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Test Report

Certification

FCC ID	2AAAS-CP02
Equipment Under Test	CP02
Test Report Serial No	V036500_02
Date of Test	August 9, 2016
Report Issue Date	August 12, 2016

Test Specifications:	**Applicant:**
FCC Part 15, Subpart C	Vivint, Inc. 4931 N. 300 W. Provo, UT 84604 U.S.A

NVLAP Testing
NVLAP Lab Code 100272-0

Certification of Engineering Report

This report has been prepared by VPI Laboratories, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Vivint, Inc.
Manufacturer	Flextronics Electronics Technology (Shenzhen) Co., Ltd. Hourui Linear Electronics Manufactory
Brand Name	Vivint
Model Number	CP02
FCC ID	2AAAS-CP02

On this 12th day of August 2016, I, individually and for VPI Laboratories, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the VPI Laboratories, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

VPI Laboratories, Inc.

Norman P Hansen

Tested by: Norman P. Hansen

Test Technician

Mark M. Feil

Reviewed by: Mark M. Feil

Laboratory Coordinator

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	August 11, 2016
02	Revise Section 2.2 to correct batteries used and correct the WiFi modules used. Add second WiFi Module photograph.	August 25, 2016

Table of Contents

1 Client Information 5
1.1 Applicant 5
1.2 Manufacturer 5
2 Equipment Under Test (EUT) 6
2.1 Identification of EUT 6
2.2 Description of EUT 6
2.3 EUT and Support Equipment 6
2.4 Interface Ports on EUT 6
2.5 Modification Incorporated/Special Accessories on EUT 7
2.6 Deviation from Test Standard 7
3 Test Specification, Methods and Procedures 8
3.1 Test Specification 8
3.2 Methods & Procedures 8
3.3 Test Procedure 9
4 Operation of EUT During Testing 10
4.1 Operating Environment 10
4.2 Operating Modes 10
4.3 EUT Exercise Software 10
5 Summary of Test Results 11
5.1 FCC Part 15, Subpart C 11
5.2 Result 11
6 Measurements, Examinations and Derived Results 12
6.1 General Comments 12
6.2 Test Results 12
7 Test Procedures and Test Equipment 19
7.1 Conducted Emissions at Mains Ports 19
7.2 Radiated Emissions 21
7.3 Measurement Uncertainty 22
8 Photographs 23

1 Client Information

1.1 Applicant

Company Name	Vivint, Inc. 4931 N. 300 W. Provo, UT 84604 U.S.A
Contact Name	Greg Hansen
Title	Regulatory Compliance Manager

1.2 Manufacturer

Company Name	Flextronics Electronics Technology (Shenzhen) Co., Ltd. 89 Yong Fu Road Tong Fu Tu Industrial Park Fu Yong Town, Bao An District Shenzhen 518103 P.R. China
Contact Name	Sally Ai
Title	QA Engineer

Company Name	Hourui Linear Electronics Manufactory Hourui Second Industrial Zone Hourui Village Xixang, Bao An District Shenzhen, P.R. China
Contact Name	Lego Leung
Title	Quality Systems & SQA Manager

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	Vivint
Model Number	CP02
Hardware Version	Revision A
Serial Number	None
Dimensions (cm)	20.0 x 15.0 x 11.0

2.2 Description of EUT

The CP02 is a control panel for use in Vivint Home systems. The CP02 was powered by a ZBPower AB-A120025A-R, 12 VDC at 2.5 A power supply. Testing was also performed using an Honor ADS-40FSG-12 and an Honor ADS-40SF-12 power supply. A 7.4 V, 1100 mAh or 1200 mAh, Lithium Ion Polymer battery provides power when AC power is removed. The CP02 has a touchscreen display and camera. The CP02 has a Zwave transceiver and a 345 MHz receiver for interfacing other system devices. A Suga SWP23MA-4 or SWP23MA-5 WiFi module, carrying FCC ID VZFSWP23MA3 and IC# 10609A-SWP23MA3, is installed in the CP02. One of 5 cell modules is installed in the CP02. The modules that may be used are: Telit HS3001 with FCC ID MIVCNN0301 and IC# 4160A-CNN0301, a Telit HS3002 with FCC ID PKRNVWCNN0403 and IC# 3229A-CNN0403, a Telit HE910-NAR with FCC ID RI7HE910NA and IC# 5131A-HE910NA, a Telit UE910-NAR with FCC ID RI7UE910NA and IC# 5131A-UE910NA, or a Telit CE910-DUAL with FCC ID RI7CE910-DUAL and IC# 5131A-CE910DUAL.

The Zwave transceiver uses a trace antenna and operates at 908.4 MHz, 908.42 MHz, or 916 MHz and uses data rates of 9.6 kbps, 40 kbps, or 100 kbps. The transmit power settings used in testing were: 908.4 MHz set at 28, 908.42 set at 30, 916 MHz set to 28. These settings are placed in firmware at the factory and cannot be changed by any user.

This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Subpart B was found to be compliant and is covered in VPI Laboratories, Inc. report V036499.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name **Model Number** **Serial Number**	**Description**	**Name of Interface Ports / Interface Cables**
BN: Vivint MN: CP02 (Note 1) SN: None	Control Panel	See Section 2.4

2.4 Interface Ports on EUT

There are no interface ports on the EUT.

2.5 Modification Incorporated/Special Accessories on EUT

There were no modifications or special accessories required to comply with the specification.

2.6 Deviation from Test Standard

There were no deviations from the test specification.

3 Test Specification, Methods and Procedures

3.1 Test Specification

Title	FCC PART 15, Subpart C (47 CFR 15) 15.203, 15.207, and 15.249 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 Conducted Limits

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.50*	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Table 1: Limits for conducted emissions at mains ports of Class B ITE.

3.2.3 §15.249 Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz

a) Except as provided in paragraph (b) of this section, 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

b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions.

1. The field strength of emissions in this band shall not exceed 2500 millivolts/meter.
2. The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.
3. Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

c) Field strength limits are specified at a distance of 3 meters.

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.

e) (e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

3.3 Test Procedure

The testing was performed according to the procedures in ANSI C63.10-2013 and 47 CFR Part 15. Testing was performed at the VPI Laboratories, Inc. Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. VPI Laboratories, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2016.

4 Operation of EUT During Testing

4.1 Operating Environment

Power Supply	120 VAC
AC Mains Frequency	60 Hz

4.2 Operating Modes

The transmitter was tested when tuned to each of the operating frequencies. The EUT was set to transmit a modulated signal at a 100% duty cycle. The AC mains voltage was varied as specified in 15.31(e) with no changes seen in transmitter characteristics.

4.3 EUT Exercise Software

Vivint CP02 test software version A.1.3.X was used to exercise the EUT.

5 Summary of Test Results

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.249(a)	Field Strength of the Fundamental Frequency	902 – 928	Complied
15.249(a)	Field Strength of the Harmonics	0.009 – 9160	Complied
15.249(d)	Field Strength of Spurious Emissions	0.009 – 9160	Complied

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

6 Measurements, Examinations and Derived Results

6.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

6.2 Test Results

6.2.1 §15.203 Antenna Requirements

The EUT uses a trace antenna and is not user replaceable.

Result

The EUT complied with the specification.

