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Test Report

Certification

FCC ID	2AAAS-CP04
Equipment Under Test	CP04
Test Report Serial No	V042225_03
Dates of Test	June 19 – 22, 2017
Report Issue Date	September 19, 2017

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	Vivint, Inc.
Brand Name	Vivint
Model Number	CP04
FCC ID	2AAAS-CP04

On this 19th day of September 2017, 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.

Tested by: Norman P. Hansen

Reviewed by: Joseph W. Jackson

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	September 19, 2017
02	Correct EUT tables to show Ethernet port and connections	September 22, 2017
03	Remove setup photos, external photos, internal photos for short term confidentiality. Add FCC accreditation designation number to section 3.3.	September 26, 2017

Table of Contents

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

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	Vivint
Model Number	CP04
Hardware Version	Rev A
Serial Number	0001723400006
Dimensions (cm)	23.0 x 16.0 x 3.5

2.2 Description of EUT

The CP04 is a control panel for use in Vivint Home systems. An external power supply provides 12 Vdc to the CP04. An internal 3.7 V LiPolymer battery will provide power in the event of a power failure. The CP04 has a WiFi transceiver module, cell module, Zwave transceiver, 902 – 928 MHz transceiver, 13.56 MHz near field transceiver, and 345 MHz receiver for interfacing other devices.

This report covers the Near Field Communication transceiver that is subject to §15.225. The NFC transceiver operates at 13.56 MHz. The antenna is a trace on the PCB.

The circuitry of the device subject to FCC Subpart B was found to be compliant and is covered in VPI Laboratories, Inc. report V042223. The 902 – 928 MHz transceiver, subject to §15.247, and the Zwave transceiver, subject to §15.249, are to be tested and covered in separate reports. The cell module is a Sierra Wireless model HL7588 and carries FCC ID N7HL7588. The WiFi module is a Vivint NM01 and carries FCC ID 2AAAS-NM01.

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: CP04 (Note 1) SN: 0001723400006	Control Panel	See Section 2.4
BN: Trendnet MN: TE100-S8P SN: 0243C3A16540	Network Switch	Ethernet/Cat 5e cable (Note 2)

Notes: (1) EUT

(2) Interface port connected to EUT.

2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
Ethernet	1	Cat 5e cable/7 meters

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 15.225
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 §15.225 Operation Within the Band 13.110 – 14.010

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% 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.

f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.3 Test Procedure

The conducted disturbance at mains ports and radiated disturbance testing was performed according to the procedures in ANSI C63.10:2013. Testing was performed at VPI Laboratories, Inc. Wanship Upper Open Area Test Site, 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, 2018. VPI Laboratories, Inc. carries FCC Accreditation Designation Number US5263.

4 Operation of EUT During Testing

4.1 Operating Environment

Power Supply	120 VAC
AC Mains Frequency	60 Hz

4.2 Operating Modes

The EUT was placed on the EUT table with the NFC transmitter in a constant transmit state. The AC mains voltage was varied as required by §15.31(e) with no change seen in transmitter characteristics.

4.3 EUT Exercise Software

NFC software A.01 was used for exercising the NFC transmitter.

5 Summary of Test Results

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests

Part 15, Subpart C Reference	Test Performed	Frequency Range (MHz)	Result
15.203	Antenna Requirement	N/A	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.225(a)	Field Strength	13.553 – 13.567	Complied
15.225(b)	Field Strength	13.410 – 13.553 13.567 – 13.710	Complied
15.225(c)	Field Strength	13.110 – 13.410 13.710 – 14.010	Complied
15.225(d)	Field Strength	0.009 – 13.110 14.010 – 30000	Complied
15.225(e)	Frequency Stability	13.110 – 14.010	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 on the PCB for an antenna and it is not replaceable.

