100	Horz
7319.4439	66.67	PK	30.6	-46.25	51.02	54	-2.98	126	102	Vert
7320.0271	59.5	LnAv	30.6	-46.24	43.86	54	-10.14	126	102	Vert
PK - Peak detector										
LnAv - Linear Average detector										



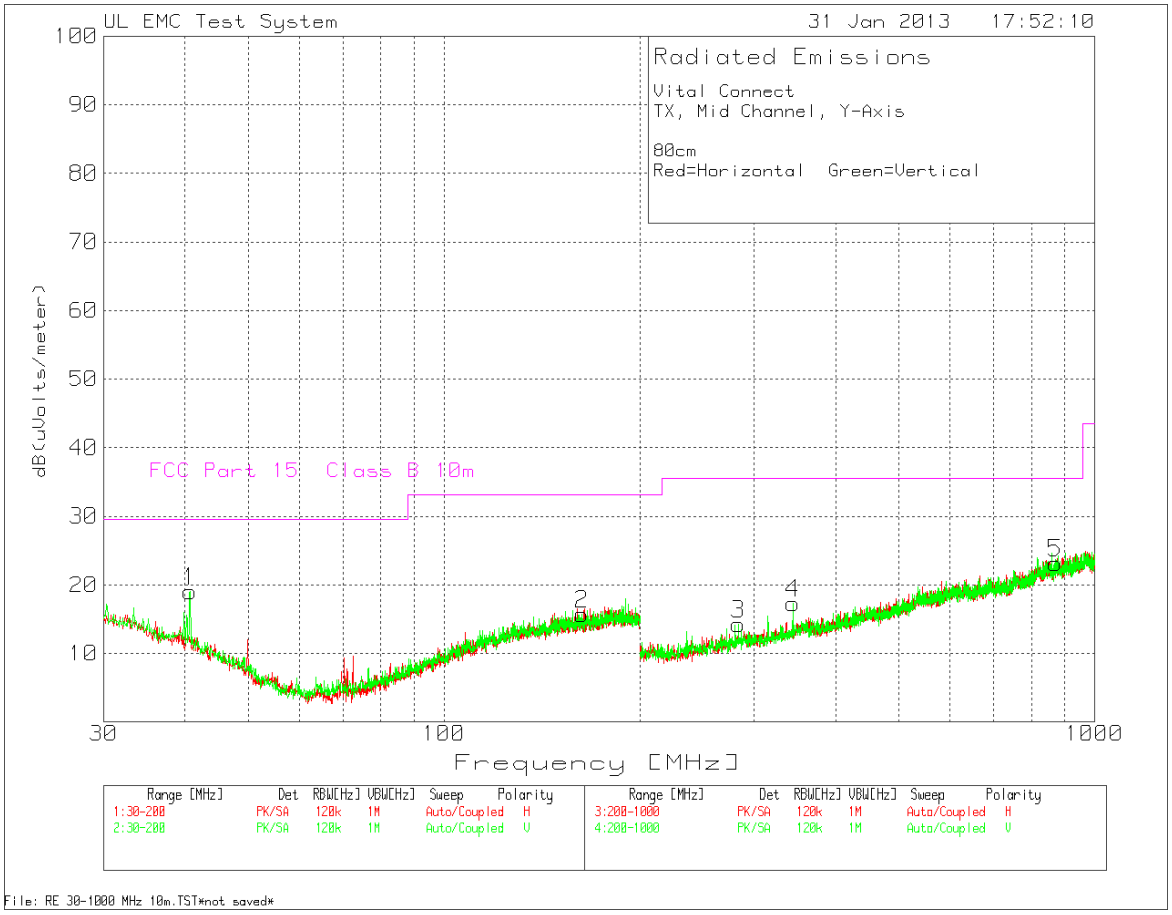
Peak Emissions scan is at least 6dB below the limit

