



LSRESEARCH, LLC

Wireless Product Development

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ENGINEERING TEST REPORT # 313025 A

LSR Job #: C-1651

Compliance Testing of:

Vitality Wireless RF Module (ZRF)

Test Date(s):

April 25, May 7-9 and 20, 2013

Prepared For:

Vigil Health Solutions, Inc.
Attn: Jason Cai / Steven Smith
2102-4464 Markham St.
Victoria, British Columbia
Canada V8Z 7X8

This Test Report is issued under the Authority of: Adam Alger, EMC Engineer

Signature:

Date: 6-11-13

Test Report Reviewed by:

Shane Rismeyer, EMC Engineer

Signature:

Date: 6-3-13

Report by:

Adam Alger, EMC Engineer

Signature:

Date: 5-28-13

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Prepared For: Vigil Health Solutions, Inc.

Name: Vitality Wireless RF Module

Report: TR 313025A FCCICTX A

Model: ZRF

LSR: C-1651

Serial: N/A (engineering sample)

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Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
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LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:



TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation

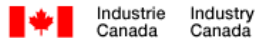
A2LA Certificate Number: 1255.01



Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948

FCC Registration Number: 90756



Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1

File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1

File Number: IC 3088



U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).

Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002

Notified Body Identification Number: 1243

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

1.0 Summary of Test Report

In April and May 2013 the EUT ZRF was tested and MEETS the following requirements:

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC:15.247 (a)(2) IC: RSS 210 A8.2 (a)	6 dB Bandwidth of a Digital Modulation System	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC:15.247 (d) IC: RSS 210 A8.2 (b)	Power Spectral Density of a Digital Modulation System	Yes
FCC :15.247(d) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
FCC : 2.1055 (d)	Frequency Stability	Yes
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

3.0 Client Information

Manufacturer Name:	Vigil Health Solutions Inc.
Address:	2102-4464 Markham St., Victoria, British Columbia Canada V8Z 7X8
Contact Person:	Jason Cai / Steven Smith

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Validity Wireless RF Module
Model Number:	ZRF
Serial Number:	N/A (engineering sample)
FCC ID	UI6-ZRF
IC Number	6706A-ZRF

3.2 Product Description

The Vigil Z Wireless Nurse Call System provides a method of communication between residents and staff within Elder Care Facilities.

3.3 Modifications Incorporated In the EUT for Compliance Purposes

Channel 2480 MHz not used

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test.

4.0 Conditions of Test

Environmental:

Temperature: 20-25° C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage: 120VAC 60 Hz
DC Voltage to Module: 3.6 VDC

Prepared For: Vigil Health Solutions, Inc.	Name: Validity Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

5.0 Additional Information

For RF conducted measurements the shield of the module was removed for access to a u.fl connection. A u.fl to SMA adapter was used for connection to spectrum analyzer.

Separate units pre-programmed for continuous transmit on low, middle, and high channels for test purpose.

6.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

7.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 8 (2010), Annex 8.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

Appendix A – Test Equipment



Date : 25-Apr-2013

Type Test : All

Job # : C-1651

Prepared By: Adam

Customer : Vigil Health Solutions

Quote #: 313025

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/29/2012	6/29/2013	Active Calibration
2	EE 960158	RF Preselector	Agilent	N9033A	MY48520110	6/29/2012	6/29/2013	Active Calibration
3	AA 960005	Biconical Antenna	EMCO	9310B	9601-2280	6/26/2012	6/26/2013	Active Calibration
4	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	5/16/2012	5/16/2013	Active Calibration
6	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	9/17/2012	9/17/2013	Active Calibration
7	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/29/2013	1/29/2014	Active Calibration
8	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/1/2013	2/1/2014	Active Calibration
9	AA 960154	2.4GHz High Pass Filter	KVM	HPF-L-14186	7272-02	6/28/2012	6/28/2013	Active Calibration
10	AA 960072	Transient Limiter	HP	11947A	3107A02515	2/15/2013	2/15/2014	Active Calibration
11	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/9/2012	5/9/2013	Active Calibration
12	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	9/26/2012	9/26/2013	Active Calibration
13	EE 960084	LISN - 15A	COM-POWER	LI-215A	191920	2/6/2013	2/6/2014	Active Calibration

Prepared For: Vigil Health Solutions, Inc.

Name: Vitality Wireless RF Module

Report: TR 313025A FCCICTX A

Model: ZRF

LSR: C-1651

Serial: N/A (engineering sample)

Appendix B – Test Data
B.1 – RF Conducted Emissions

Manufacturer	Vigil
Test Location	LS Research, LLC
Rule Part	FCC Part 15.247 / RSS-210 Annex 8
General Measurement Procedure	FCC KDB 558074 D01 DTS Meas Guidance v03r01 ANSI C63.10-2009 Section 6.7
General Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

B.1.1 – RF Conducted – Fundamental Bandwidth

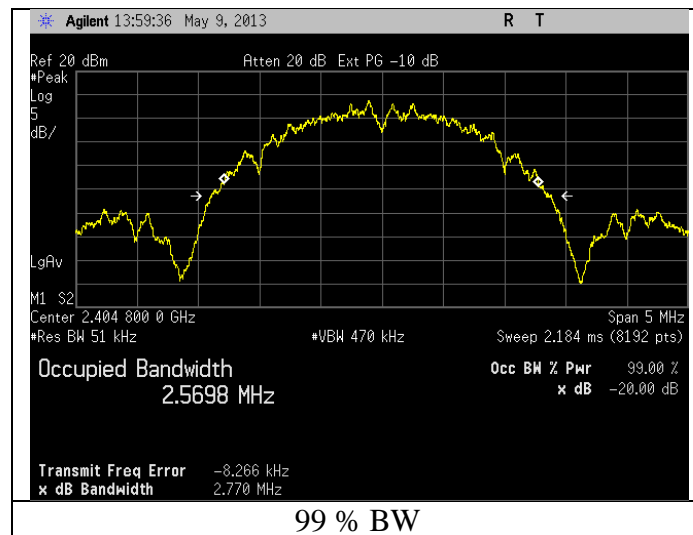
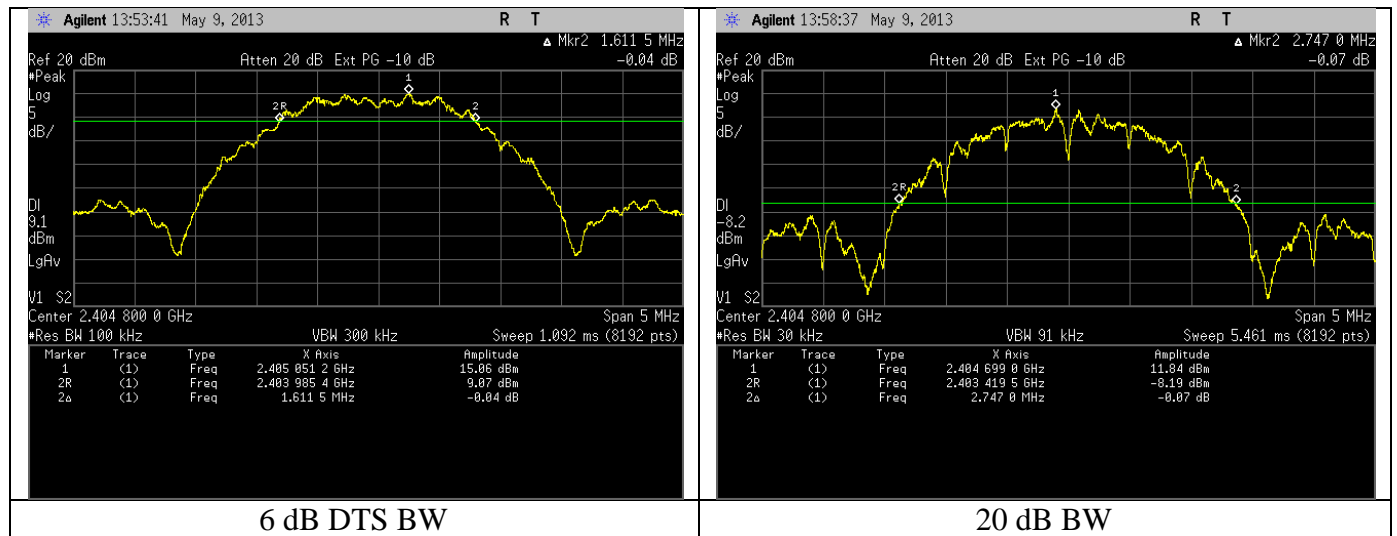
Manufacturer	Vigil
Date	5-9-13
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC Part 15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 8.0 DTS bandwidth ANSI C63.10-2009 Section 6.9 RSS-GEN Section 4.6
Additional Description of Measurement	Peak detector used
Additional Notes	Continuous transmit modulated used for this test.

