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Report On

Radio Testing of the
NantWorks
Vitality Personal Reminding Device

FCC Subpart C Part 15.249

Report No. SC1204200

May 2012



America

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REPORT ON	Radio Testing of the NantWorks Personal Reminding Device
TEST REPORT NUMBER	SC1204200
PREPARED FOR	NantWorks 12230 El Camino Real, Suite #400 San Diego, CA 92130
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APPROVED BY	 Chip R. Fleury Name Authorized Signatory
DATED	May 18, 2012



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Revision History

SC1204200 NantWorks Vitality Personal Reminding Device					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/18/12	Initial Release				Ferdinand Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
NantWorks
Personal Reminding Device

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the NantWorks Personal Reminding Device to the requirements of FCC Subpart C Part 15.249.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	NantWorks
Model Number(s)	Glowpack
FCC ID Number	IFU380100
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	FCC Subpart C Part 15.249 (October 1, 2011).
Start of Test	April 11, 2012
Finish of Test	April 11, 2012
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Subpart C Part 15.249 is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
-	§15.207(a)	Conducted Emissions	N/A*	
2.1	§15.215(c)	20 dB Bandwidth	Compliant	
2.2	§15.249(a)	Field Strength Limits for Fundamental and Harmonics	Compliant	
2.3	§15.249(d)	Spurious Radiated Emissions	Compliant	

* Not applicable. EUT is battery powered.

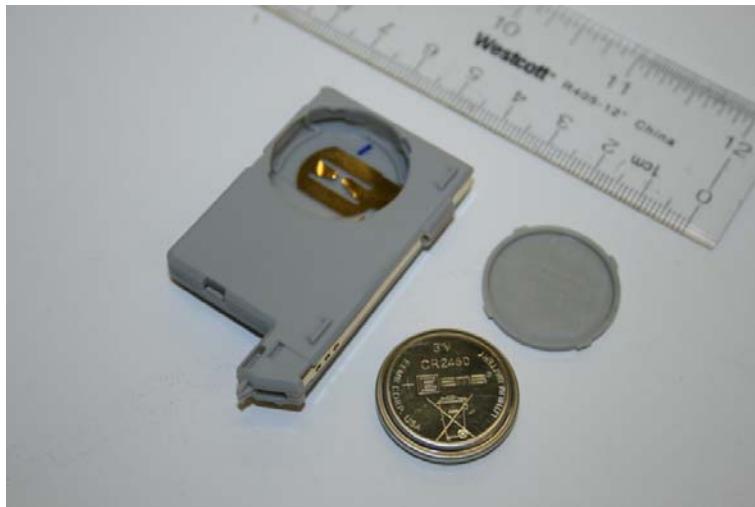
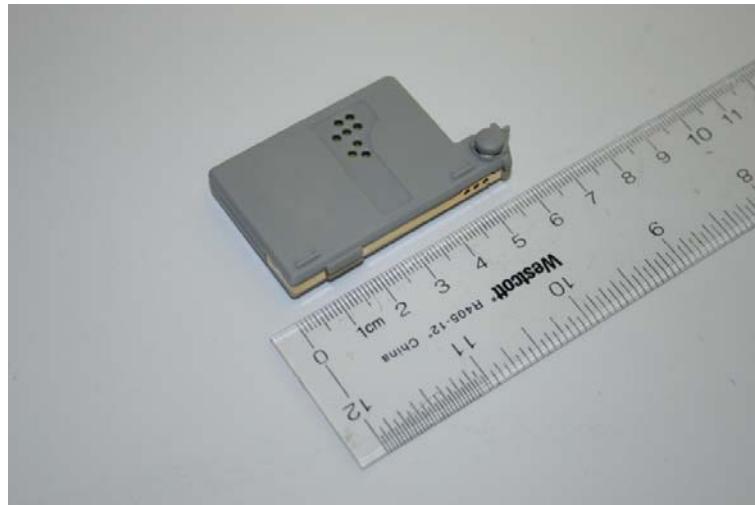


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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a NantWorks Personal Reminding Device as shown in the photograph below. The EUT works together with a Reminder Light device. The Reminder Light device is already certified device by FCC (FCC ID: YOC373200). The EUT is installed inside a Bag and used to store medicine that is pre-filled inside packs. The Reminder Light will download information from the servers, connecting via cellular network. When it is time for a dose, the Reminder Light will activate and via 900MHz radio will activate the EUT.



Equipment Under Test



Equipment Under Test

1.3.2 EUT General Description

EUT Description	Personal Reminding Device
Model Name	Vitality
Model Number(s)	Glowpack
Rated Voltage	3.0VDC from CR2450 Lithium Coin Battery
Output Power	84.8dB μ V/m @ 3 meters (90.6 μ W EIRP)
Frequency Range	907.892 MHz in the 902 MHz to 928 MHz Band
Number of Operating Frequencies	1
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)
Antenna Gain	1.25 dBi (typical)
Modulation Used	2FSK

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT transmitting continuously at max power.