8.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

Config#2

PLOT

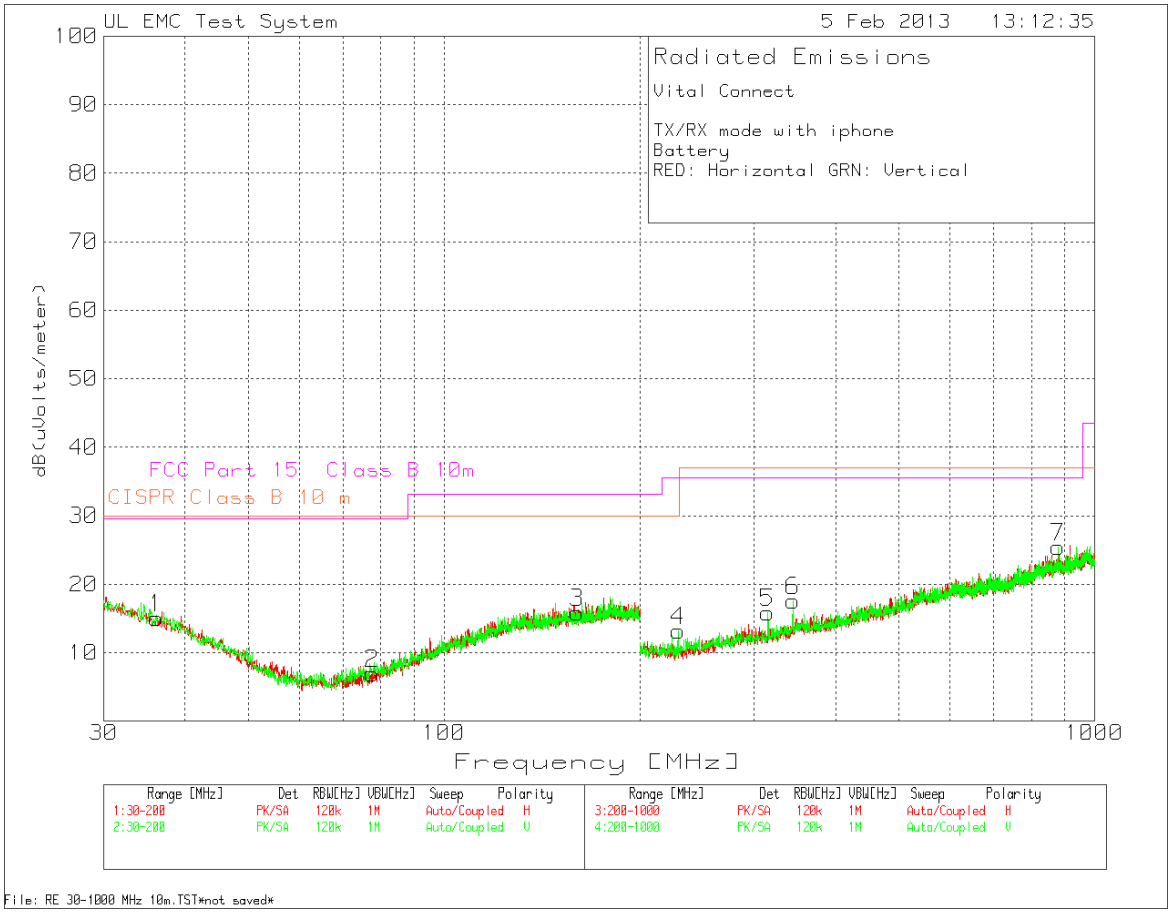


Peak Emissions scan is at least 6dB below the limit.