6.2.2 §15.207 Conducted Emissions at AC Mains Ports

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBµV)	Limit (dBµV)	Margin (dB)
0.39	Hot Lead	Peak (Note 1)	33.0	48.1	-15.1
2.69	Hot Lead	Peak (Note 1)	30.6	46.0	-15.4
14.58	Hot Lead	Peak (Note 1)	35.7	50.0	-14.3
15.55	Hot Lead	Peak (Note 1)	39.4	50.0	-10.6
16.53	Hot Lead	Peak (Note 1)	36.9	50.0	-13.1
17.50	Hot Lead	Peak (Note 1)	35.1	50.0	-14.9
0.15	Neutral Lead	Peak (Note 1)	47.3	56.0	-8.7
0.20	Neutral Lead	Peak (Note 1)	44.2	53.6	-9.4
0.39	Neutral Lead	Peak (Note 1)	37.0	48.1	-11.1
15.55	Neutral Lead	Peak (Note 1)	37.1	50.0	-12.9
16.55	Neutral Lead	Peak (Note 1)	36.9	50.0	-13.1
18.45	Neutral Lead	Peak (Note 1)	35.9	50.0	-14.1

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Result

The EUT complied with the specification limit by a margin of 8.7 dB.

6.2.3 §15.249(a) Fundamental Field Strength

The table below shows the fundamental emission, measured at 3 meters using quasi-peak detection.

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)	Polarity
908.40	Quasi-Peak	57.8	36.1	93.9	94.0	-0.1	Vertical*
908.42	Quasi-Peak	57.7	36.1	93.8	94.0	-0.2	Vertical*
916.00	Quasi-Peak	57.4	36.2	93.6	94.0	-0.4	Vertical*
* Vertical measurements were much stronger than measurements made with the receive antenna horizontal; therefore, the measurements taken with the antenna in the vertical polarity are shown.							

Result

The EUT complied with the specification.

6.2.4 §15.249(a) and §15.249(d) Field Strength of Harmonics and Spurious Emissions

The spurious emissions and harmonic emissions were measured from the lowest frequency used in the device to the 10th harmonic of the highest frequency. The table below shows the emissions from the transmitter. Emissions from the digital circuitry and receivers of the EUT are shown in VPI Laboratories, Inc. report V036499.

6.2.4.1 Transmitting at 908.40 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1816.8	Peak	Vertical	4.8	30.0	34.8	74.0	-39.2
1816.8	Average	Vertical	-3.3	30.0	26.7	54.0	-27.3
1816.8	Peak	Horizontal	1.4	30.0	31.4	74.0	-42.6
1816.8	Average	Horizontal	-4.8	30.0	25.2	54.0	-28.8
2725.2	Peak	Vertical	22.0	33.6	55.6	74.0	-18.4
2725.2	Average	Vertical	20.37	33.6	53.97	54.0	-0.03
2725.2	Peak	Horizontal	20.7	33.6	54.3	74.0	-19.7
2725.2	Average	Horizontal	18.6	33.6	52.2	54.0	-1.8
3633.6	Peak	Vertical	2.4	36.7	39.1	74.0	-34.9
3633.6	Average	Vertical	-7.7	36.7	29.0	54.0	-25.0
3633.6	Peak	Horizontal	1.5	36.7	38.2	74.0	-35.8
3633.6	Average	Horizontal	-9.7	36.7	27.0	54.0	-27.0
4542.0	Peak	Vertical	3.7	38.4	42.1	74.0	-31.9
4542.0	Average	Vertical	-1.0	38.4	37.4	54.0	-16.6
4542.0	Peak	Horizontal	6.9	38.4	45.3	74.0	-28.7

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4542.0	Average	Horizontal	3.2	38.4	41.6	54.0	-12.4
5450.4	Peak	Vertical	2.2	40.5	42.7	74.0	-31.3
5450.4	Average	Vertical	-6.0	40.5	34.5	54.0	-19.5
5450.4	Peak	Horizontal	2.1	40.5	42.6	74.0	-31.4
5450.4	Average	Horizontal	-5.3	40.5	35.2	54.0	-18.8
6358.8	Peak	Vertical	7.9	41.5	49.4	74.0	-24.6
6358.8	Average	Vertical	5.2	41.5	46.7	54.0	-7.3
6358.8	Peak	Horizontal	8.6	41.5	50.1	74.0	-23.9
6358.8	Average	Horizontal	5.4	41.5	46.9	54.0	-7.1
7267.2	Peak	Vertical	0.4	43.7	44.1	74.0	-29.9
7267.2	Average	Vertical	-10.5	43.7	33.2	54.0	-20.8
7267.2	Peak	Horizontal	1.1	43.7	44.8	74.0	-29.2
7267.2	Average	Horizontal	-10.1	43.7	33.6	54.0	-20.4
8175.6	Peak	Vertical	1.5	45.4	46.9	74.0	-27.1
8175.6	Average	Vertical	-8.8	45.4	36.6	54.0	-17.4
8175.6	Peak	Horizontal	1.6	45.4	47.0	74.0	-27.0
8175.6	Average	Horizontal	-8.6	45.4	36.8	54.0	-17.2
9084.0	Peak	Vertical	1.2	46.9	48.1	74.0	-25.9
9084.0	Average	Vertical	-9.5	46.9	37.4	54.0	-16.6
9084.0	Peak	Horizontal	2.0	46.9	48.9	74.0	-25.1
9084.0	Average	Horizontal	-9.0	46.9	37.9	54.0	-16.1

6.2.4.2 Transmitting at 908.42 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1816.8	Peak	Vertical	6.3	30.0	36.3	74.0	-37.7
1816.8	Average	Vertical	1.0	30.0	31.0	54.0	-23.0
1816.8	Peak	Horizontal	6.0	30.0	36.0	74.0	-38.0
1816.8	Average	Horizontal	0.8	30.0	30.8	54.0	-23.2
2725.3	Peak	Vertical	21.6	33.6	55.2	74.0	-18.8
2725.3	Average	Vertical	20.1	33.6	53.7	54.0	-0.3
2725.3	Peak	Horizontal	21.2	33.6	54.8	74.0	-19.2
2725.3	Average	Horizontal	18.2	33.6	51.8	54.0	-2.2
3633.7	Peak	Vertical	1.7	36.7	38.4	74.0	-35.6
3633.7	Average	Vertical	-9.4	36.7	27.3	54.0	-26.7
3633.7	Peak	Horizontal	1.9	36.7	38.6	74.0	-35.4
3633.7	Average	Horizontal	-9.0	36.7	27.7	54.0	-26.3
4542.1	Peak	Vertical	4.6	38.4	43.0	74.0	-31.0
4542.1	Average	Vertical	-0.3	38.4	38.1	54.0	-15.9
4542.1	Peak	Horizontal	7.6	38.4	46.0	74.0	-28.0
4542.1	Average	Horizontal	4.0	38.4	42.4	54.0	-11.6
5450.5	Peak	Vertical	2.5	40.5	43.0	74.0	-31.0
5450.5	Average	Vertical	-4.6	40.5	35.9	54.0	-18.1
5450.5	Peak	Horizontal	3.1	40.5	43.6	74.0	-30.4
5450.5	Average	Horizontal	-4.4	40.5	36.1	54.0	-17.9
6258.9	Peak	Vertical	6.3	41.4	47.7	74.0	-26.3
6258.9	Average	Vertical	2.9	41.4	44.3	54.0	-9.7
6258.9	Peak	Horizontal	8.5	41.4	49.9	74.0	-24.1
6258.9	Average	Horizontal	6.1	41.4	47.5	54.0	-6.5
7267.4	Peak	Vertical	1.0	43.7	44.7	74.0	-29.3
7267.4	Average	Vertical	-10.3	43.7	33.4	54.0	-20.6
7267.4	Peak	Horizontal	0.9	43.7	44.6	74.0	-29.4
7267.4	Average	Horizontal	-10.0	43.7	33.7	54.0	-20.3
8175.8	Peak	Vertical	1.4	45.4	46.8	74.0	-27.2