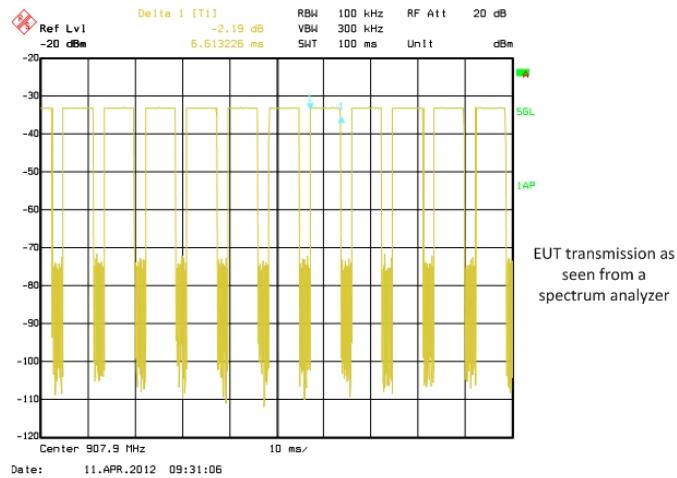
1.4.2 EUT Exercise Software

Firmware was modified in order to make the EUT transmit continuously and modulated.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
N/A	N/A	N/A

1.4.4 Simplified Test Configuration Diagram



EUT continuously transmitting
at 907.9 MHz at max power
(modulated)



EUT-NantWorks Vitality
Glowpack Personal Reminding
Device



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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number N/A		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, 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.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY

1.8.1 FCC – Registration No.: US5281

TUV SUD America Inc. (San Diego), a §2.498 listed test firm operates the EMC Laboratory registered under Sony Electronics Inc. Product Quality Division EMC. This laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is US5281.

1.8.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego), has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.



SECTION 2

TEST DETAILS

Radio Testing of the
NantWorks
Personal Reminding Device



2.1 20 dB BANDWIDTH

2.1.1 Specification Reference

Part 15 Subpart C §15.215(c)

2.1.2 Standard Applicable

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

2.1.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

April 11, 2012/FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Ambient Temperature	22.2°C
Relative Humidity	43.2%
ATM Pressure	99.2 kPa

2.1.7 Additional Observations

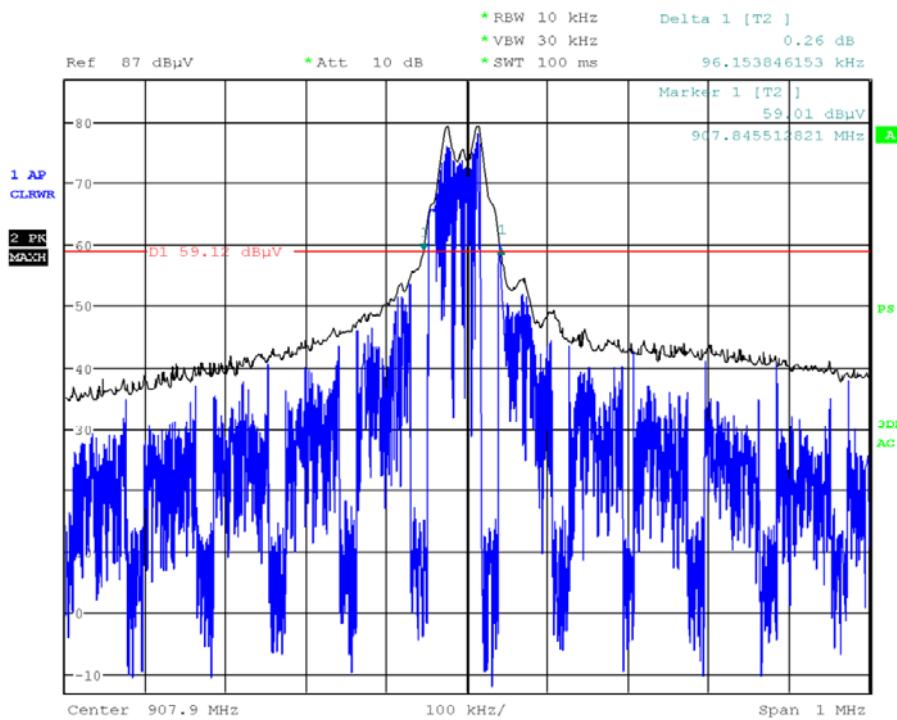
- This is a radiated test.
- A peak output reading was taken. A display line was drawn 20dB below the peak level.
- 20dB bandwidth verified using delta-marker measurements from the line drawn.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- Trace is max hold.