8.4. DIGITAL DEVICE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, HORIZONTAL)

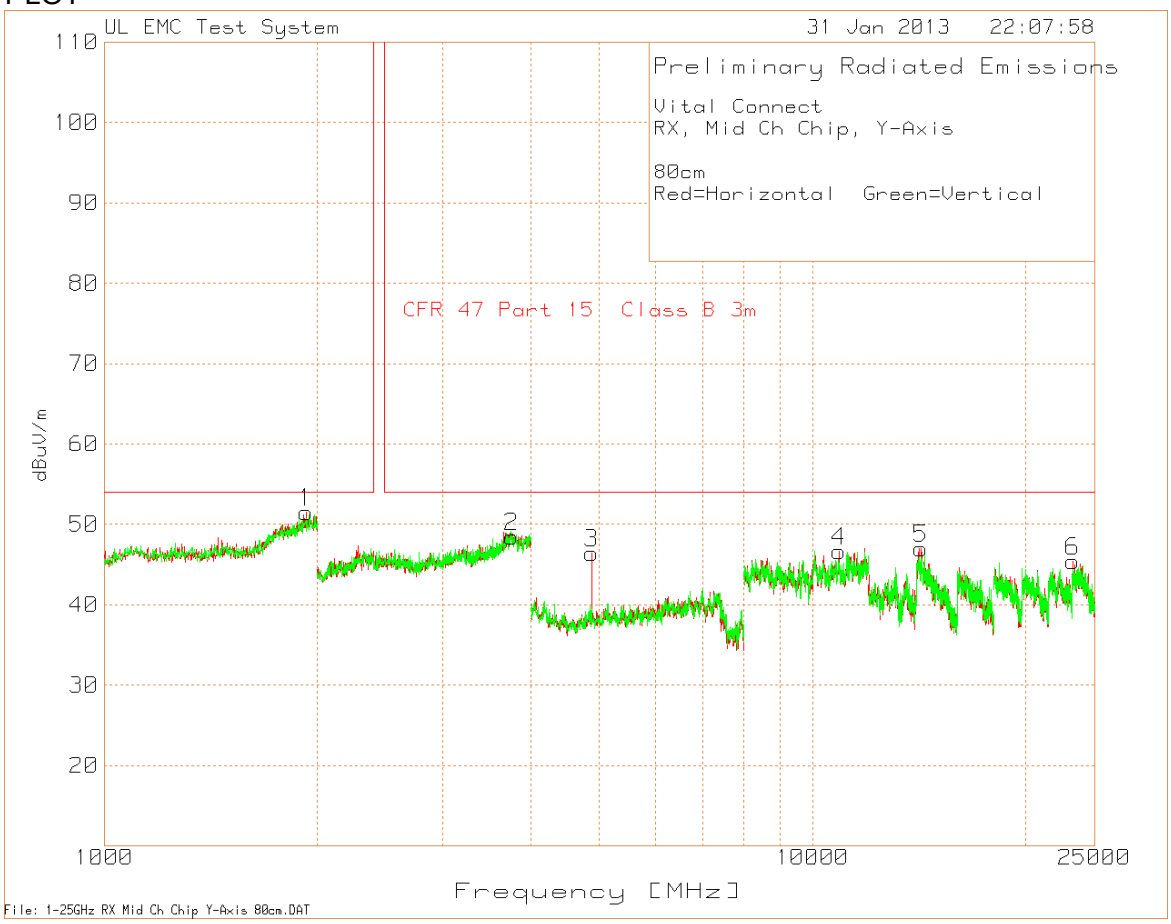
HORIZONTAL PLOT



Peak Emissions scan is at least 6dB below the limit.

SPURIOUS EMISSIONS 1GHz TO 25GHz (DIGITAL DEVICE)

PLOT



Peak Emissions scan is at least 6dB below the limit.

9. MAXIMUM PERMISSIBLE RF EXPOSURE

9.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

9.2. IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

9.3. EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

9.4. LIMITS AND IC EXEMPTION

VARIABLE LIMITS

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency:

824 MHz / 1500 = 0.55 mW/cm^2 (FCC)
824 MHz / 150 = 5.5 W/m^2 (IC).

FIXED LIMITS

For operation in the PCS band, the 2.4 GHz band and the 5 GHz bands:

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2
From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

INDUSTRY CANADA EXEMPTION

RSS-102 Clause 2.5.2 RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W.