Result

The EUT complied with the specification

6.2.2 §15.207 Conducted Emissions at the AC Mains

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.15	Hot Lead	Peak (Note 1)	45.0	56.0	-11.0
0.17	Hot Lead	Peak (Note 1)	40.3	55.0	-14.7
0.41	Hot Lead	Peak (Note 1)	36.4	47.7	-11.3
2.97	Hot Lead	Peak (Note 1)	28.9	46.0	-17.1
3.05	Hot Lead	Peak (Note 1)	28.2	46.0	-17.8
4.56	Hot Lead	Peak (Note 1)	27.9	46.0	-18.1
0.15	Neutral Lead	Quasi-Peak (Note 1)	48.3	56.0	-7.7
0.19	Neutral Lead	Peak (Note 1)	48.5	54.1	-5.6
0.22	Neutral Lead	Peak (Note 1)	46.8	52.9	-6.1
0.25	Neutral Lead	Peak (Note 1)	42.6	51.8	-9.2
0.28	Neutral Lead	Peak (Note 1)	40.9	50.9	-10.0
0.41	Neutral Lead	Peak (Note 1)	33.0	47.6	-14.6

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.

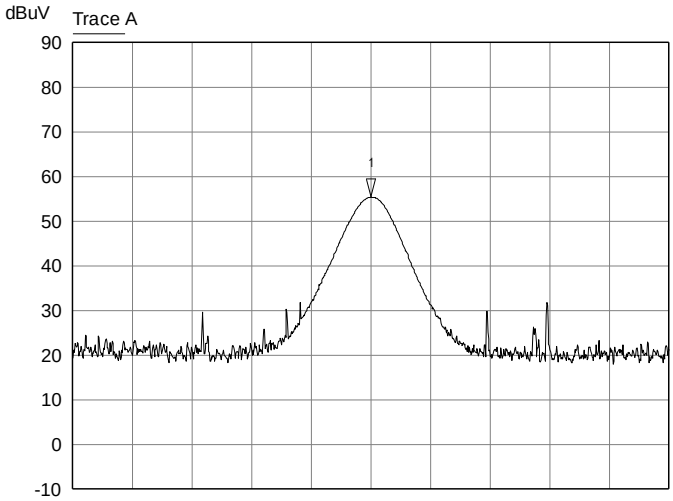
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Result

The EUT complied with the specification limit by a margin of 5.6 dB.

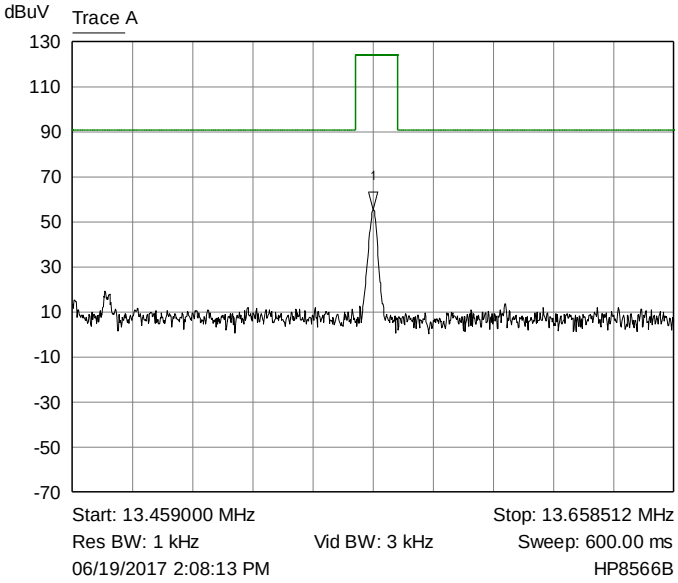
6.2.3 §15.225 (a) – (c) Radiated Disturbance Data (13.110 – 14.010 MHz)

The plots below show the fundamental frequency compared to the limits of FCC §15.225 (a) – (c).



Mkr	X-Axis	Value	Notes
1 ▽	13.558756 MHz	55.5000 dBuV	

Graph 1: Plot of Fundamental Frequency (Peak Emission)



Mkr	X-Axis	Value	Notes
1 ▽	13.558756 MHz	55.4000 dBuV	

Graph 2: Plot of Fundamental Frequency (Emission Mask Shown)

Result

The EUT complied with the specification for emissions in the band 13.110 to 14.010 MHz.