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
8175.8	Average	Vertical	-8.9	45.4	36.5	54.0	-17.5
8175.8	Peak	Horizontal	1.7	45.4	47.1	74.0	-26.9
8175.8	Average	Horizontal	-7.9	45.4	37.5	54.0	-16.5
9084.2	Peak	Vertical	1.1	46.9	48.0	74.0	-26.0
9084.2	Average	Vertical	-9.5	46.9	37.4	54.0	-16.6
9084.2	Peak	Horizontal	1.5	46.9	48.4	74.0	-25.6
9084.2	Average	Horizontal	-9.3	46.9	37.6	54.0	-16.4

6.2.4.3 Transmitting at 916.00 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1832.0	Peak	Vertical	4.7	30.1	34.8	74.0	-39.2
1832.0	Average	Vertical	-5.0	30.1	25.1	54.0	-28.9
1832.0	Peak	Horizontal	4.6	30.1	34.7	74.0	-39.3
1832.0	Average	Horizontal	-5.2	30.1	24.9	54.0	-29.1
2748.0	Peak	Vertical	21.5	33.7	55.2	74.0	-18.8
2748.0	Average	Vertical	20.0	33.7	53.7	54.0	-0.3
2748.0	Peak	Horizontal	19.8	33.7	53.5	74.0	-20.5
2748.0	Average	Horizontal	18.1	33.7	51.8	54.0	-2.2
3664.0	Peak	Vertical	1.3	36.8	38.1	74.0	-35.9
3664.0	Average	Vertical	-10.9	36.8	25.9	54.0	-28.1
3664.0	Peak	Horizontal	1.9	36.8	38.7	74.0	-35.3
3664.0	Average	Horizontal	-9.3	36.8	27.5	54.0	-26.5
4580.0	Peak	Vertical	4.6	38.5	43.1	74.0	-30.9
4580.0	Average	Vertical	-0.7	38.5	37.8	54.0	-16.2
4580.0	Peak	Horizontal	7.1	38.5	45.6	74.0	-28.4
4580.0	Average	Horizontal	3.2	38.5	41.7	54.0	-12.3
5496.0	Peak	Vertical	2.1	40.6	42.7	74.0	-31.3
5496.0	Average	Vertical	-6.3	40.6	34.3	54.0	-19.7
5496.0	Peak	Horizontal	2.0	40.6	42.6	74.0	-31.4

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5496.0	Average	Horizontal	-5.6	40.6	35.0	54.0	-19.0
6412.0	Peak	Vertical	6.1	41.6	47.7	74.0	-26.3
6412.0	Average	Vertical	2.4	41.6	44.0	54.0	-10.0
6412.0	Peak	Horizontal	7.7	41.6	49.3	74.0	-24.7
6412.0	Average	Horizontal	4.5	41.6	46.1	54.0	-7.9
7328.0	Peak	Vertical	0.5	43.9	44.4	74.0	-29.6
7328.0	Average	Vertical	-10.6	43.9	33.3	54.0	-20.7
7328.0	Peak	Horizontal	1.1	43.9	45.0	74.0	-29.0
7328.0	Average	Horizontal	-10.2	43.9	33.7	54.0	-20.3
8244.0	Peak	Vertical	1.7	45.5	47.2	74.0	-26.8
8244.0	Average	Vertical	-10.7	45.5	34.8	54.0	-19.2
8244.0	Peak	Horizontal	1.7	45.5	47.2	74.0	-26.8
8244.0	Average	Horizontal	-8.0	45.5	37.5	54.0	-16.5
9160.0	Peak	Vertical	1.3	46.9	48.2	74.0	-25.8
9160.0	Average	Vertical	-10.6	46.9	36.3	54.0	-17.7
9160.0	Peak	Horizontal	1.3	46.9	48.2	74.0	-25.8
9160.0	Average	Horizontal	-9.3	46.9	37.6	54.0	-16.4

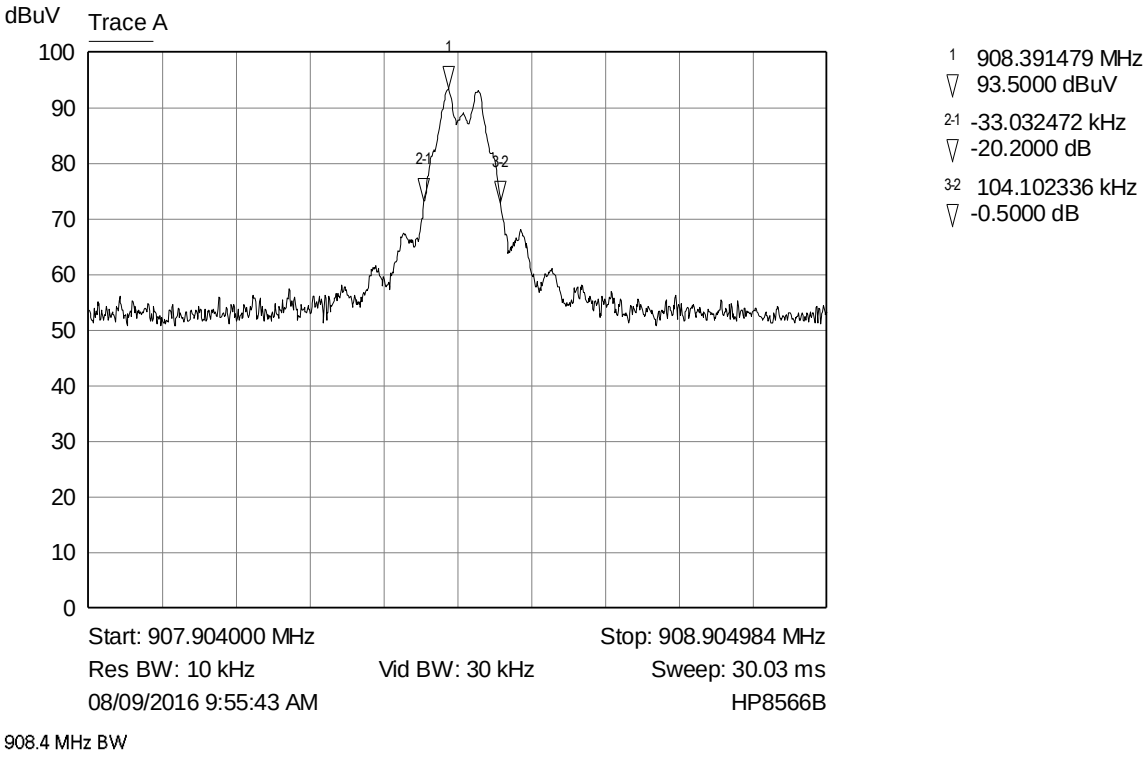
Result

The EUT complied with the specification.