10. RF EXPOSURE RESULTS

KDB 447498 D01 v05
App A table
2450MHz, 5mm Limit is 10mW for SAR exclusion. Therefore the EUT is excluded because the output power (2.51mW) is under the limit

Section 4.3.1(1)

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[16] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[17]
   - The result is rounded to one decimal place for comparison

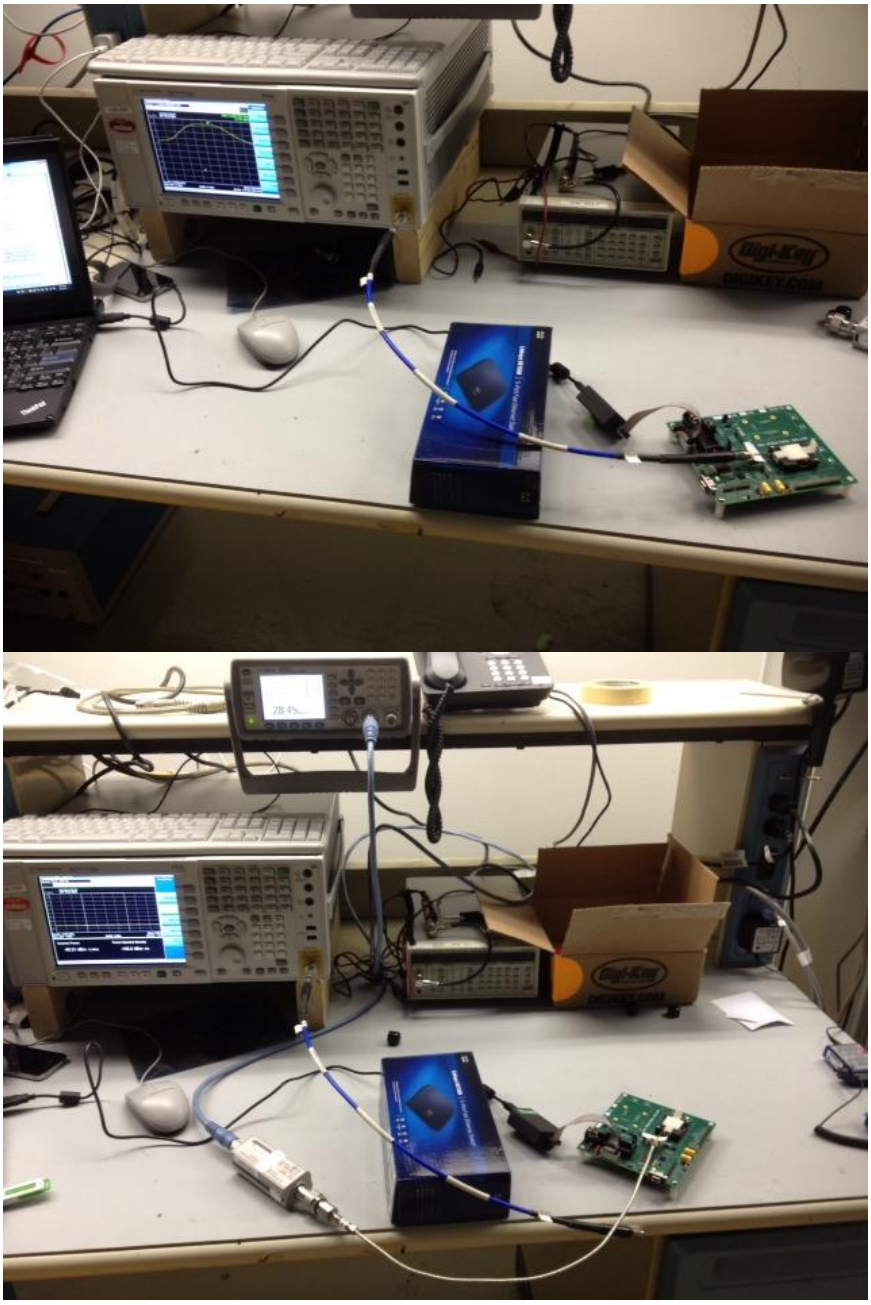
   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