6.2.4 §15.225 (d) Radiated Disturbance Data (0.009 – 1000 MHz, excluding the range 13.110 – 14.010 MHz)

The transmitter was tested for spurious emissions from 0.009 – 1000 MHz using the limits of §15.209. The worst-case emission test data is shown in the table below. The EUT was also tested for emissions from the digital circuitry of the device using the limits of §15.109 and was found to be compliant. The result of this testing is shown in Nemko-CCL, Inc. report V042223.

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
27.12	Peak (Note 1)	19.0	10.8	29.8	69.5	-39.7
40.68	Peak (Note 1)	11.6	17.1	28.7	40.0	-11.3
54.24	Peak (Note 1)	15.2	13.6	28.8	40.0	-11.2
67.8	Peak (Note 1)	11.7	13.7	25.4	40.0	-14.6
81.36	Peak (Note 1)	6.8	14.0	20.8	40.0	-19.2
94.92	Peak (Note 1)	11.2	15.0	26.2	43.5	-17.3
108.48	Peak (Note 1)	17.0	15.5	32.5	43.5	-11.0
122.04	Peak (Note 1)	3.3	15.1	18.4	43.5	-25.1
135.60	Peak (Note 1)	6.9	15.5	22.4	43.5	-21.1

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.

Note 2: Active Loop antenna was used for measurements below 30 MHz.

Note 3: At frequencies below 30 MHz, the measurement distance was 3 meters and the limit adjusted accordingly using an inverse proportionality factor of 40 dB per decade. At frequencies above 30 MHz, the measurement distance was 3 meters.

Result

The EUT complied with the specification for emissions outside the band 13.110 to 14.010 MHz by 11.0 dB.

6.2.5 §15.225(e) Frequency Stability

The EUT was tested for frequency stability as specified in §15.225(e). A variance of 126 Hz was seen across all testing.

Temperature	Frequency of Fundamental Emission			
(°C)	Startup	2 minutes	5 minutes	10 minutes
+50	13,558,792	13,558,786	13,558,784	13,558,780

Temperature	Frequency of Fundamental Emission			
(°C)	Startup	2 minutes	5 minutes	10 minutes
+40	13,558,804	13,558,796	13,558,796	13,558,792
+30	13,558,826	13,558,816	13,558,812	13,558,812
+20	13,558,862	13,558,846	13,558,842	13,558,838
+10	13,558,880	13,558,872	13,558,870	13,558,868
0	13,558,900	13,558,896	13,558,892	13,558,888
-10	13,558,916	13,558,912	13,558,908	13,558,908
-20	13,558,916	13,558,916	13,558,916	13,558,918

Table 2: Frequency vs Temperature Stability

Temperature	Frequency of Fundamental Emission		
20°C	85% of Nominal	Nominal	115% of Nominal
	102 VAC	120 VAC	138 VAC
	13,558,840	13,558,838	13,558,840

Table 3: Frequency vs Voltage Stability

Result

The EUT complied with the specification as the fundamental frequency was maintained with ± 0.01% of the operating frequency through the tests.

6.3 Sample Field Strength Calculation

The field strength is calculated by adding the *Correction Factor* (*Antenna Factor* + *Cable Factor*), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. The basic equation with a sample calculation is shown below:

$$Receiver\ Amplitude\ Reading = Receiver\ Reading - Amplifier\ Gain$$

$$Correction\ Factor = Antenna\ Factor + Cable\ Factor$$

$$Field\ Strength = Receiver\ Amplitude\ Reading + Correction\ Factor + Averaging\ Factor$$

Example

Assuming a *Receiver Reading* of 42.5 dBµV is obtained from the receiver, the *Amplifier Gain* is 26.5 dB the *Antenna Factor* is 4.5 dB, the *Cable Factor* is 4.0 dB, and the *Averaging Factor* is -6.0. The *Field Strength* is calculated by subtracting the *Amplifier Gain* and adding the *Correction Factor* and *Averaging Factor*, giving a *Field Strength* of 18.5 dBµV/m.