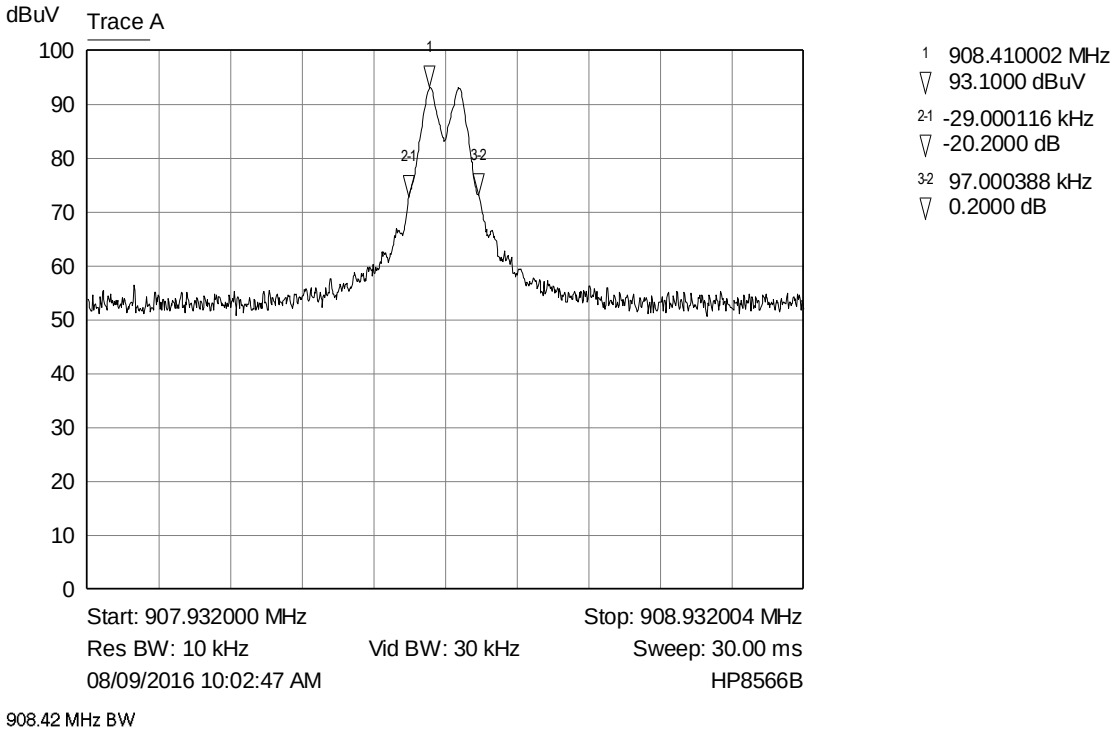
6.2.5 Channel Bandwidth

The 20 dB bandwidths of the operating frequencies are shown in the plots below. The plot shows the fundamental emission 20 dB band width is contained totally within the 902 – 928 MHz frequency band.

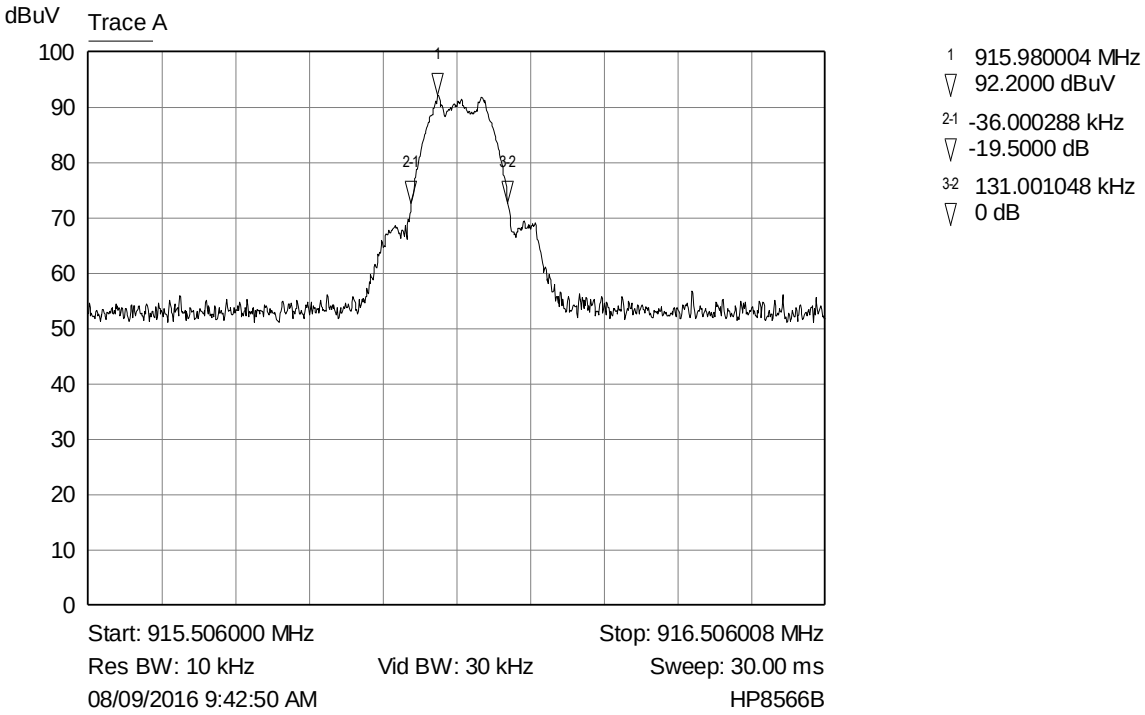
Frequency (MHz)	Bandwidth (kHz)
908.40	104.1
908.42	97.0
916.00	131.0



Graph 1: Channel Bandwidth (908.40 MHz)



Graph 2: Channel Bandwidth (908.42 MHz)



Graph 3: Channel Bandwidth (916 MHz)

7 Test Procedures and Test Equipment

7.1 Conducted Emissions at Mains Ports

The conducted emissions at mains and telecommunications ports from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted emissions at mains ports measurements are performed in a screen room using a (50 Ω/50 µH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of devices with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

- Each power cord, which is terminated in a mains supply plug, shall be tested separately.
- Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
- Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
- Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.

- When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

For testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	Hewlett Packard	8566B	V033345	03/28/2016	03/28/2017
Quasi-Peak Detector	Hewlett Packard	85650A	V034141	03/03/2016	03/03/2017
LISN	VPI Labs	LISN-COMM-50	V034042	02/26/2016	02/26/2017
Conductance Cable Wanship Site #2	VPI Labs	Cable J	V034832	01/11/2016	01/11/2017
Transient Limiter	Hewlett Packard	11947A	V033591	01/11/2016	01/11/2017
Test Software (AC)	VPI Labs	Revision 01	V035674	N/A	N/A

Table 2: List of equipment used for conducted emissions testing at mains ports.