(2.51mW)/(5mm)(sqrt 2.450GHz)=0.32 which is <3.0

11. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

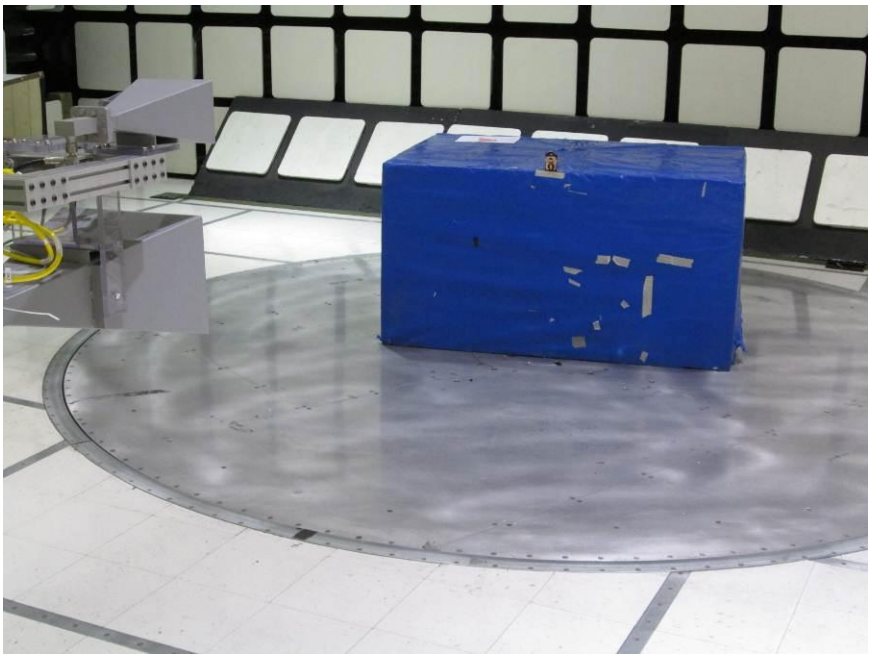
ANTENNA PORT CONDUCTED PHOTO



RADIATED RF MEASUREMENT SETUP

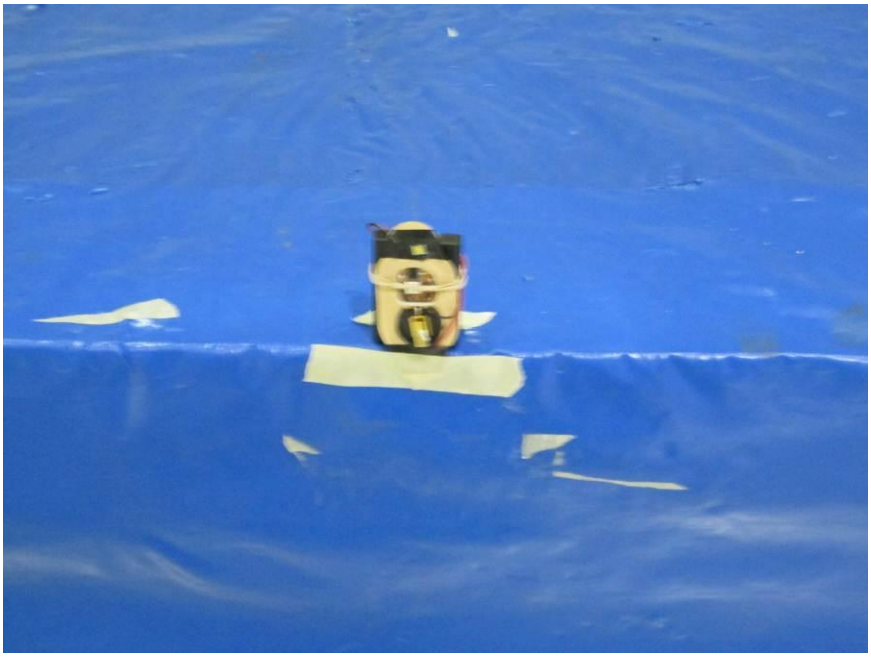