$$Receiver\ Amplitude\ Reading\ =\ 42.5 - 26.5\ =\ 16.0\ \mathrm{dB\mu V/m}$$

$$Correction\ Factor\ =\ 4.5 + 4.0\ =\ 8.5\ \mathrm{dB}$$

$$Averaging\ Factor = -6.0$$

$$Field\ Strength\ =\ 16.0 + 8.5 + (-6.0)\ =\ 18.5\ \mathrm{dB\mu V/m}$$

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	V034141	02/15/2017	02/15/2018
Quasi-Peak Detector	Hewlett Packard	85650A	V039474	03/16/2017	03/16/2018
LISN	VPI Labs	LISN-COMM-50	V034042	02/24/2017	02/24/2018
Conductance Cable Wanship Upper Site	VPI Labs	Cable J	V034832	01/09/2017	01/09/2018
Transient Limiter	Hewlett Packard	11947A	V033591	01/09/2017	01/09/2018
Test Software (AC)	VPI Labs	Revision 01	V035674	N/A	N/A

Table 4: List of equipment used for conducted emissions testing at mains ports.

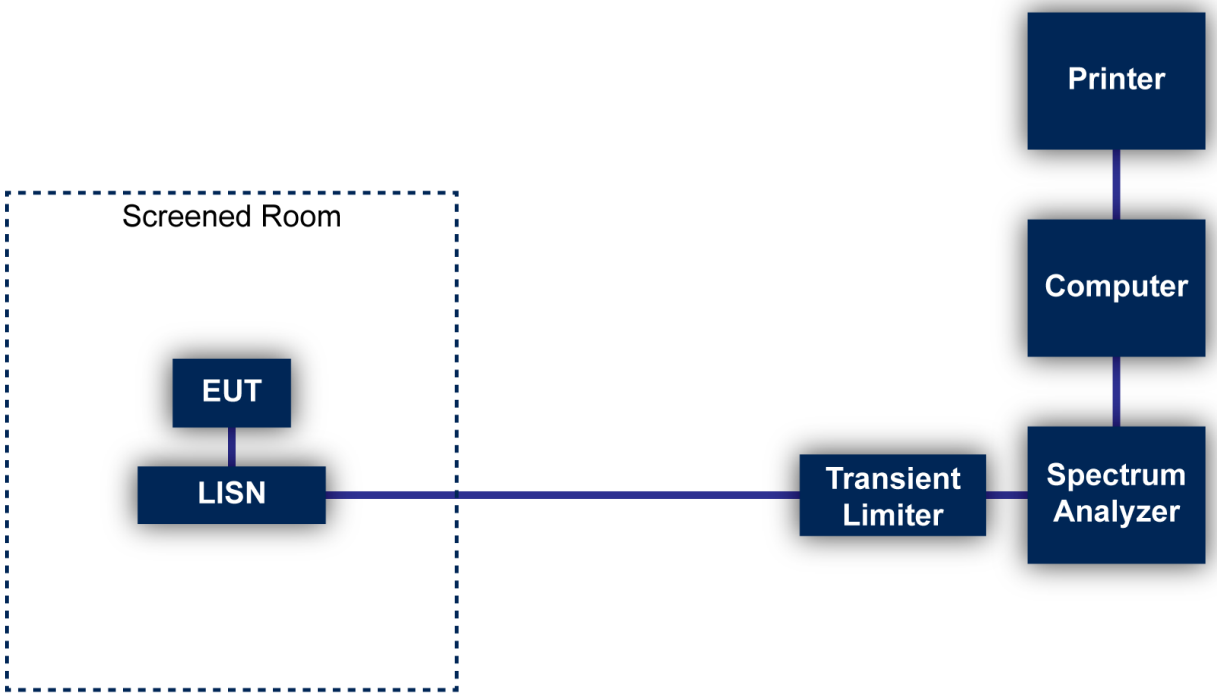


Figure 1: Conducted Emissions Test

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	06/06/2017	06/06/2018
Spectrum Analyzer	Hewlett Packard	8566B	V034141	02/15/2017	02/15/2018
Quasi-Peak Detector	Hewlett Packard	85650A	V039474	03/16/2017	03/16/2018