All the equipment listed above is calibrated using either an independent calibration laboratory or VPI Laboratories, Inc. personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

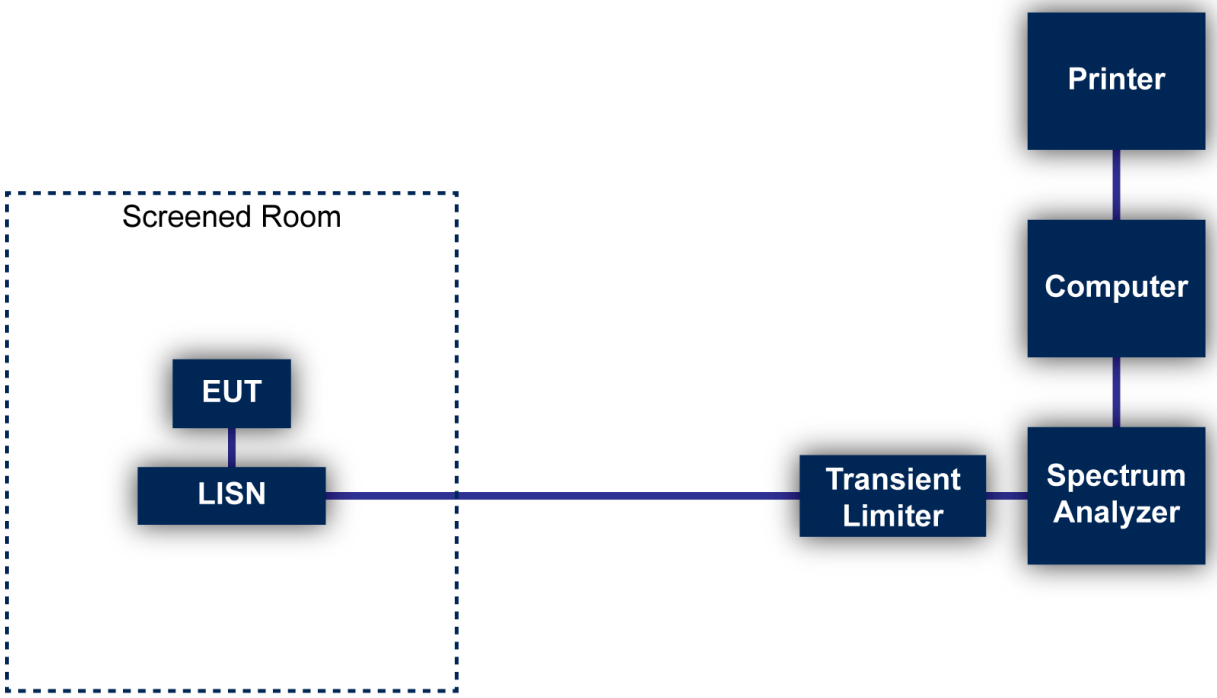


Figure 1: Conducted Emissions Test

7.2 Radiated Emissions

The radiated emissions from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A preamplifier with a fixed gain of 26 dB and a power amplifier with a fixed gain of 22 dB were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For frequencies below 30 MHz, a 9 kHz resolution Bandwidth was used.

A loop antenna was used to measure frequencies below 30 MHz. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 10 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated emissions. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. For frequencies above 1000 MHz, the EUT is placed on a table 1.5 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emissions testing that is performed at distances closer than the specified distance; an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	V033119	06/17/2016	06/17/2017
Spectrum Analyzer	Hewlett Packard	8566B	V033345	03/28/2016	03/28/2017
Quasi-Peak Detector	Hewlett Packard	85650A	V034141	03/03/2016	03/03/2017
Loop Antenna	EMCO	6502	V034216	10/01/2014	10/01/2016
Biconilog Antenna	EMCO	3142E-PA	V035736	06/24/2016	06/24/2018
Double Ridged Guide Antenna	EMCO	3115	V033469	02/09/2016	02/09/2018
High Frequency Amplifier	Miteq	AFS4-001018000-35-10P-4	V033997	01/15/2016	01/15/2017
6’ High Frequency Cable	Microcoax	UFB197C-0-0720-000000	V033638	01/11/2016	01/11/2017
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	V033979	01/15/2016	01/15/2017

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	V033639	01/11/2016	01/11/2017
Pre/Power-Amplifier	Hewlett Packard	8447F	V034218	09/18/2015	09/18/2016
Test Software (AC)	VPI Labs	Revision 01	V035673	N/A	N/A

Table 3: List of equipment used for radiated emissions testing.

All the equipment listed above is calibrated using either an independent calibration laboratory or VPI Laboratories, Inc. personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