Table

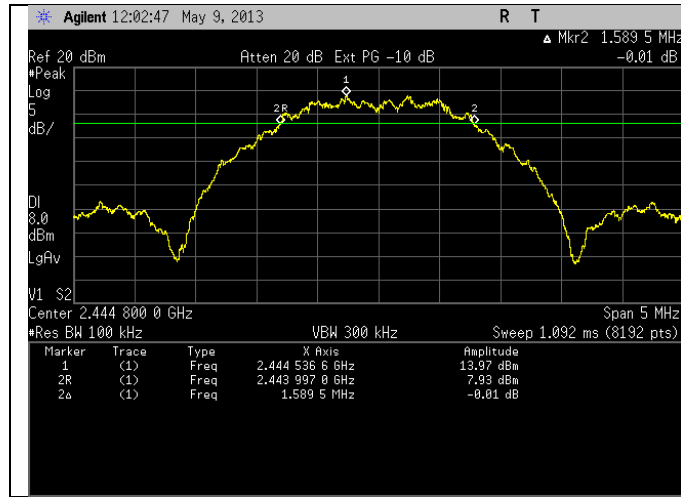
Frequency (MHz)	6 dB DTS BW (MHz)	20 dB BW (MHz)	99 % BW (MHz)
2405	1.611	2.747	2.569
2445	1.589	2.781	2.566
2475	1.628	2.761	2.557

Plots

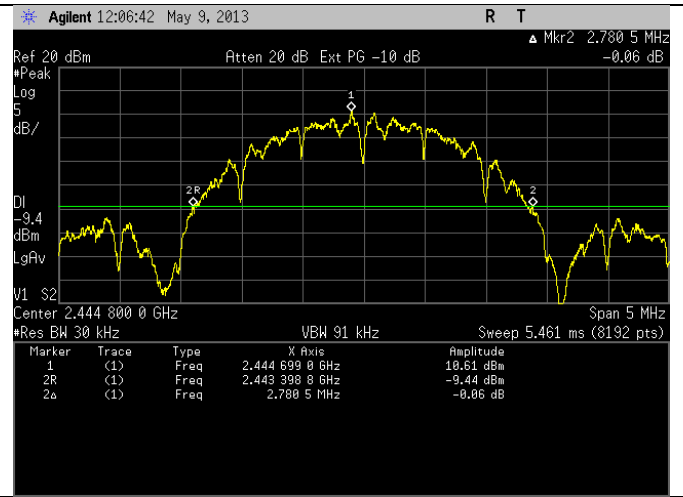
Low Channel – 2405 MHz



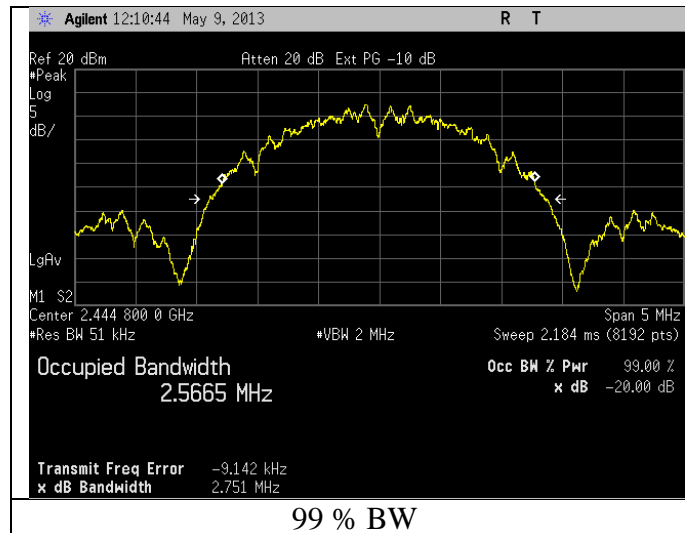
Mid Channel – 2445 MHz



6 dB DTS BW

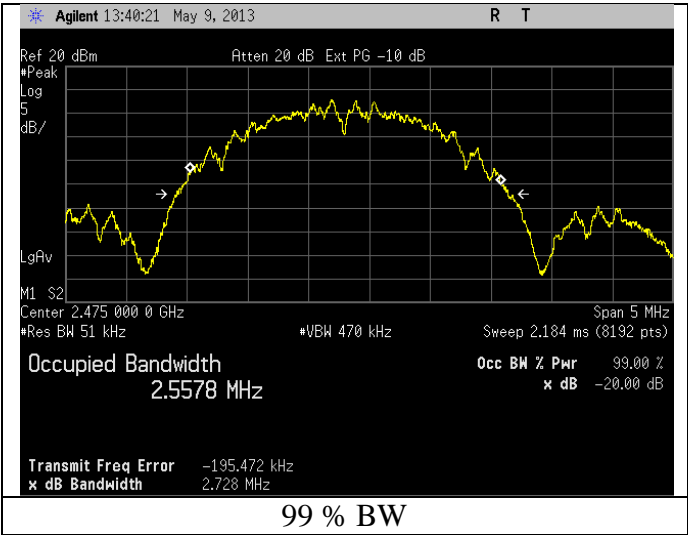
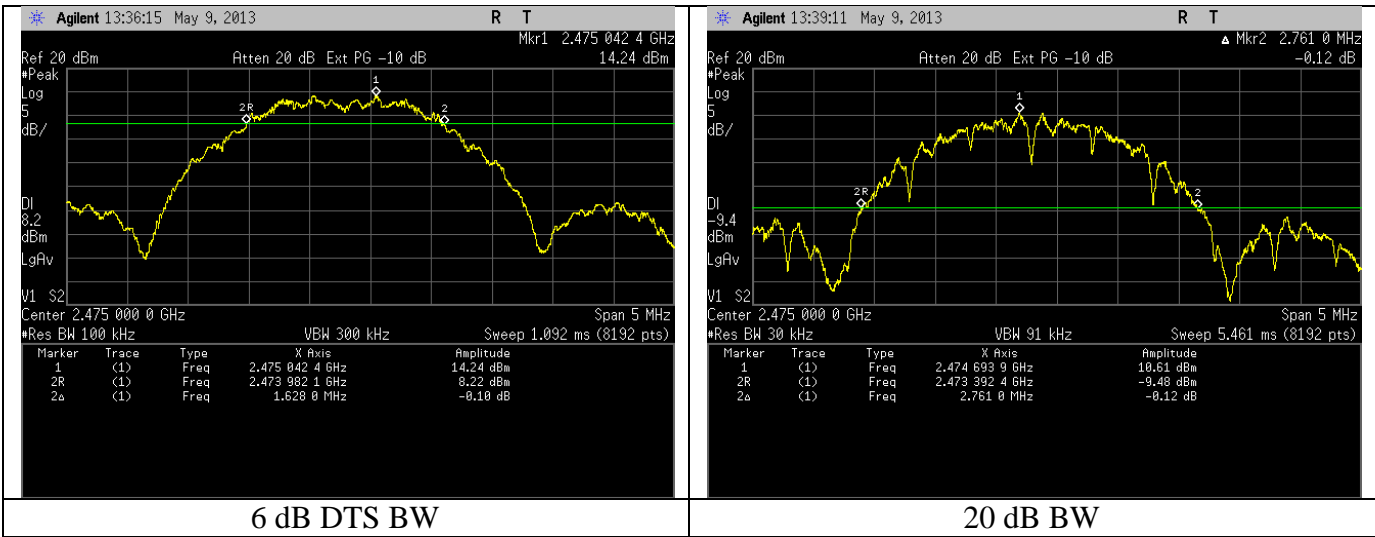


20 dB BW



99 % BW

High Channel – 2475 MHz



Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

B.1.2 – RF Conducted – Fundamental Power and Spectral Density

Manufacturer	Vigil
Date	5-9-13
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 9.1.1 – Maximum peak conducted output power FCC KDB 558074 Section 10.2 – Peak PSD
Additional Description of Measurement	3 kHz resolution bandwidth used for Peak Power Spectral Density measurement
Additional Notes	Sample Calculation: Margin (dB) = Limit – Measured level Continuous transmit modulated used for this test.