2.1.8 Test Results

20dB Bandwidth
96.153kHz

Frequency Band: 902 MHz to 928 MHz Band

907.892 MHz - (20dB BW/2) = 907.843 MHz (within the frequency band - **Compliant**)
907.892 MHz + (20dB BW/2) = 907.94 MHz (within the frequency band - **Compliant**)



Date: 11.APR.2012 11:14:35



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2.2 FIELD STRENGTH LIMITS FOR FUNDAMENTAL AND HARMONICS

2.2.1 Specification Reference

Part 15 Subpart C §15.249(a)

2.2.2 Standard Applicable

(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

2.2.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

2.2.4 Date of Test/Initial of test personnel who performed the test

April 11, 2012/FSC

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions

Ambient Temperature	22.1°C
Relative Humidity	37.5%
ATM Pressure	100.0 kPa

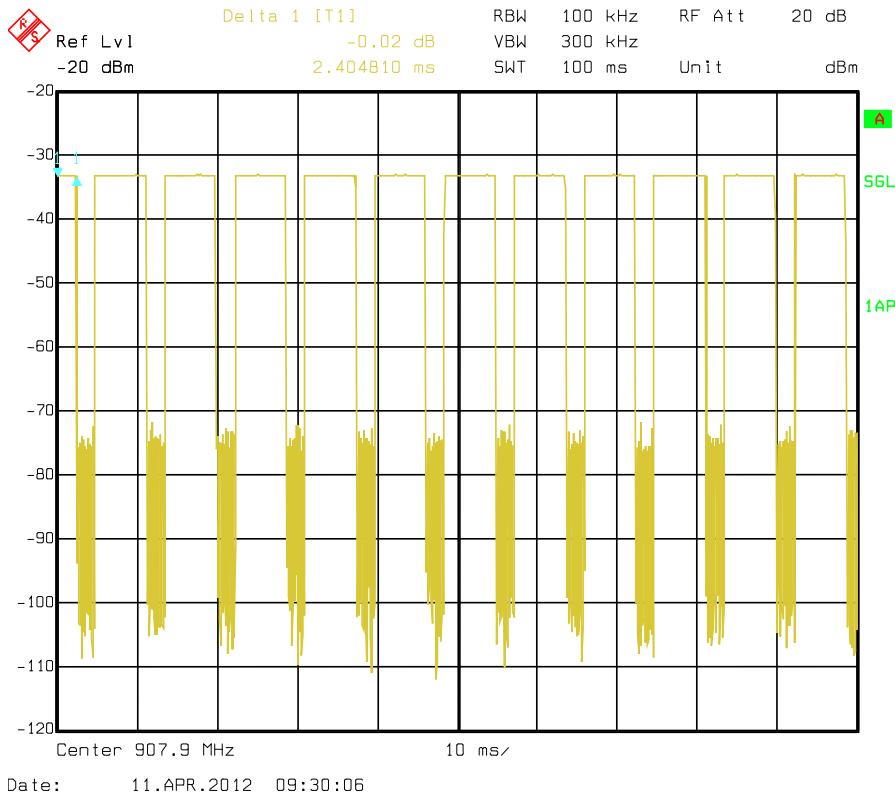
2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to >10th harmonic (18GHz).
- EUT will be installed only in horizontal position according to client/manufacturer. Verification on other orthogonal axes not required.
- Measurement was done using EMC32 V8.52 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

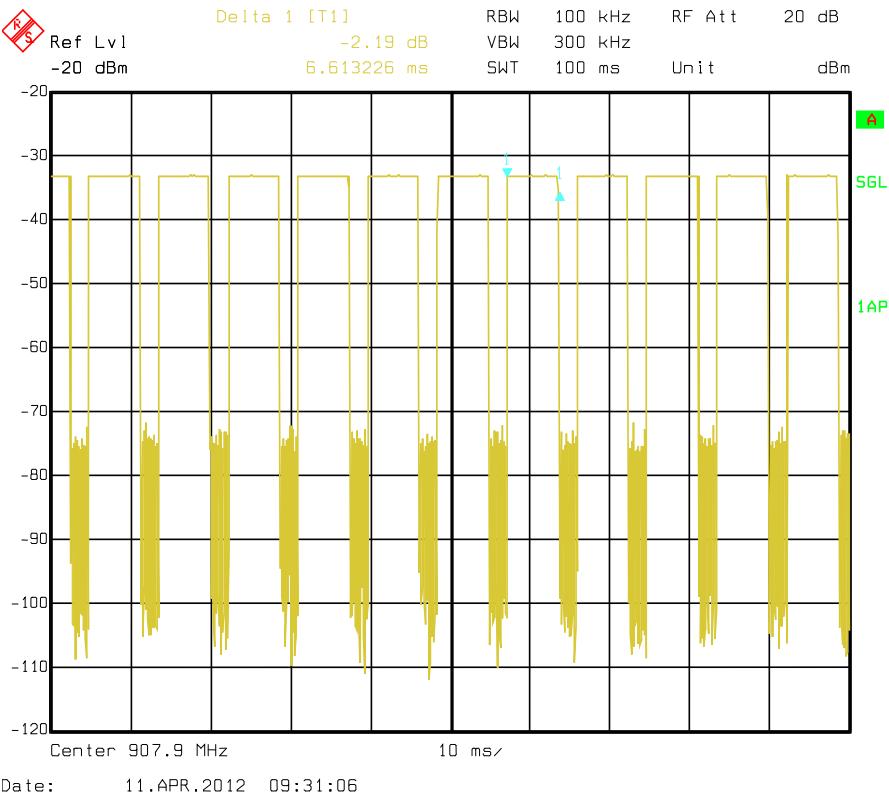
2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 2400 MHz			58.4
Correction Factor (dB)	Asset# 1153 (cable)	3.3	-4.8
	Asset# 8628 (preamplifier)	-36.4	
	Asset# 6669 (antenna)	28.3	
Reported Peak Final Measurement (db μ V/m) @ 2400 MHz			53.6

