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EMC Test Report

Application for FCC Grant of Equipment Authorization
Canada Certification

FCC Part 15 Subpart C
RSS-210 Annex J

Model: CE04

FCC ID:	2AAAS-CE04
APPLICANT:	Vivint Inc 4931 N. 300 W. Provo, UT 84604
TEST SITE(S):	National Technical Systems 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-5
PROJECT NUMBER:	PR079234
REPORT DATE:	July 26, 2018
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FINAL TEST DATES:	May 29 and 30 and June 4, 2018
TOTAL NUMBER OF PAGES:	63

ACCREDITED
Testing Cert #0214.26

VALIDATING SIGNATORIES

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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	July 26, 2018	First release	
1	September 21, 2018	Reissued to correct standard number on cover page and add serial numbers and information about power supplies to support equipment table.	David Guidotti
2	October 25, 2018	Corrected typos on page 9 and 62	dwb

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SCOPE

An electromagnetic emissions test has been performed on the Vivint Inc model CE04, pursuant to the following rules:

RSS-Gen Issue 5 " General Requirements for Compliance of Radio Apparatus"
RSS 210 Issue 9 " Licence-Exempt Radio Apparatus: Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems test procedures:

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

National Technical Systems is accredited by the A2LA, certificate number 0214.26, to perform the test(s) listed in this report, except where noted otherwise.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Vivint Inc model CE04 complied with some of the requirements of the following regulations:

RSS-Gen Issue 5 " General Requirements for Compliance of Radio Apparatus"
RSS 210 Issue 9 " Licence-Exempt Radio Apparatus: Category I Equipment"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Vivint Inc model CE04 and therefore apply only to the tested sample. The sample was selected and prepared by Greg Hansen of Vivint Inc.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report for the tests performed. Some test results are contained in a separate report.

TEST RESULTS SUMMARY

DEVICES OPERATING IN THE 57-64 GHz BAND

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.255 (d) / 15.209	RSS-210 J.3 (a) & RSS-GEN	Radiated Spurious Emissions, 30 kHz – 40 GHz	44.9 dBμV/m @ 224.97 MHz (-1.1 dB)	general limits < 40 GHz (see page 19)	Complies
15.255 (f)		Frequency Stability	10.3 ppm	Signal must remain in the band	Complies

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antenna	Unique or integral antenna required	Complies
15.207	RSS-Gen Table 4	AC Conducted Emissions POE adapter	39.3 dBμV @ 0.487 MHz (-6.9 dB)	Refer to page 18	Complies
15.207	RSS-Gen Table 4	AC Conducted Emissions AC Adapter	40.1 dBμV @ 0.485 MHz (-6.2 dB)	Refer to page 18	Complies
15.255 (g)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSS-Gen 6.8	User Manual	N/A - No detachable antennas		
-	RSS-Gen 8.4	User Manual		Statement for all products	Complies

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (field strength)	dBμV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBμV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Vivint Inc model CE04 is a 802.11ad transceiver that is designed to provide fast network services to homes. It also contains a 2.4 GHz 11bgn Wi-Fi transceiver for management purposes. It is powered by PoE or direct 48 VDC adapter. Since the EUT is normally mounted on roofs during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 42.5-57 VDC, 1 Amp.

The sample was received on May 29, 2018 and tested on May 29 and 30 and June 4, 2018. The following samples were used for testing:

Company	Model	Description	Serial Number	FCC ID
Vivint, Inc.	CE04	V-band transceiver	0191803100041B	2AAAS-CE04
Vivint, Inc. (spare)	CE04	V-band transceiver	0191803100040C	2AAAS-CE04

OTHER EUT DETAILS

The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes. In some cases, the highest internal source determines the frequency range of test for radiated emissions. The highest internal source of the EUT was declared as 62.64 GHz.

ANTENNA SYSTEM

The antenna system consists of two integral phased array antenna elements provided in each of the four directions. Each phased array antenna element has 30 antennas (4 faces of 60 (2x30) antennas = 240 total antennas). The antenna gain is 23dBi.

ENCLOSURE

The EUT enclosure is primarily constructed of aluminum. It measures approximately 26 cm in diameter by 17 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

No local support equipment was used during testing.