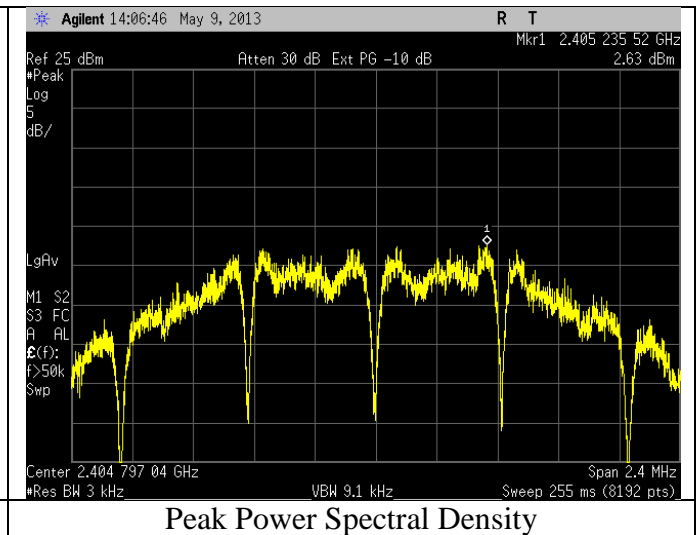
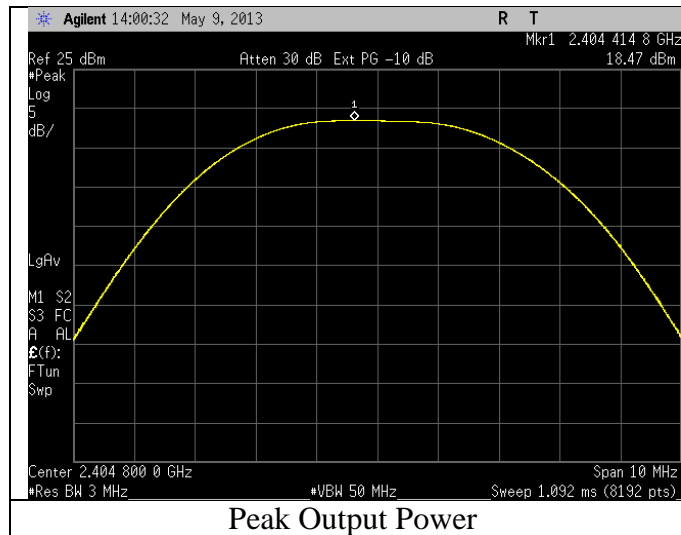
Table

Frequency (MHz)	6 dB DTS BW (MHz)	20 dB BW (MHz)	99 % BW (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)	PKPSD (dBm)	Limit (dBm)	Margin (dB)
2405	1.611	2.747	2.569	18.47	30.00	11.53	2.63	8.00	5.37
2445	1.589	2.781	2.566	17.48	30.00	12.52	2.03	8.00	5.97
2475	1.628	2.761	2.557	17.76	30.00	12.24	2.65	8.00	5.35

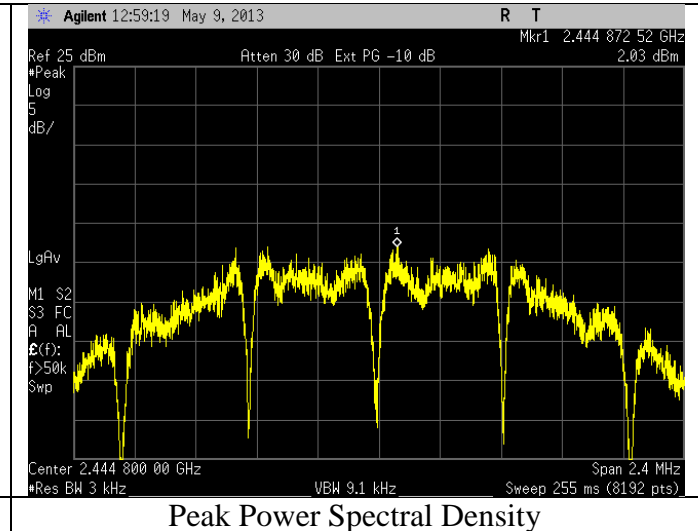
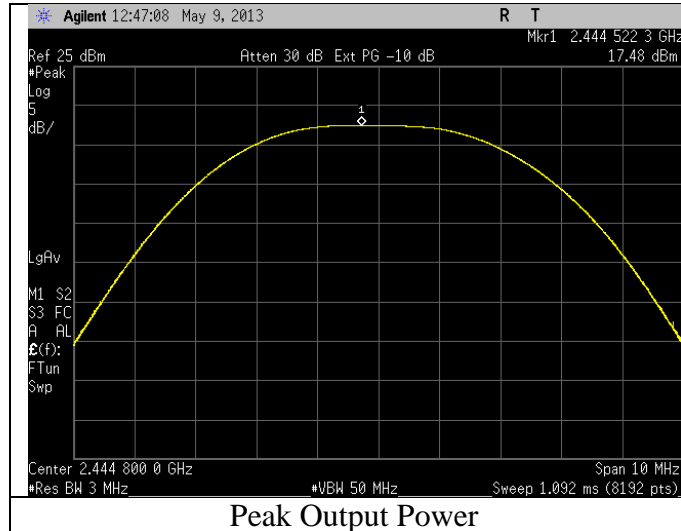
Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

Plots

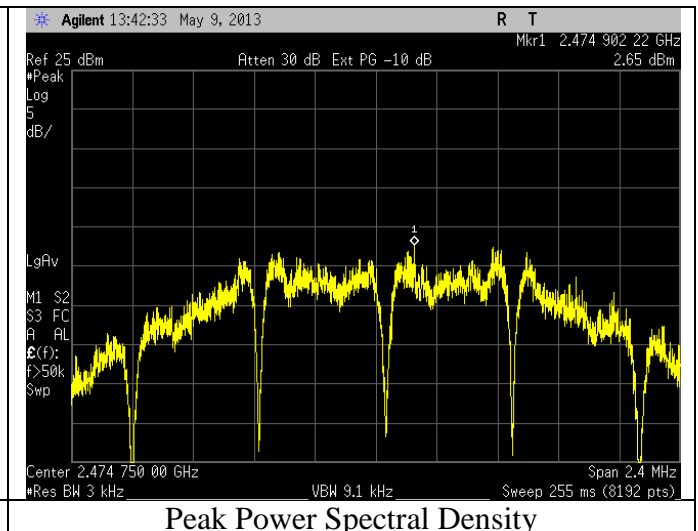
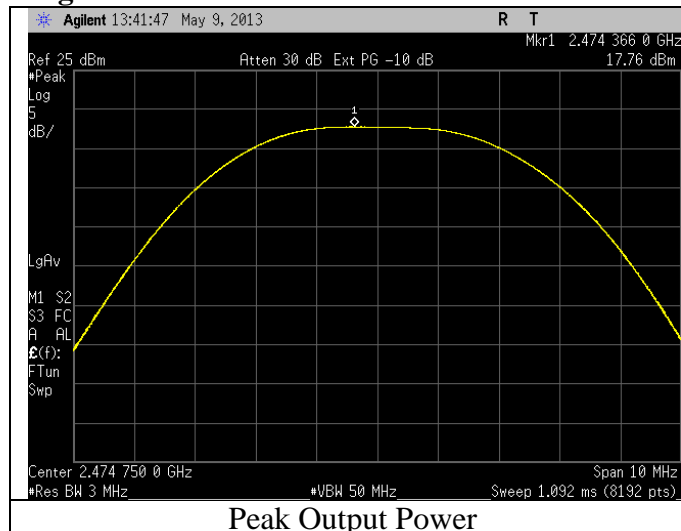
Low Channel – 2405 MHz



Mid Channel – 2445 MHz



High Channel – 2475 MHz



Prepared For: Vigil Health Solutions, Inc.