2.2.9 Duty Cycle Correction Factor Calculation



Plot showing 2.4ms partial transmission ("On" time)



Plot showing 6.6ms typical transmission (“On” time)

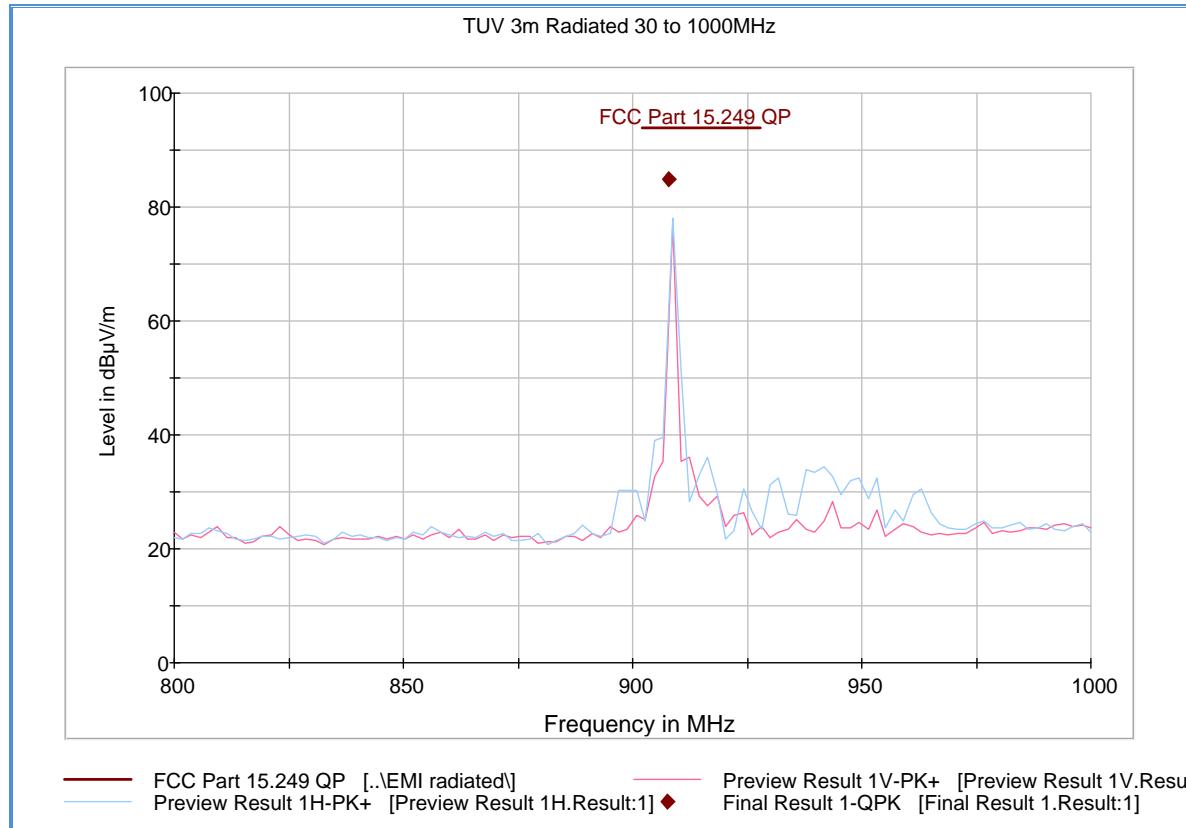
Duty Cycle Calculation: $= (6.6 \text{ ms} \times 11) + 2.4 \text{ ms}$
 $= 72.6 \text{ ms} + 2.4 \text{ ms}$
 $= 75 \text{ ms “On” time per 100 ms sweep}$