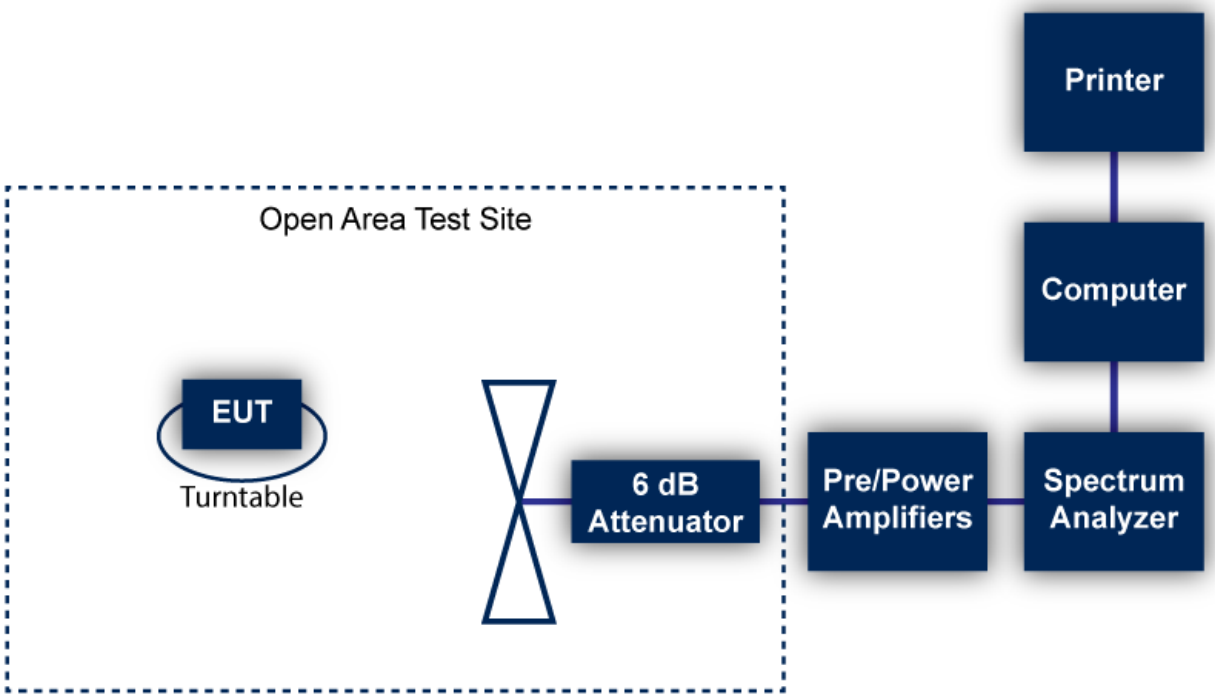


Figure 2: Radiated Emissions Test

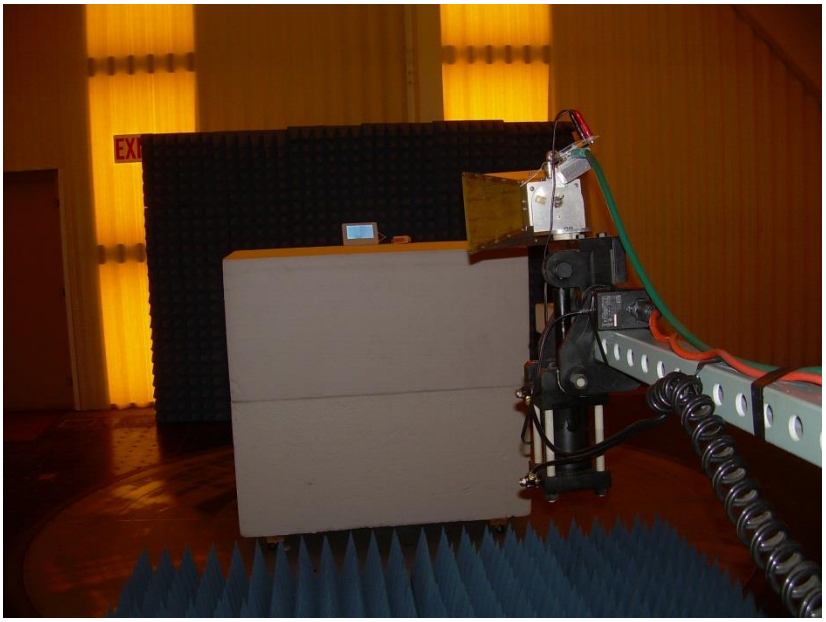
7.3 Measurement Uncertainty

Test	Uncertainty (±dB)	Confidence (%)
Conducted Emissions	2.8	95
Radiated Emission (9 kHz to 30 MHz)	3.3	95
Radiated Emissions (30 MHz to 1 GHz)	3.4	95
Radiated Emissions (1 GHz to 18 GHz)	5.0	95

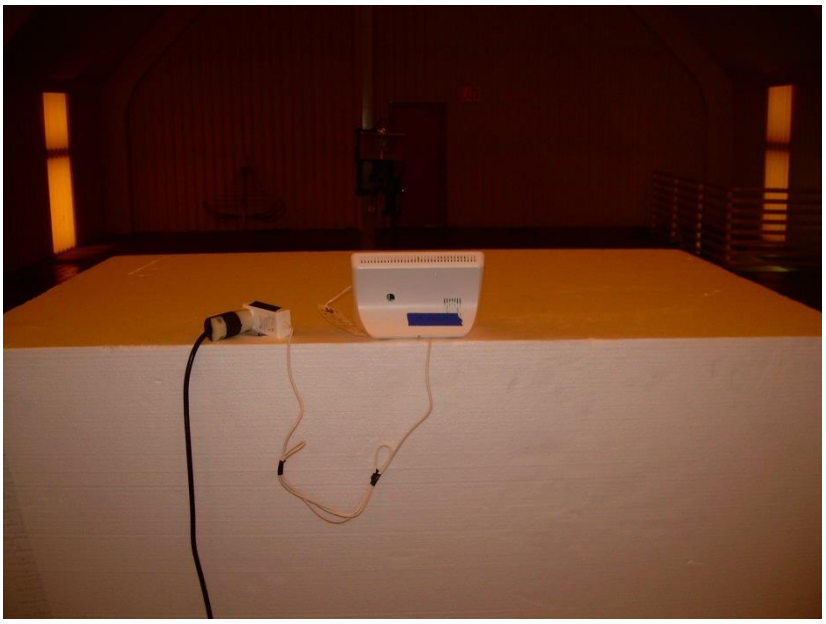
8 Photographs

Photograph 1: Front View Radiated Emissions Configuration – Below 1000 MHz

Photograph 2: Back View Radiated Emissions Configuration – Below 1000 MHz



Photograph 3: Front View Radiated Emissions Configuration – Above 1000 MHz



Photograph 4: Back View Radiated Emissions Configuration – Below 1000 MHz

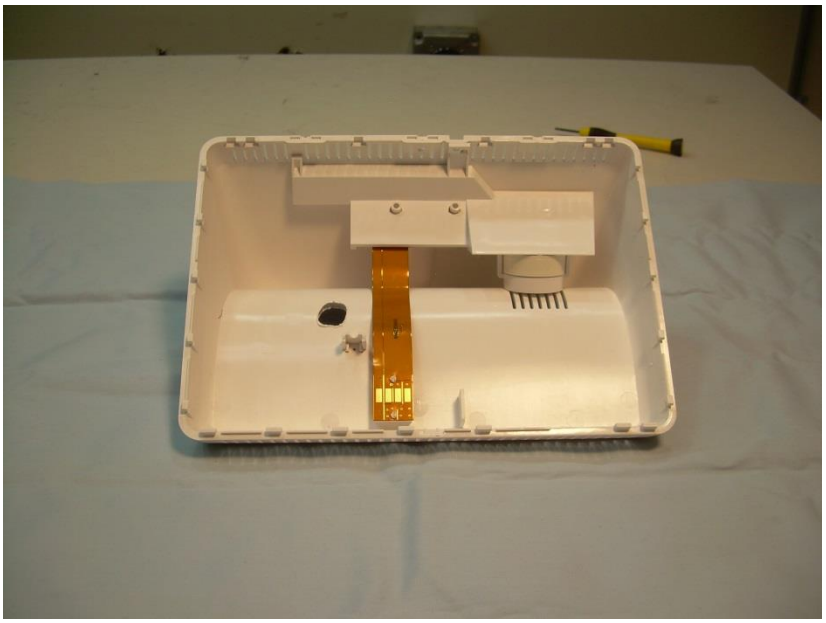
Photograph 5 - Front View Conducted Emissions Worst Case Configuration