Report: TR 313025A FCCICTX A

LSR: C-1651

Name: Vitality Wireless RF Module

Model: ZRF

Serial: N/A (engineering sample)

B.1.3 – RF Conducted – Fundamental Spurious

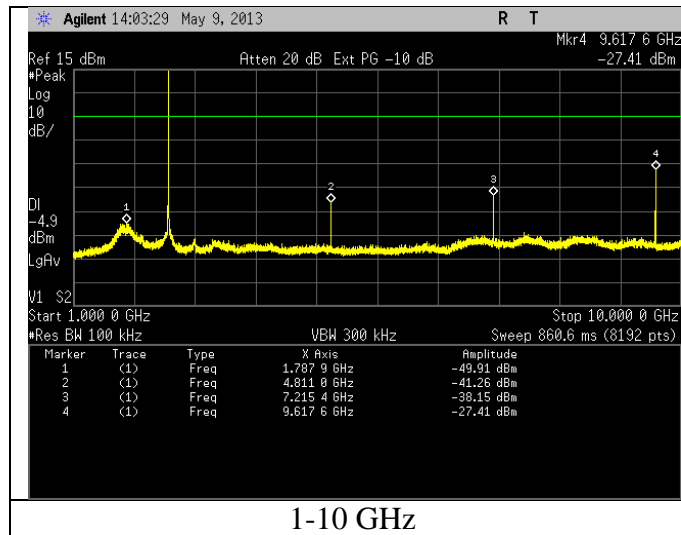
Manufacturer	Vigil
Date	5-9-13
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 11.0 – Emissions in non-restricted frequency bands
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	No Emissions found to be within 25dB of limit Continuous transmit modulated used for this test.

Plots start next page

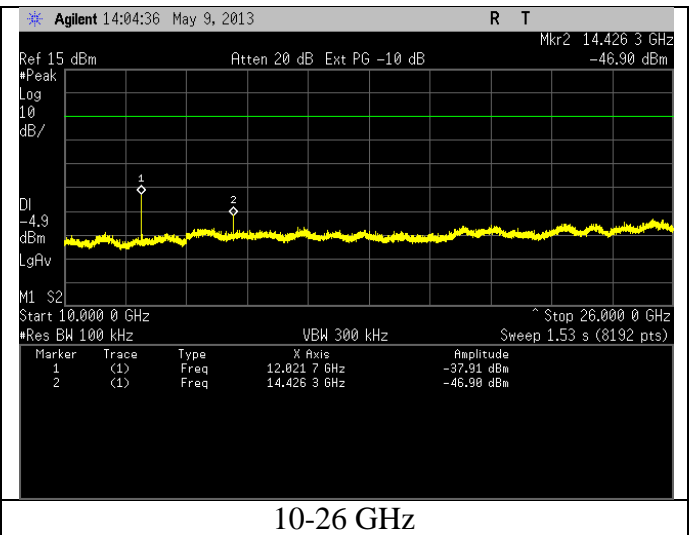
Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

Plots

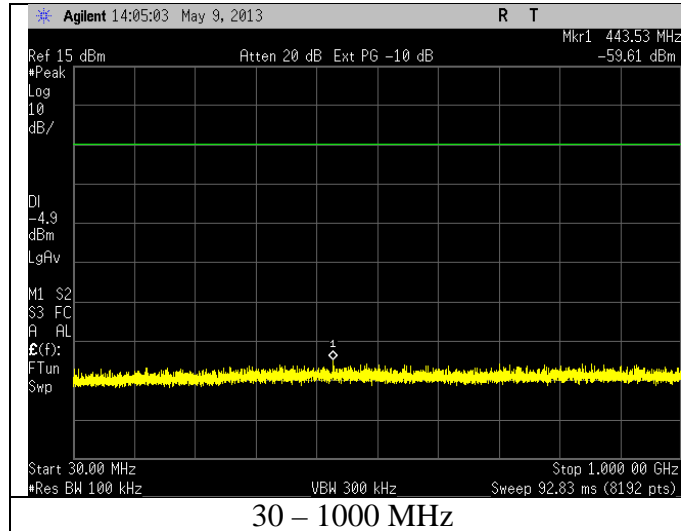
Low Channel – 2405 MHz



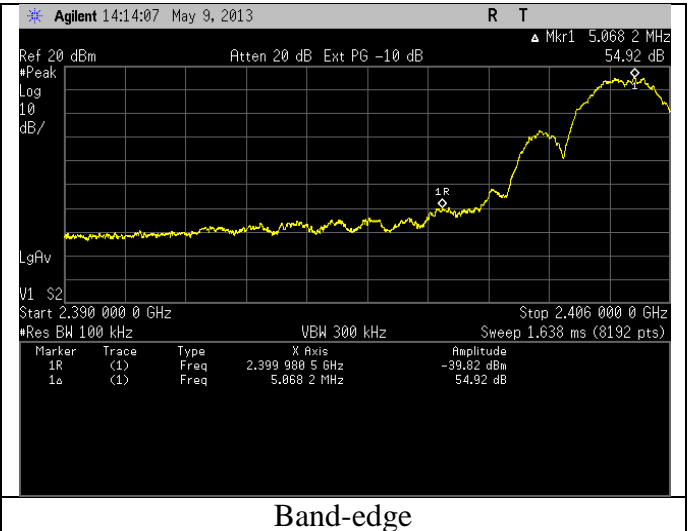
1-10 GHz



10-26 GHz

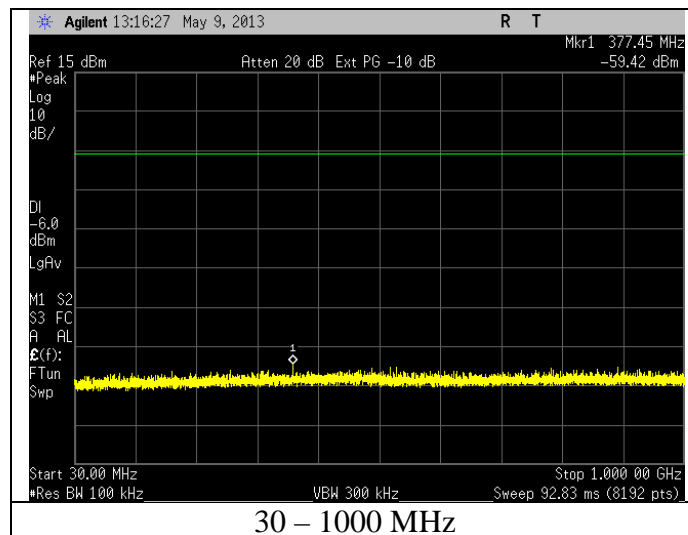
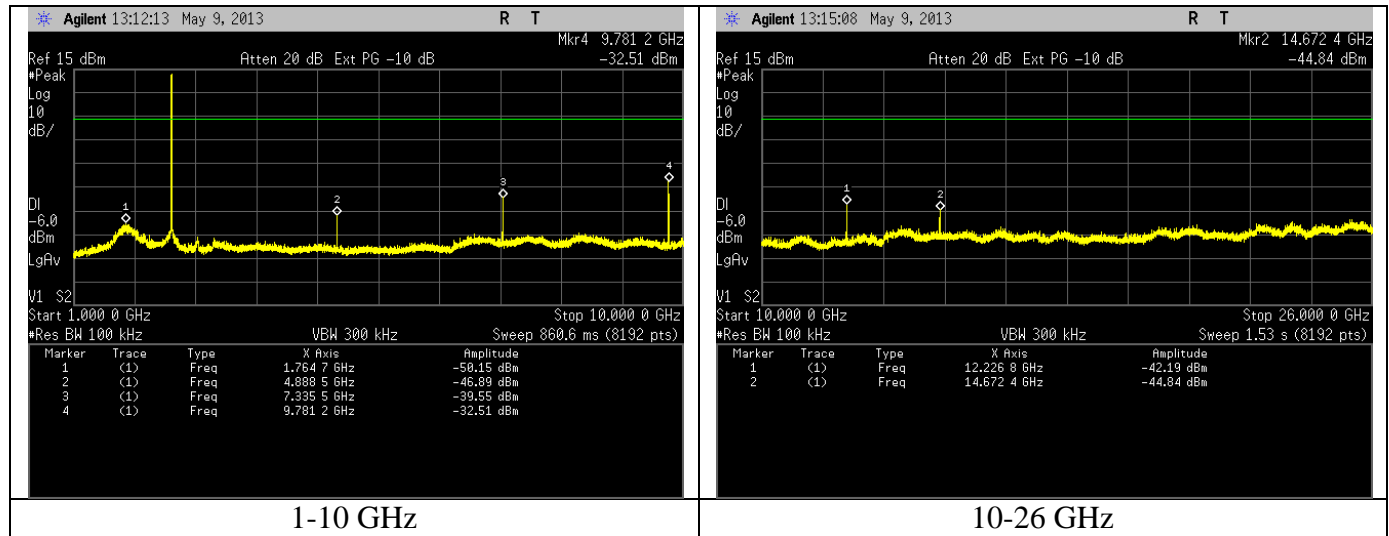