Duty Cycle Correction Factor $= 20 \log (0.75)$
 $= -2.5 \text{ dB}$

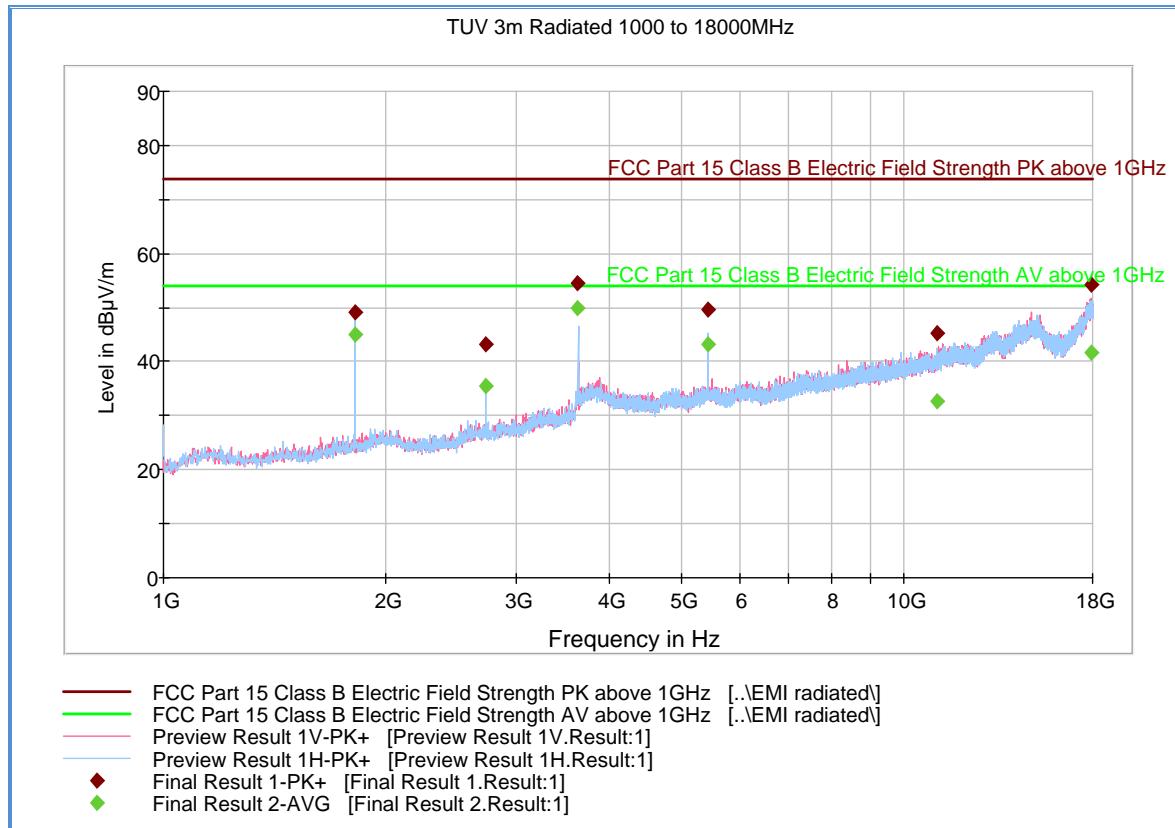
2.2.10 Test Results

See attached plots.

2.2.11 Test Results Fundamental



2.2.12 Test Results Harmonics



Peak Data

Frequency (MHz)	MaxPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1815.820000	49.2	1000.0	1000.000	100.0	H	255.0	-7.0	24.7	73.9
2723.740000	43.3	1000.0	1000.000	117.0	H	316.0	-4.0	30.6	73.9
3631.500000	54.5	1000.0	1000.000	110.0	H	281.0	1.5	19.4	73.9
5447.380000	49.6	1000.0	1000.000	112.0	H	285.0	4.0	24.3	73.9
11096.560000	45.2	1000.0	1000.000	230.0	H	220.0	11.7	28.7	73.9
17885.640000	54.2	1000.0	1000.000	354.0	V	225.0	20.9	19.7	73.9

Average Data (Average Detector)

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1815.820000	45.1	1000.0	1000.000	100.0	H	255.0	-7.0	8.8	53.9
2723.740000	35.6	1000.0	1000.000	117.0	H	316.0	-4.0	18.3	53.9
3631.500000	49.9	1000.0	1000.000	110.0	H	281.0	1.5	4.0	53.9
5447.380000	43.2	1000.0	1000.000	112.0	H	285.0	4.0	10.7	53.9
11096.560000	32.7	1000.0	1000.000	230.0	H	220.0	11.7	21.2	53.9
17885.640000	41.6	1000.0	1000.000	354.0	V	225.0	20.9	12.3	53.9



Average Data (Using Duty Cycle Correction Factor)

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1815.820000	46.7							7.2	53.9
2723.740000	40.8							13.1	53.9
3631.500000	52.0							1.9	53.9
5447.380000	47.1							6.8	53.9
11096.560000	42.7							11.2*	53.9
17885.640000	51.7							2.2*	53.9

* These frequencies are noise floor measurements.