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Phihong	POE50U-560DG	PoE injector	P71304366A1	
HP	ProBook	Laptop	5cg5284dsw	
TP-Link	TL-SG105E	Ethernet switch	2173509004882	
HP	756413-003	Laptop Power Supply	WECJQ0CAR19CMW	
TP-Link	T090060-2C1	Switch Power Supply		

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
PoE Ethernet	Injector out	Cat 6	Shielded	10
Ethernet	Switch	Cat 6	Shielded	10
DC power	48 VDC	2 wire	Shielded	2
Chassis	Earth	1 wire	Unshielded	1

Additional on Support Equipment

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Ethernet (laptop)	Injector in	Cat 6	Shielded	2
DC in (laptop)	External pwr supply out	2 wire	Unshielded	2
External pwr supply in	AC mains	3 wire	Unshielded	2

EUT OPERATION

During emissions testing all 4 radios were transmitting at maximum power on the same V-band channel, 1 of 3 available. In addition, the 2.4 GHz Wi-Fi transceiver was on, waiting for a client to connect.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Designation / Registration Numbers FCC	Canada	Location
Chamber 5	US0027	2845B-5	41039 Boyce Road Fremont, CA 94538-2435

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

Software is used to view and convert receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers. The software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters for testing below 1 GHz and 1.5m for testing above 1 GHz. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

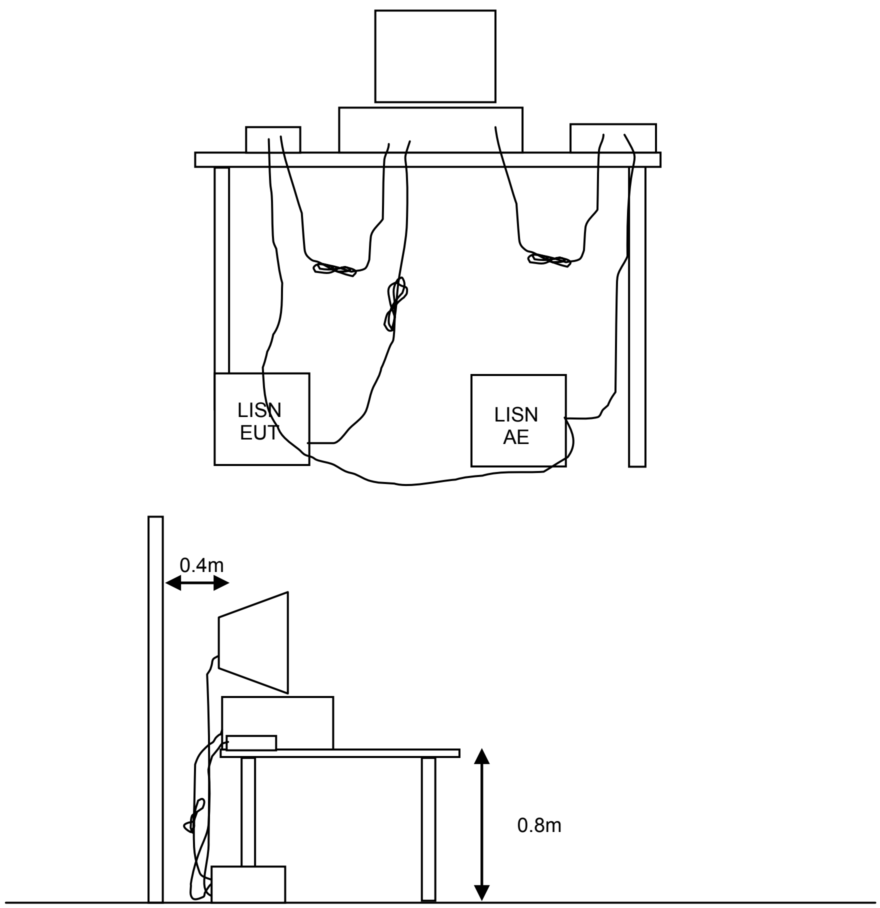


Figure 1 Typical Conducted Emissions Test Configuration

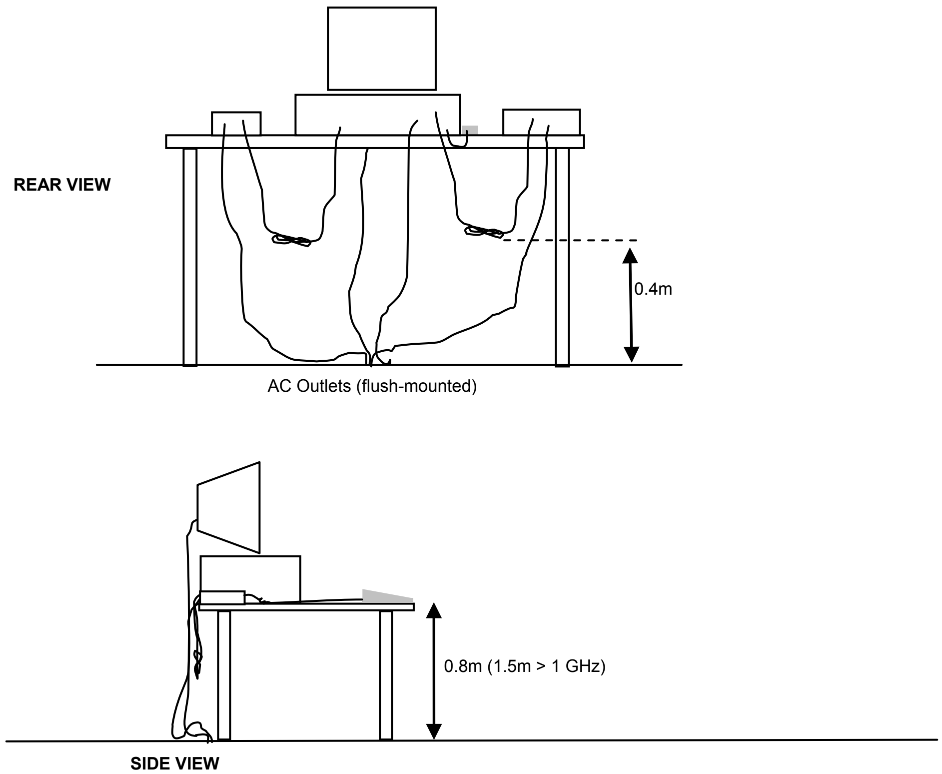
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