30 – 1000 MHz



Band-edge

Mid Channel – 2445 MHz



Prepared For: Vigil Health Solutions, Inc.

Report: TR 313025A FCCICTX A

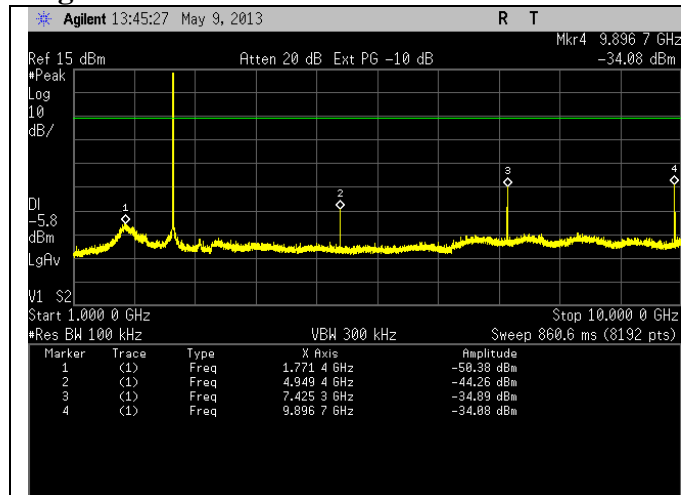
LSR: C-1651

Name: Vitality Wireless RF Module

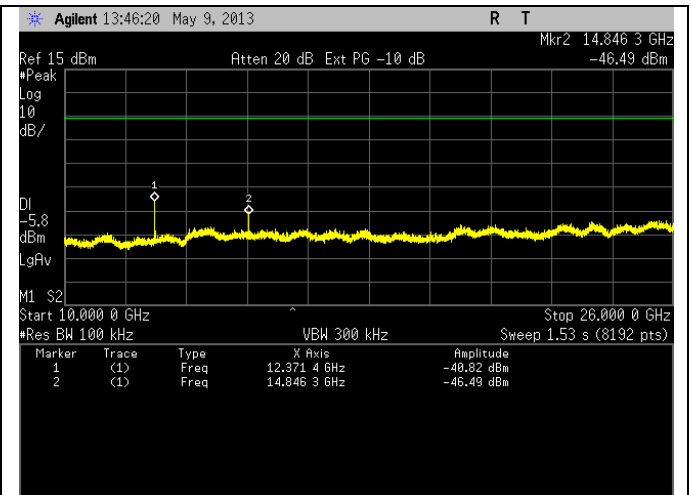
Model: ZRF

Serial: N/A (engineering sample)

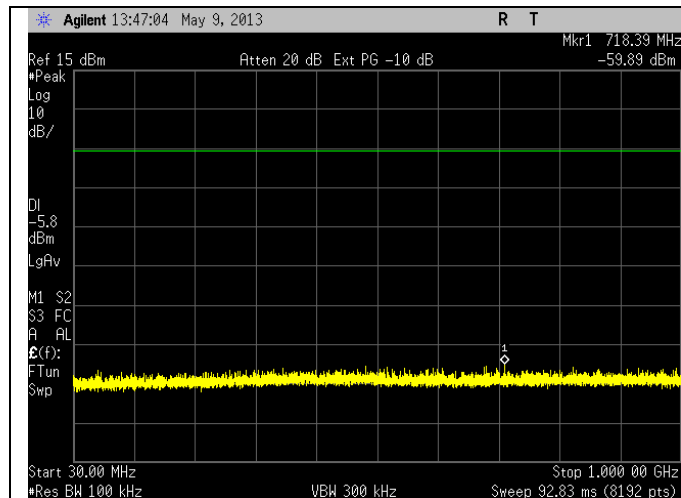
High Channel – 2475 MHz



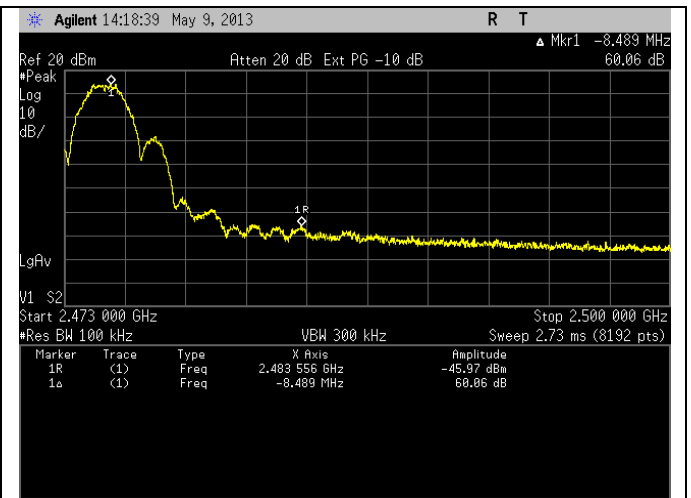
1-10 GHz



10-26 GHz



30 – 1000 MHz



Band-edge

Prepared For: Vigil Health Solutions, Inc.

Report: TR 313025A FCCICTX A

LSR: C-1651

Name: Vitality Wireless RF Module

Model: ZRF

Serial: N/A (engineering sample)

B.2 – Radiated Emissions

Rule Part(s)	FCC: 15.247 / 15.205 / 15.209 IC: RSS-210 A8 / RSS-210 Section 2.2			
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 – 2009 FCC KDB 558074 D01 DTS Meas Guidance v03r01			
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber			
Test Distance	See data section			
EUT Placement	80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-26GHz
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: As specified		1 - 40 GHz: RBW : 1MHz VBW: As specified	
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

FCC Part 15.209 / IC RSS-210 Section 2.7 Limits:

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

B.2.1 – Radiated Band-Edge Restricted Bands

Manufacturer	Vigil
Date	4-25-13 and 5-7-13
Operator	Adam A / Peter F
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009 FCC KDB 558074
Test Distance	3 meter (1-4 GHz)
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1MHz VBW 3 MHz
Additional Notes	1) Tested in the worst case of continuous transmit modulated mode with EUT Antenna in three orthogonal positions at maximum power. Maximum results reported. 2) Continuous transmit modulated used for this test.