Photograph 6 - Back View Conducted Emissions Worst Case Configuration

Photograph 7 - Front View of the EUT

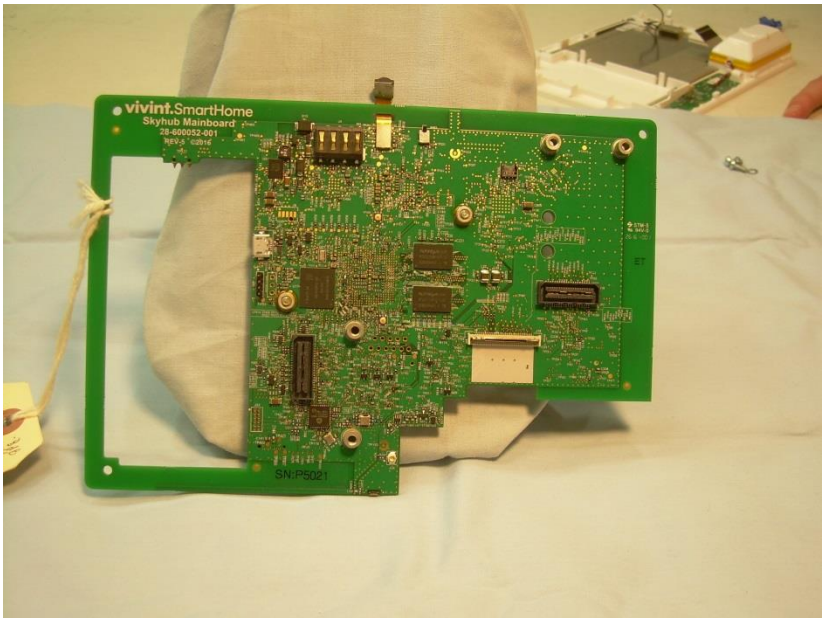
Photograph 8 - Back View of the EUT

Photograph 9 – Bottom View of the EUT

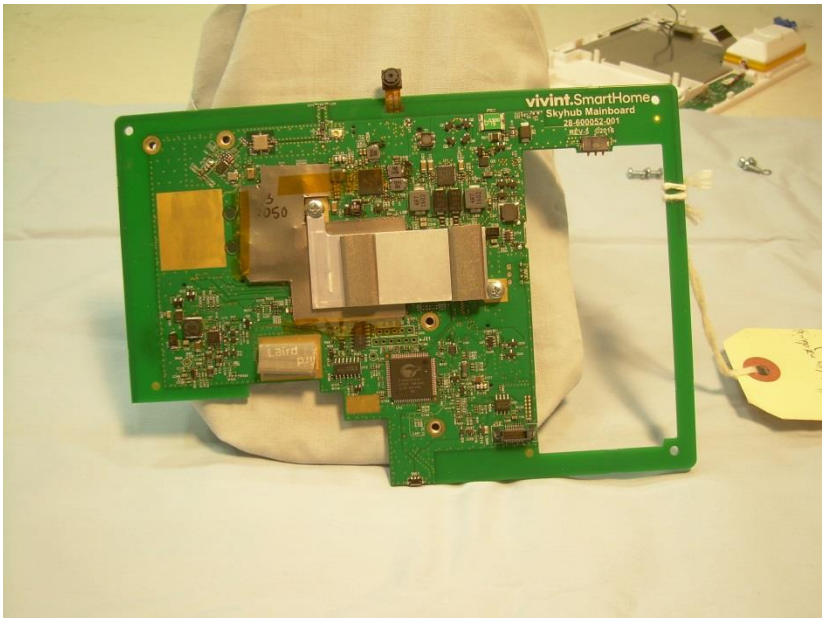


Photograph 10 – View of the Back Housing

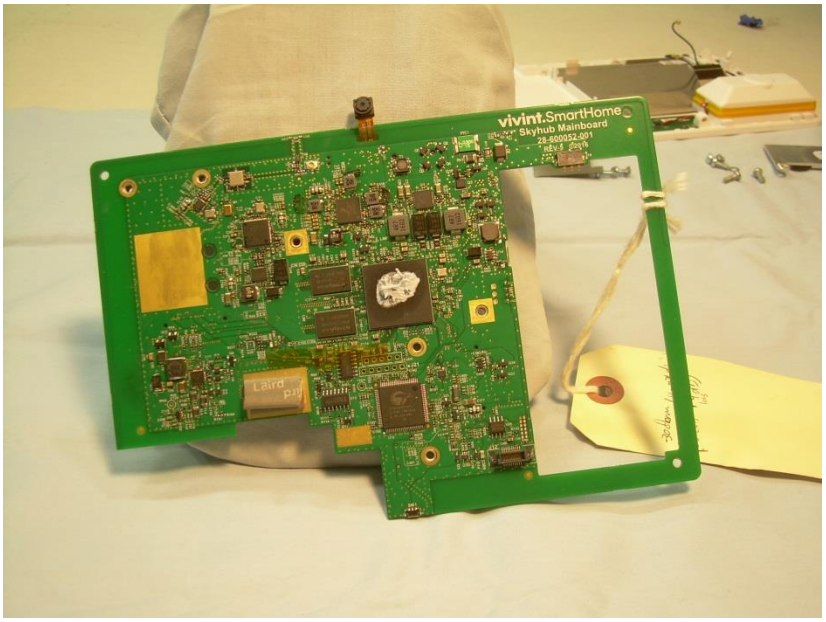
Photograph 11 – View of the EUT with Back Housing Removed



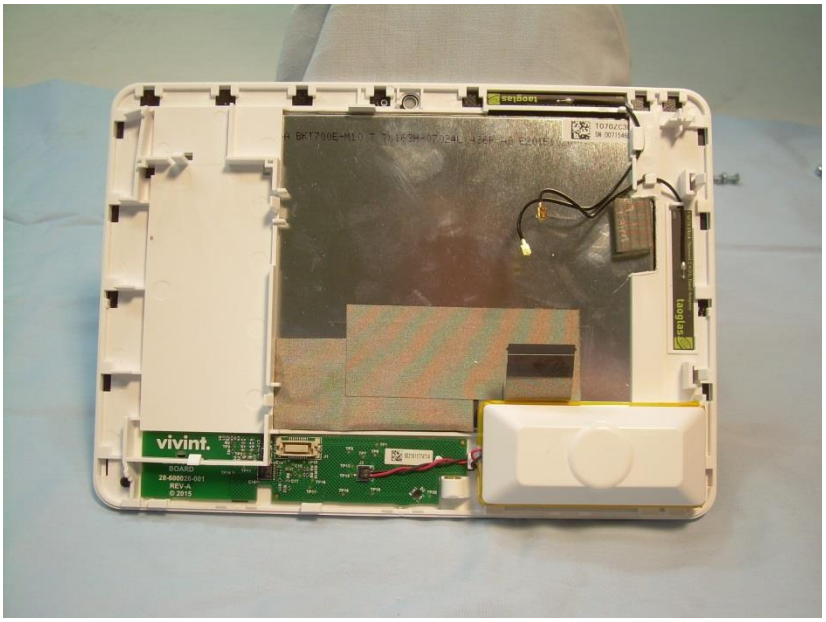
Photograph 12 – View of the Back Side of the Main PCB with Modules Removed



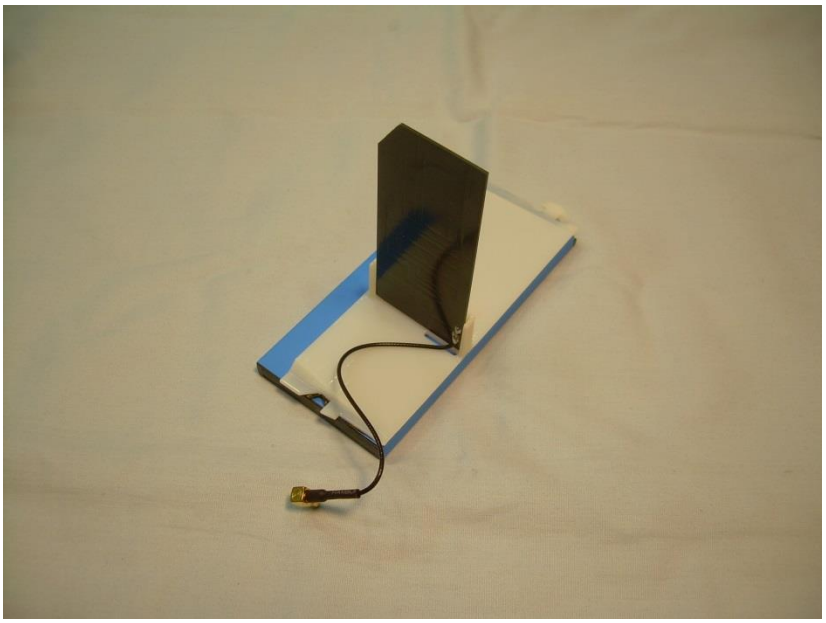
Photograph 13 – Front View of the Main PCB with Conductive Tape in Place