Loop Antenna	EMCO	6502	V034216	01/25/2017	01/25/2019
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
Standard Gain Horn	ETS-Lindgren	3160-09	V034223	ICO	ICO
Standard Gain Horn	ETS-Lindgren	3160-10	V034224	ICO	ICO
High Frequency Amplifier	Miteq	AFS4-001018000-35-10P-4	V033997	01/09/2017	01/09/2018
6’ High Frequency Cable	Microcoax	UFB197C-0-0720-000000	V033638	01/09/2017	01/09/2018
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	V033979	01/09/2017	01/09/2018
3 Meter Radiated Emissions Cable Wanship Upper Site	Microcoax	UFB205A-0-4700-000000	V033639	01/09/2017	01/09/2018
Test Software (FCC)	VPI Labs	Revision 01	V035673	N/A	N/A

Table 5: List of equipment used for radiated emissions testing.

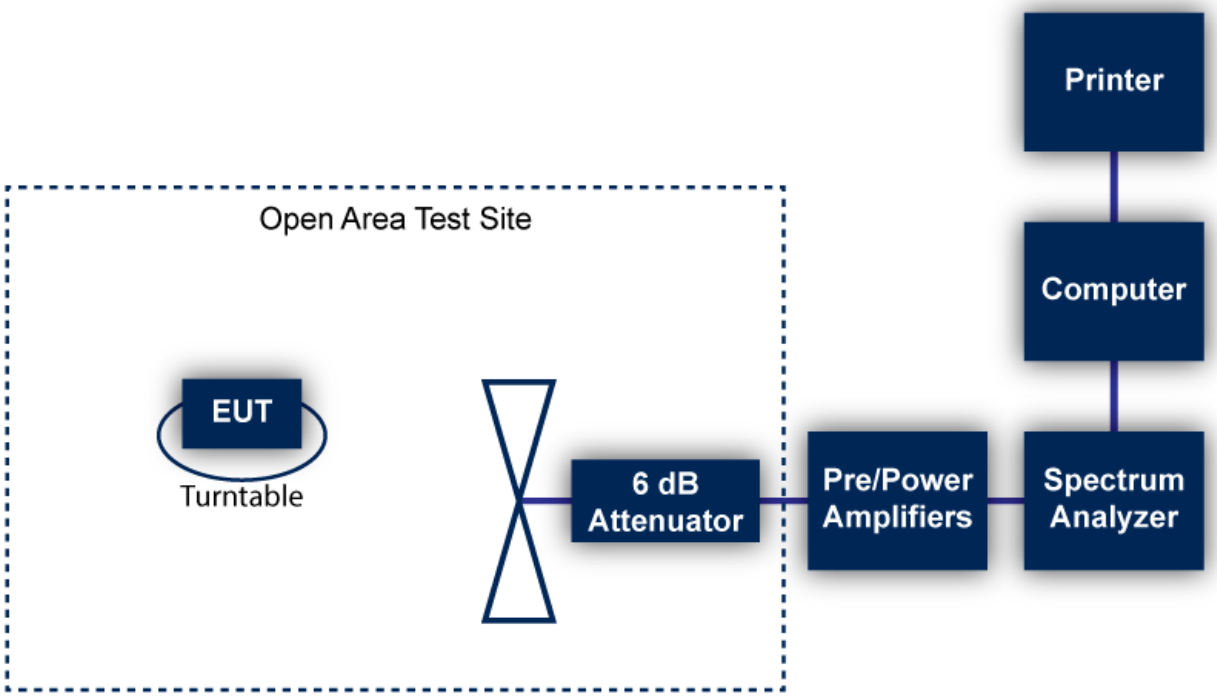


Figure 2: Radiated Emissions Test

7.3 Equipment Calibration

All applicable equipment 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.

7.4 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
Radiated Emissions (18 GHz to 40 GHz)	4.1	95

8 Photographs

Photographs are shown in exhibits filed for certification.

--- End of Report ---