Example Calculation:

FCC 15.209 Peak Limit @ 3 meter (dBμV/m) – Peak Reading (dBμV/m) = Peak Margin

Calculated Average (dBμV/m) = Peak Reading (dBμV/m) – Duty Cycle Correction (dB)

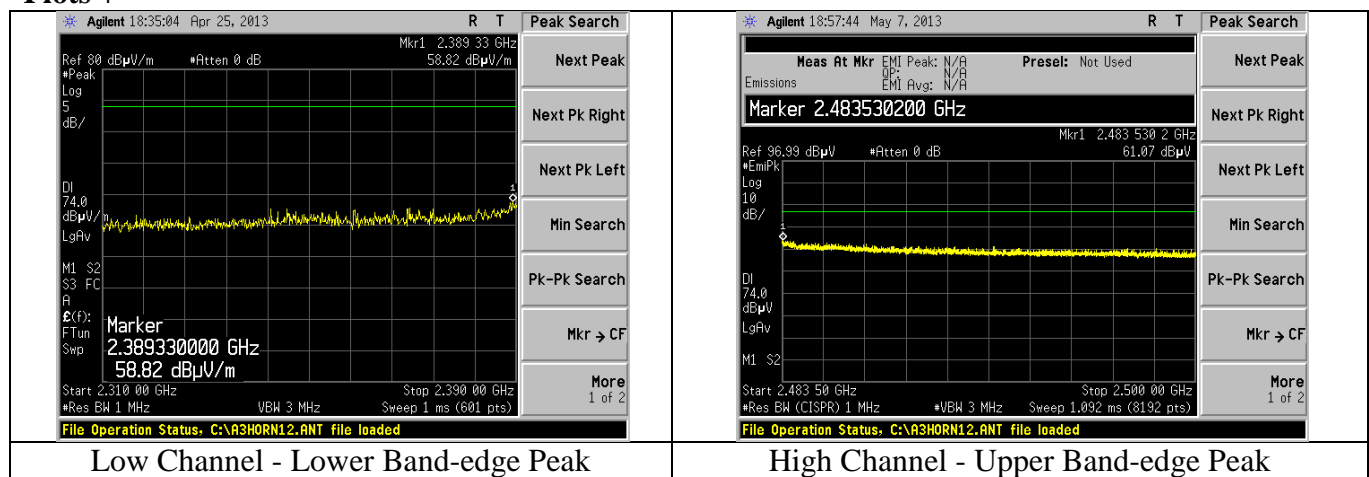
FCC 15.209 Average Limit @ 3 meter (dBμV/m) – Calculated Average (dBμV/m) = Average Margin

Data Table

Channel (MHz)	Peak Emission (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Duty Cycle Correction (dB) ¹	Calculated Average (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)
2405	58.82	74.00	15.18	20.00	38.82	54.00	15.18
2475	61.07	74.00	12.93	20.00	41.07	54.00	12.93

Note 1: See Appendix E of this report for duty cycle correction measurements.

Plots +



Prepared For: Vigil Health Solutions, Inc.

Report: TR 313025A FCCICTX A

LSR: C-1651

Name: Vitality Wireless RF Module

Model: ZRF

Serial: N/A (engineering sample)

B.2.1 – Radiated Harmonics in Restricted Bands

Manufacturer	Vigil
Date	5-8 and 5-9-13
Operator	Mike H / Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	1 meter 4-26 GHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1 MHz
Additional Notes	1) Tested in continuous transmit modulated mode with EUT Antenna in three orthogonal positions at maximum power. Maximum results reported. 2) Tested at 1 meter test distance so a distance correction factor of 9.5 added to 3 meter limit

Example Calculation:

FCC 15.209 Peak Limit @ 1 meter (dB μ V/m) – Peak Reading (dB μ V/m) = Peak Margin

Calculated Average (dB μ V/m) = Peak Reading (dB μ V/m) – Duty Cycle Correction (dB)

FCC 15.209 Average Limit @ 1 meter (dB μ V/m) – Calculated Average (dB μ V/m) = Average Margin

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
Report: TR 313025A FCCICTX A	Model: ZRF
LSR: C-1651	Serial: N/A (engineering sample)

Data Table Low Channel

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Duty Cycle (dB)	Calculated Average (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Antenna Polarity	EUT orientation
4810	1.04	332	77.83	83.50	5.67	20.00	57.83	63.50	5.67	H	F
12025	1.08	197	66.85	83.50	16.65	20.00	46.85	63.50	16.65	H	S

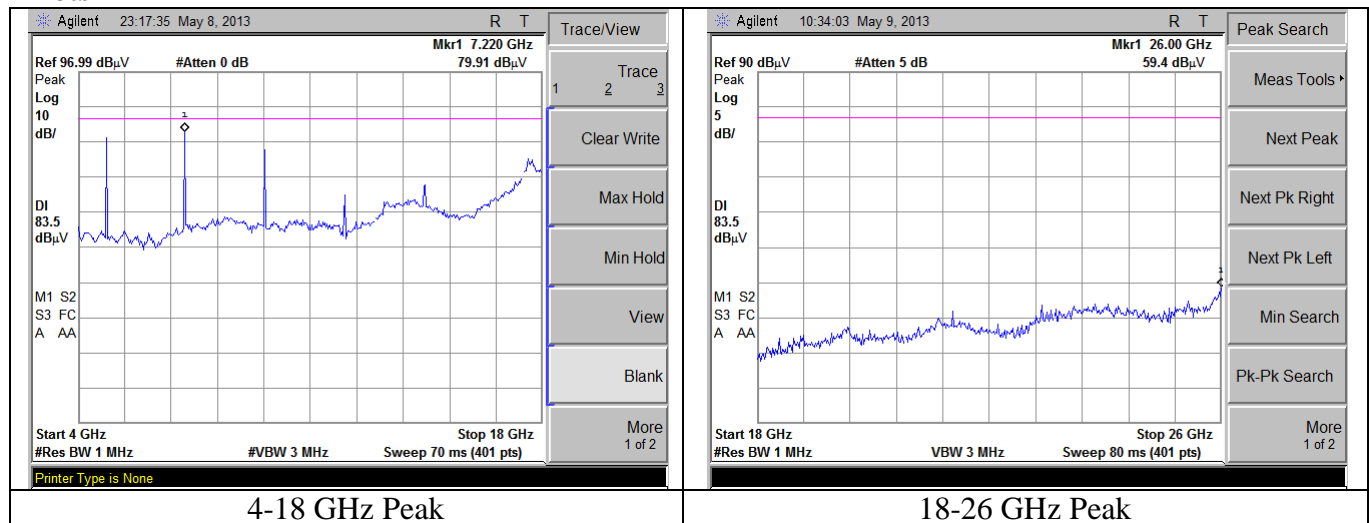
Middle Channel

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Duty Cycle (dB)	Calculated Average (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Antenna Polarity	EUT orientation
4890	1.00	286	77.07	83.50	6.43	20.00	57.07	63.50	6.43	H	F
7335	1.00	218	80.23	83.50	3.27	20.00	60.23	63.50	3.27	H	F
12225	1.10	194	63.59	83.50	19.91	20.00	43.59	63.50	19.91	V	V

High Channel

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Duty Cycle (dB)	Calculated Average (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Antenna Polarity	EUT orientation
4950	1.00	193	71.83	83.50	11.67	20.00	51.83	63.50	11.67	H	S
7425	1.07	106	81.02	83.50	2.48	20.00	61.02	63.50	2.48	V	F
12375	1.00	58	65.18	83.50	18.32	20.00	45.18	63.50	18.32	V	F

Plots



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B.2.1 – Radiated Emissions Transmit Mode

Manufacturer	Vigil
Date	5-7, 31, 2013
Operator	Peter F / Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter 30-4000 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1 MHz
Additional Notes	1) Tested in continuous transmit modulated mode with EUT Antenna in three orthogonal positions at maximum power. Maximum results reported. 2) NO EMISSIONS FOUND

Example Calculation:

Limit (dBµV/m) – Reading (dBµV/m) = Margin

Below 1 GHz

Frequency (MHz)	Peak Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Note
97.27	19.87	43.5	23.63	1
972.5	35.97	54	18.03	1,2