Test Notes : Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:

$$\begin{aligned} 1815.82 \text{ MHz} &= 49.2 \text{ dB}\mu\text{V/m (Peak)} \\ &= 49.2 \text{ dB}\mu\text{V/m} + (-2.5 \text{ dB DCCF}) \\ &= 46.7 \text{ dB}\mu\text{V/m (Average)} \end{aligned}$$



2.3 SPURIOUS RADIATED EMISSIONS

2.3.1 Specification Reference

Part 15 Subpart C §15.249(d)

2.3.2 Standard Applicable

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

2.3.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

2.3.4 Date of Test/Initial of test personnel who performed the test

April 11, 2012/FSC

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions

Ambient Temperature	22.1°C
Relative Humidity	37.5%
ATM Pressure	100.0 kPa

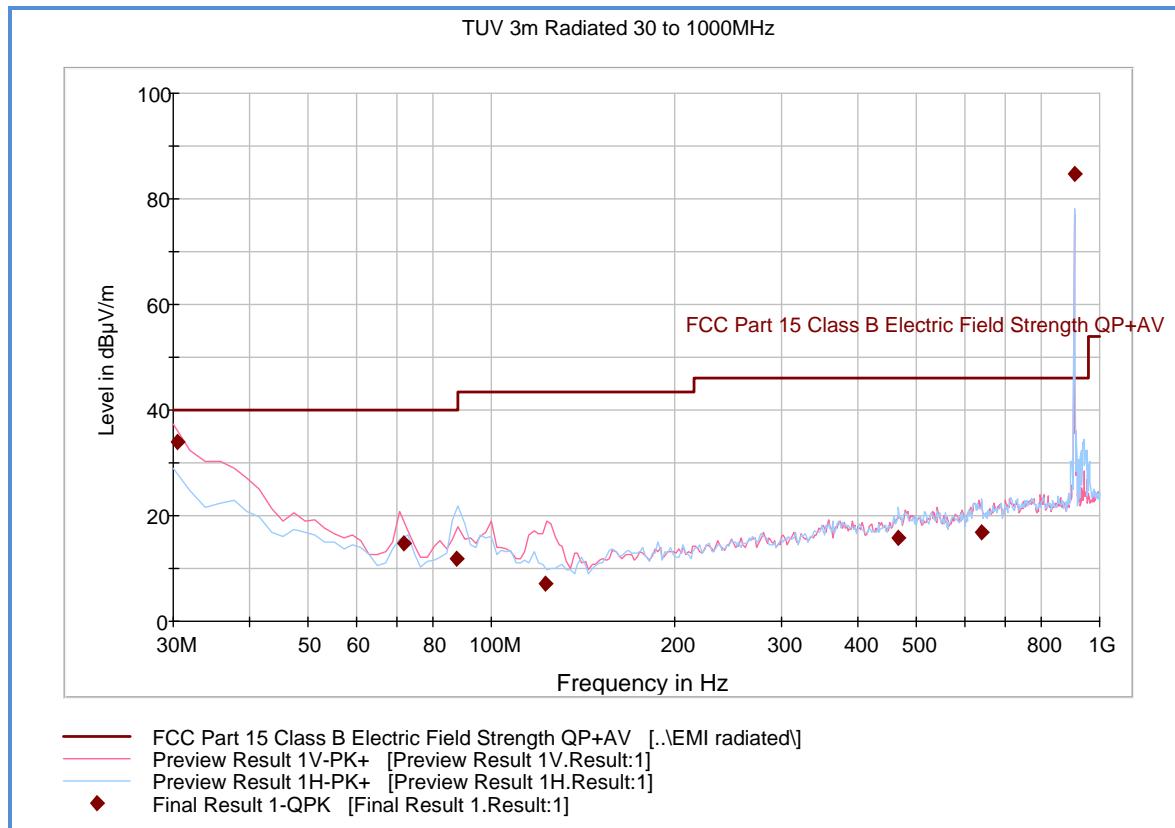
2.3.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to >10th harmonic (18GHz).
- No significant emission observed below 1GHz.
- Above 1GHz measurement results are identical to test results presented under Section 2.2.12 of this test report. No other spurious emissions observed other than harmonics of the fundamental frequency.
- Measurement was done using EMC32 V8.52 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.3.8 for sample computation.