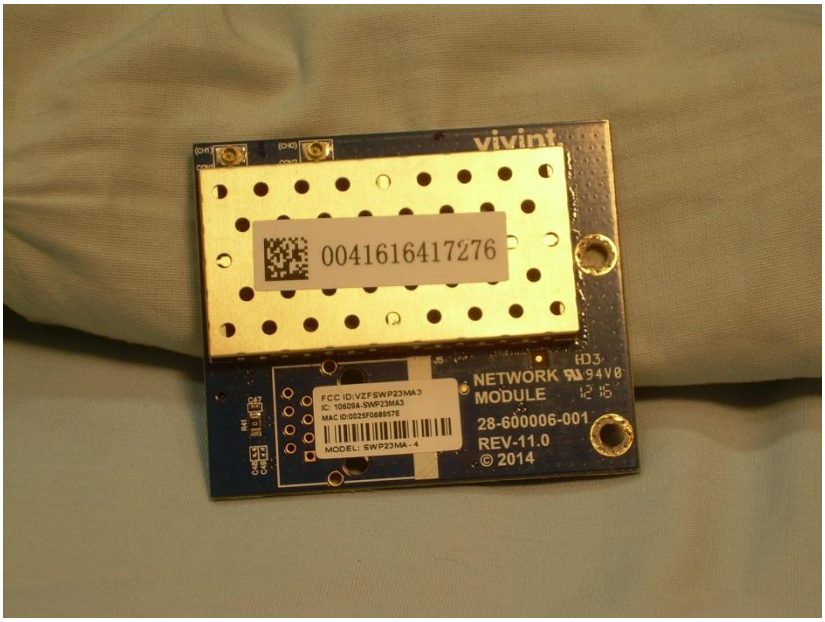
Photograph 14 – Front View of the Main PCB with Conductive Tape Removed



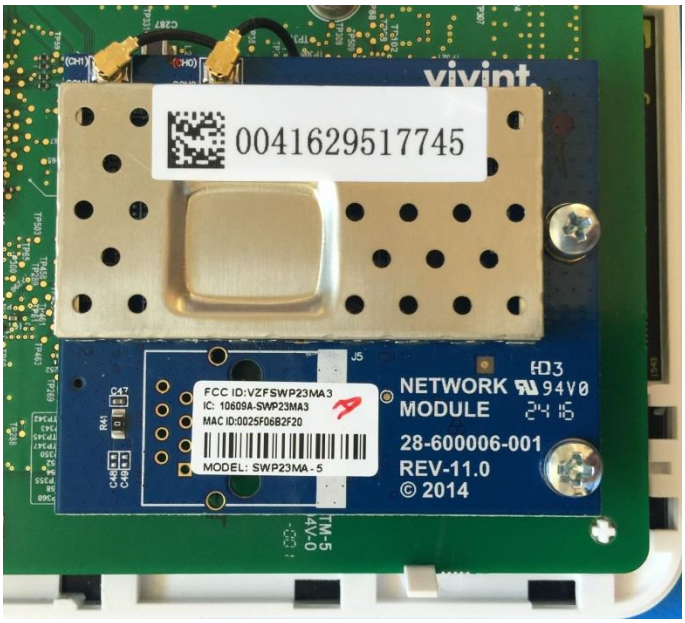
Photograph 15 – View of the EUT with Main PCB and Modules Removed



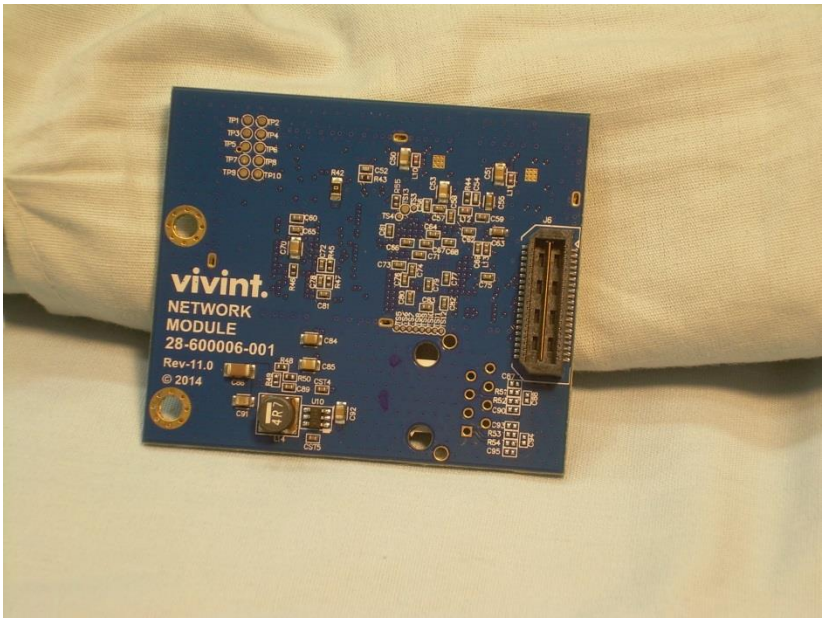
Photograph 16 –View of the Cell Antenna and Battery



Photograph 17 – View of the Suga SWP23MA-4WiFi Module on Interface PCB

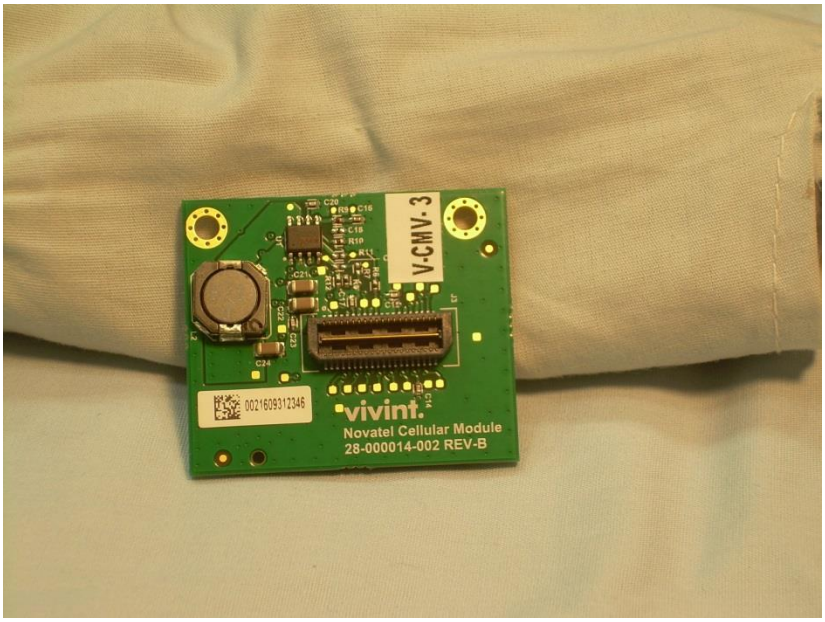


Photograph 18 – View of the Suga SWP23MA-5 WiFi Module on Interface PCB



Photograph 19 – View of the Interface Side of the WiFi Module Interface PCB

Photograph 20 – View of a Cell Module on the Interface PCB



Photograph 21 – View of the Interface Side of the Cell Module Interface PCB

--- End of Report ---