Above 1 GHz

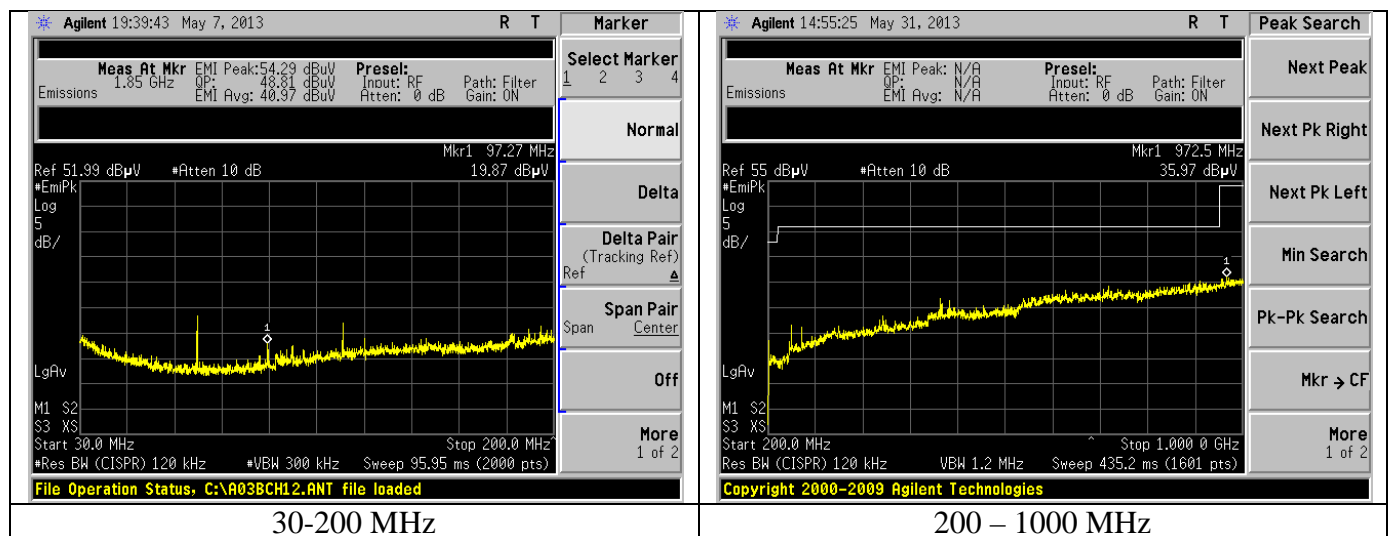
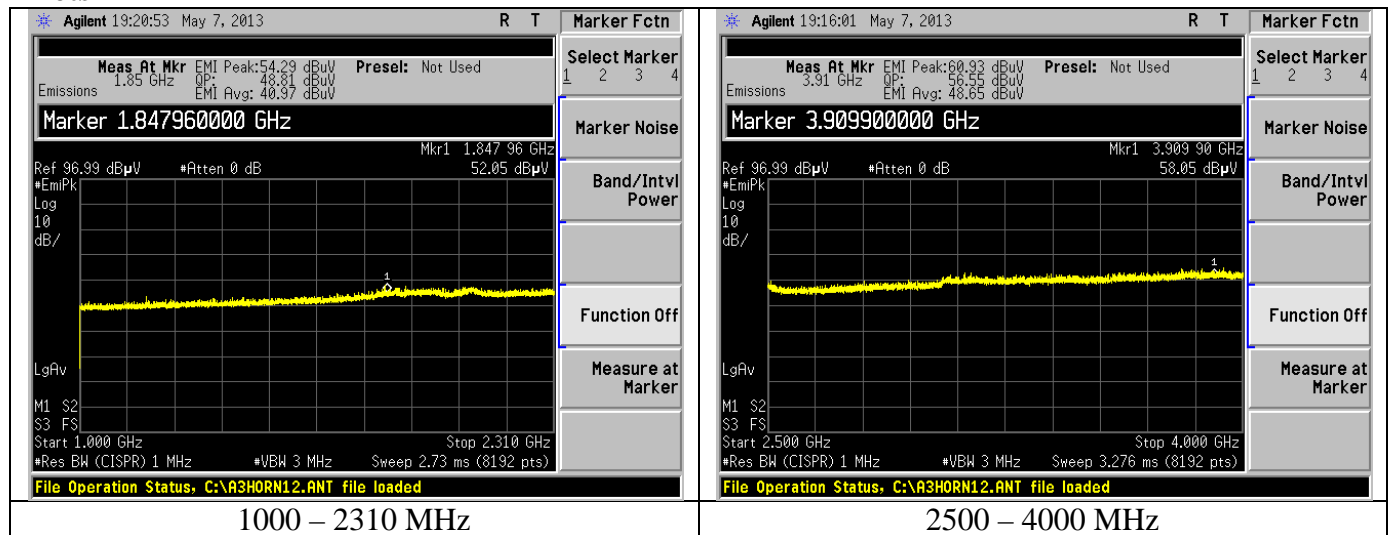
Frequency (MHz)	Peak Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Average Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Note
1847.96	54.29	74	19.71	40.97	54	13.03	1
3909.9	60.93	74	13.07	48.65	54	5.35	1

Note 1: Noise floor measurements. No emissions from EUT found

Note 2: Peak noise floor meets average limit.

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Plots



Note: Peak detector with max hold in vertical and horizontal antenna polarizations. No emissions found associated with EUT. (Minor emissions seen from DC bench supply)

B3 – Frequency Stability

Manufacturer	Vigil
Operator	Adam A
Additional Notes	<p>The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the RF output power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied from the nominal.</p> <p>The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.</p> <p>Continuous transmit modulated used for this test. EUT does not operate beyond 3.6 VDC or below 1.8 VDC</p>

	3.6 VDC	2.6 VDC	1.8 VDC	
	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQ DRIFT (Hz)
LOW CHANNEL	2404793066	2404793091	2404795233	2167
MID CHANNEL	2439789650	2439789550	2439791650	2100
HIGH CHANNEL	2474789688	2474789838	2474792438	2750

B4 – AC Mains Conducted Emissions

Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the EMI Receiver. The LISN used has the ability to terminate the unused port with a 50 Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements was as specified for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

An off-the-shelf DC power supply was used for the test to supply the EUT with the appropriate DC voltage.

Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBμV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

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Report: TR 313025A FCCICTX A	Model: ZRF
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Test Data

Manufacturer:	Vigil				
Date(s) of Test:	5-20-13				
Test Engineer:	Adam A				
Voltage:	120 VAC (Off-the-shelf AC to DC power supply used for this test)				
Operation Mode:	Continuous transmit modulated used for this test.				
Environmental Conditions in the Lab:	Temperature: 71° F Relative Humidity: 40%				
Test Location:	X	AC Mains Test area			Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane			10cm Spacers
	X	80cm above Ground Plane			Other:
Measurements:		Pre-Compliance		Preliminary	X Final
Detectors Used:	X	Peak		Quasi-Peak	Average