2.3.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 2400 MHz			58.4
Correction Factor (dB)	Asset# 1153 (cable)	3.3	-4.8
	Asset# 8628 (preamplifier)	-36.4	
	Asset# 6669 (antenna)	28.3	
Reported Peak Final Measurement (db μ V/m) @ 2400 MHz			53.6

2.3.9 Test Results Below 1GHz



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.480000	34.0	1000.0	120.000	147.0	V	49.0	-12.5	6.0	40.0
71.781643	14.7	1000.0	120.000	100.0	V	254.0	-22.2	25.3	40.0
87.572745	11.9	1000.0	120.000	100.0	H	220.0	-21.2	28.1	40.0
122.586613	7.2	1000.0	120.000	100.0	V	86.0	-20.9	36.3	43.5
466.814749	15.8	1000.0	120.000	112.0	H	66.0	-7.5	30.2	46.0
639.940762	16.9	1000.0	120.000	328.0	H	14.0	-4.1	29.1	46.0
907.877275	84.8	1000.0	120.000	153.0	H	176.0	-1.1	9.2	94.0



SECTION 3

TEST EQUIPMENT USED



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3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
1033	Bilog Antenna	3142C	00044556	EMCO	08/01/11	08/01/12
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/10/11	08/10/12
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/15/11	06/15/12
1051	Double-ridged waveguide horn antenna	3115	9412-4364	EMCO	11/07/11	11/07/12
1016	Pre-amplifier	PAM-0202	187	PAM	08/17/11	08/17/12
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	10/13/11	10/13/12
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	08/17/11	08/17/12
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	08/17/11	08/17/12
7514	Multimeter	34410A	MY45002624	Agilent	08/01/11	08/01/12
	Test Software	EMC32	V8.52	Rhode & Schwarz		N/A



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements

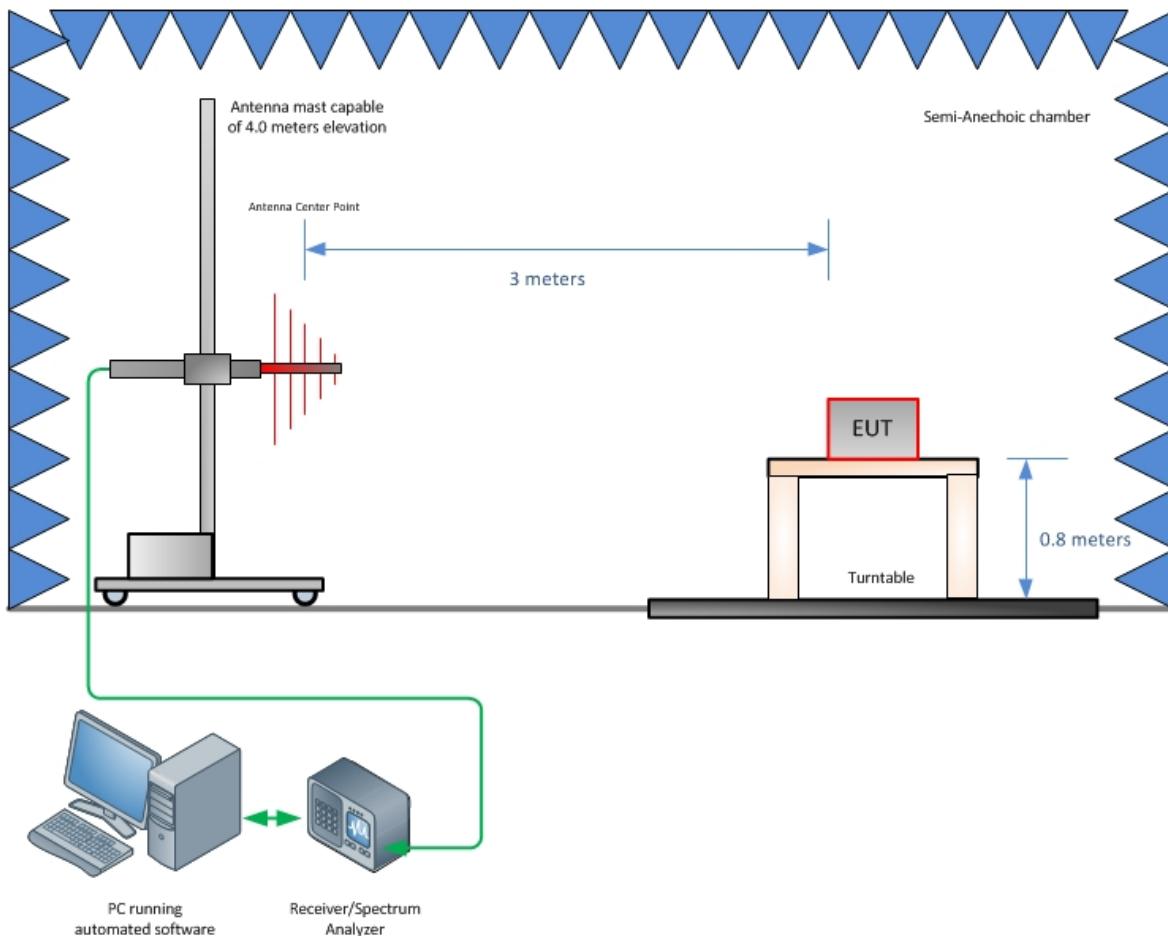
Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1 Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2 Cables	Rectangular	0.50	0.29	0.08
3 Preamp	Rectangular	0.50	0.29	0.08
4 Antenna	Rectangular	0.41	0.24	0.06
5 Site	Rectangular	2.00	1.15	1.33
6 EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):				1.38
Coverage Factor (k):				2
Expanded Uncertainty:				2.79