RADIATED Below 1GHz

RADIATED Above 1GHz

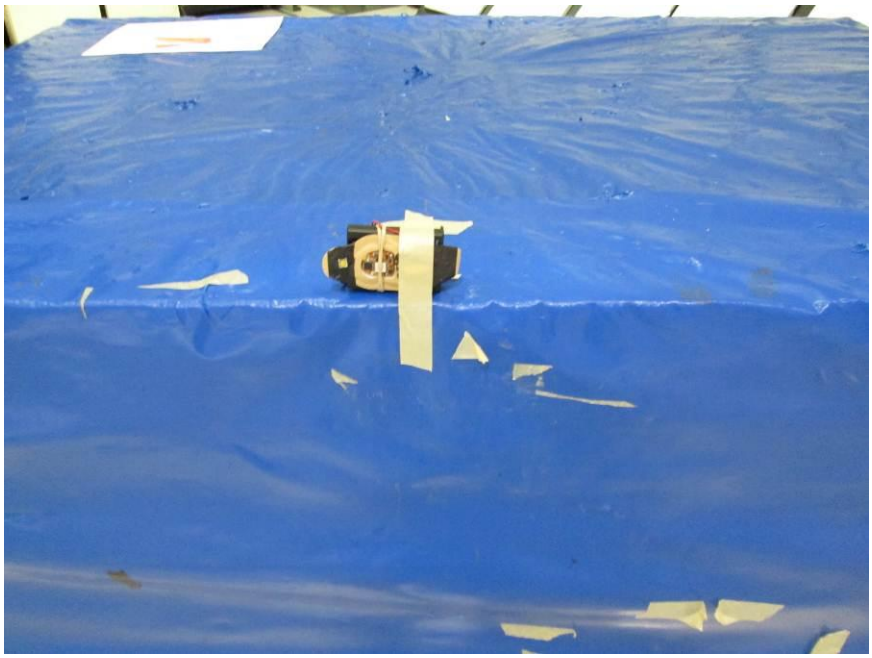


RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION

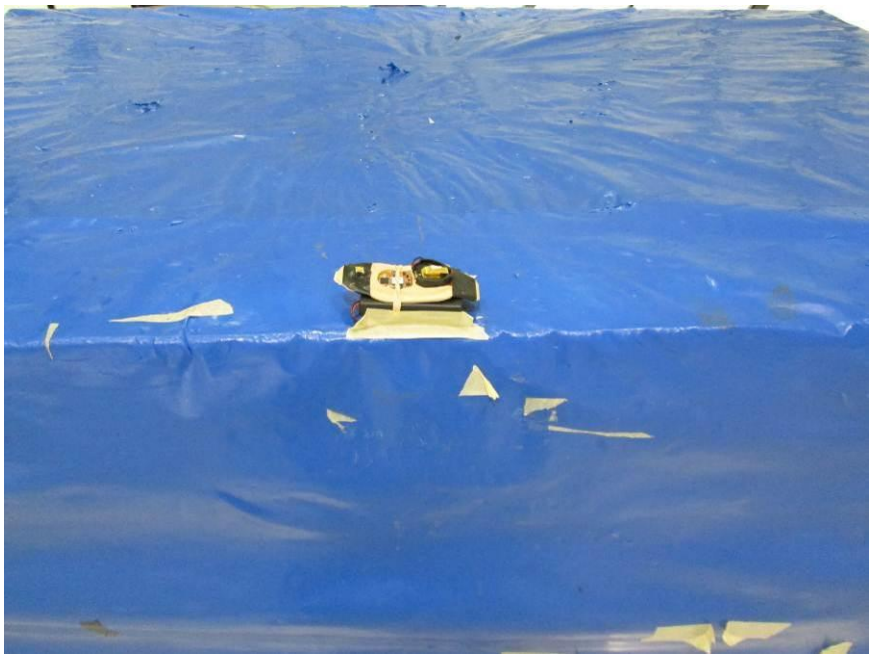
X-AXIS FRONT PHOTO



Y-AXIS FRONT PHOTO



Z-AXIS FRONT PHOTO



END OF REPORT