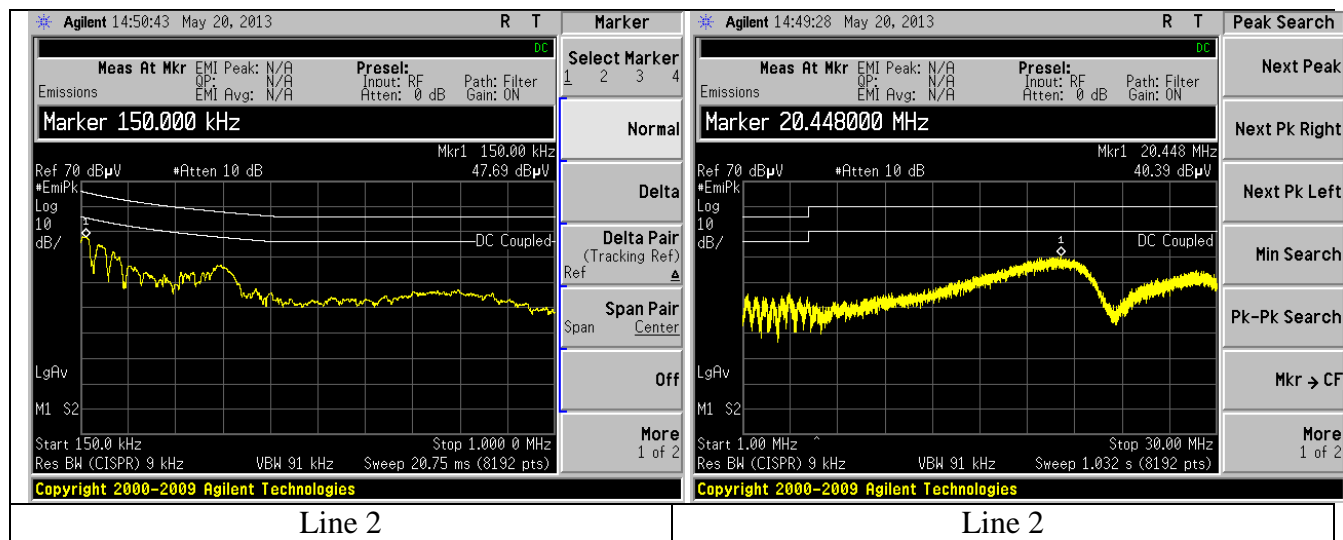
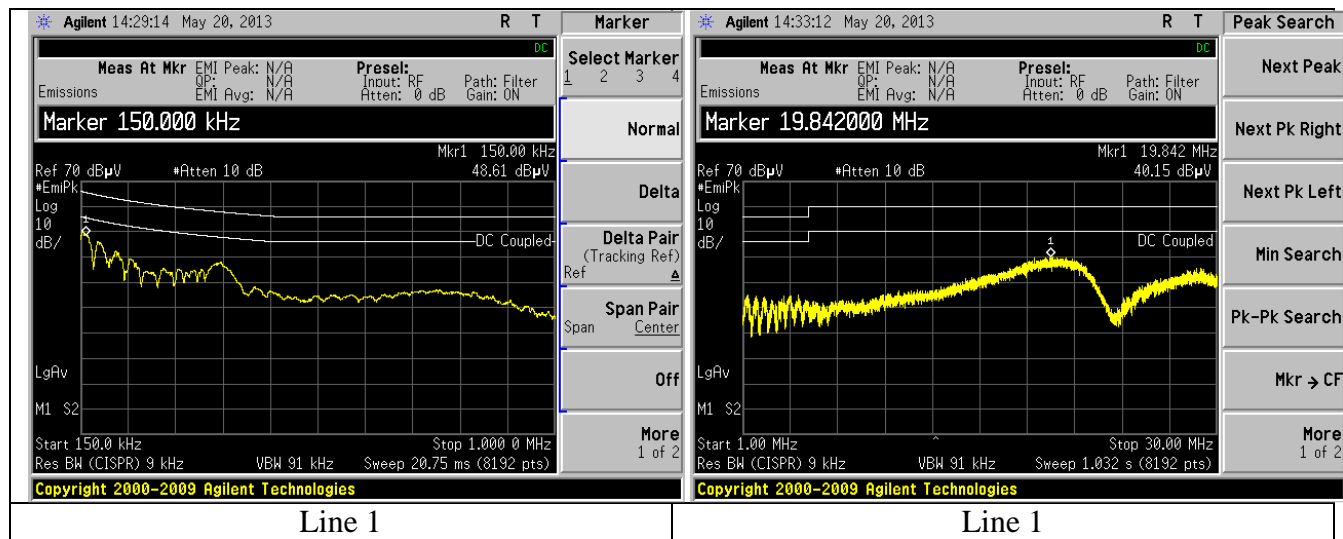
Sample Calculation:

Average Margin (dB) = Average Limit (dBμV) – Peak Reading (dBμV)

Note: Peak Emissions Compared to Average Limit

Frequency (MHz)	Line	Peak Reading (dBμV)	Average Limit (dBμV)	Average Margin (dB)
0.150	1	49.02	56.00	6.98
0.172	1	46.86	54.86	8.00
0.200	1	43.11	53.61	10.50
0.396	1	38.82	47.94	9.12
19.842	1	40.15	50.00	9.85
20.777	1	39.56	50.00	10.44
0.150	2	47.69	56.00	8.31
0.171	2	44.41	54.91	10.50
0.200	2	41.83	53.61	11.78
0.394	2	37.35	47.98	10.63
20.448	2	40.39	50.00	9.61
29.048	2	34.87	50.00	15.13

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).



Appendix C - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k=2$.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.32 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.63 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64°/ 2.88 %RH

Appendix D - References

Publication	Year	Title
FCC CFR Parts 0-15	2013	Code of Federal Regulations – Telecommunications
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-210 Annex 8	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment
RSS-GEN Issue 3	2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01 DTS Meas Guidance v03r01	2013	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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Appendix E – Duty Cycle

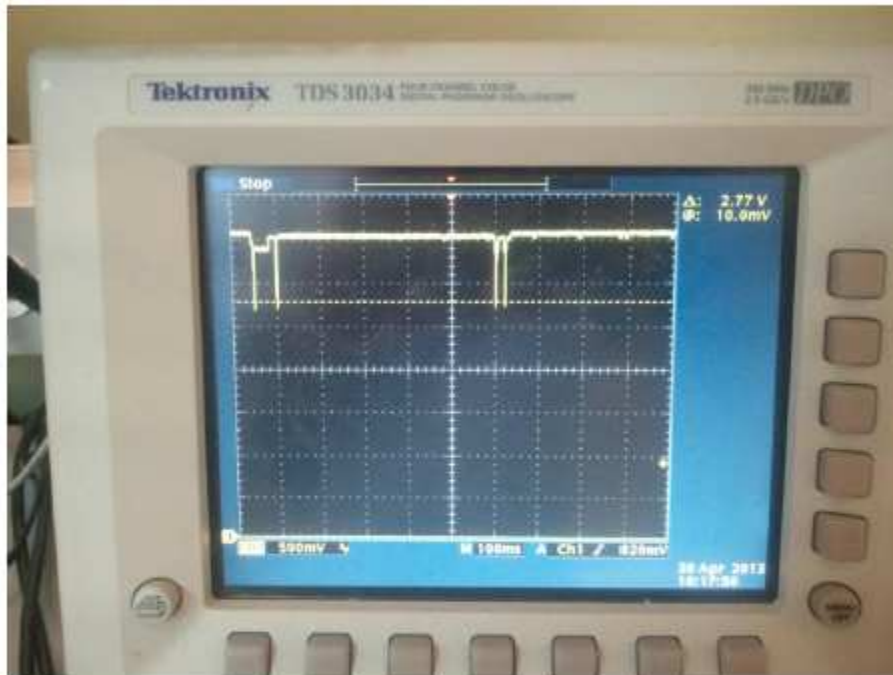
This information was provided by the client.

Worst case duty cycle in association mode = $20 * \log(10/100) = -20 \text{ dB}$

Normal mode has much lower duty cycle

Vigil ZRF TX transmission length is less than 2 ms.

Picture below indicate worst case TX transmission:



Voltage is measured on battery side. Main voltage drop indicate RF transmission.

The captured picture shows ZRF working in fail of association mode. ZRF keep retrying to find correct parent to associate with in this mode. X-axis scale is 100 ms per division. The closest transmission is more than 20 ms apart. The transmit package occupies no more than 10 ms within any 100 ms window.

In normal working condition, ZRF will make one or less transmission in 100 ms windows.

Appendix F – RF Exposure Assessment

The following MPE calculations are based on a measured conducted RF power of 18.47dBm as presented to the antenna. The peak gain of this antenna, based on field strength measurements over a conducting ground plane is 0.3 dBi.

Enter data only in yellow cells

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 18.47 (dBm)

Maximum peak output power at antenna input terminal: 70.307 (mW)

Antenna gain(typical): 0.3 (dBi)

Maximum antenna gain: 1.072 (numeric)

Prediction distance: 20 (cm)

Prediction frequency: 2405 (MHz)

MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm²)

Power density at prediction frequency: 0.014988 (mW/cm²)

Maximum allowable antenna gain: 18.5 (dBi)

Margin of Compliance at 20 cm = 18.2 dB

END OF REPORT

Date	Version	Comments	Person
5-28-13	V0	Initial Draft Release	Adam A
6/3/13	V0	First Review	SDR
6-11-13	V1	Approved for release	Adam A

Prepared For: Vigil Health Solutions, Inc.	Name: Vitality Wireless RF Module
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