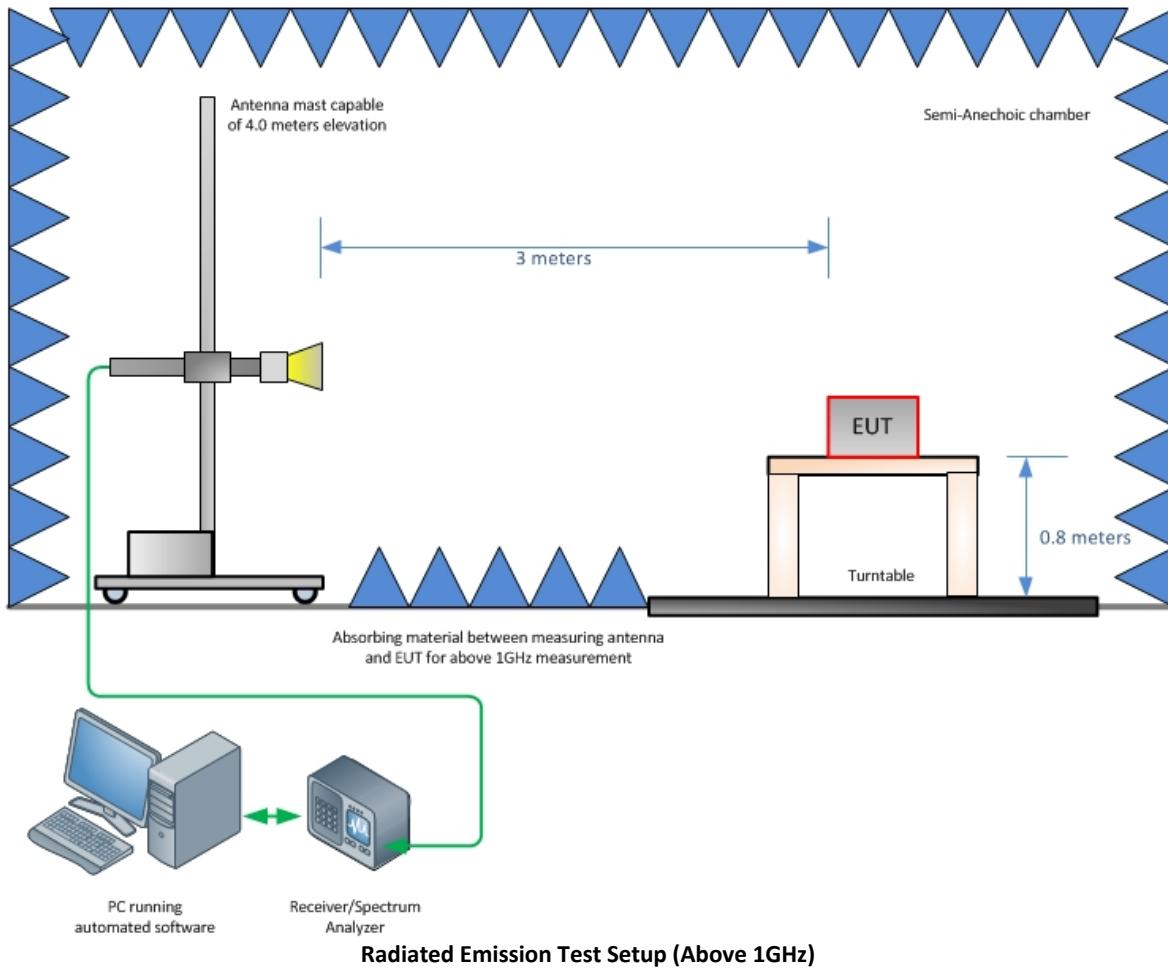
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)





SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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