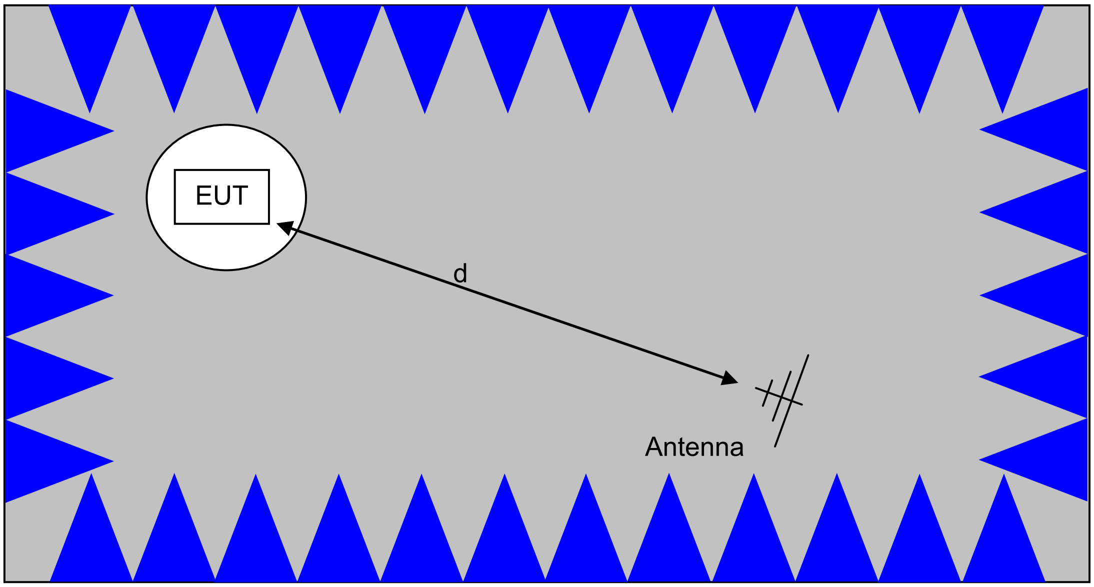
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

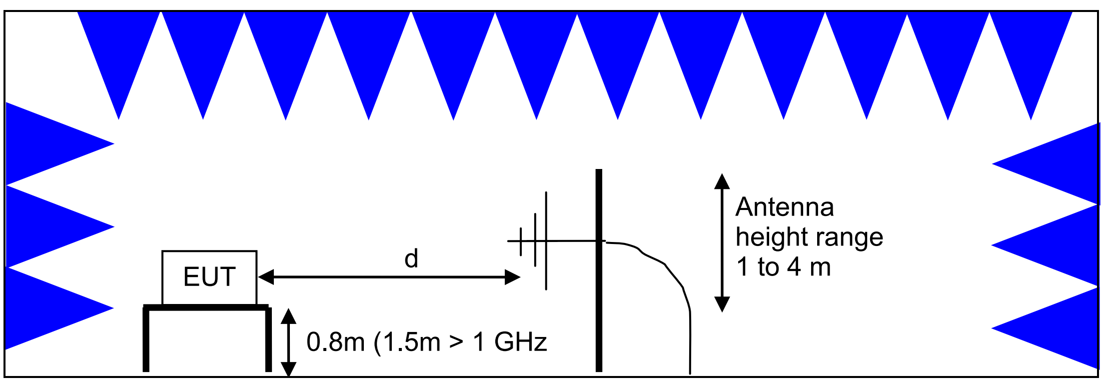


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



<u>Test Configuration for Radiated Field Strength Measurements</u>
<u>Semi-Anechoic Chamber, Plan and Side Views</u>

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1].

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

[1] The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 7

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 30 - 1,000 MHz, 29-May-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	5/30/2017	5/30/2019
Com-Power	Preamplifier, 1-1000 MHz	PAM-103	2885	8/30/2017	8/30/2018
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/28/2016	10/28/2018
Radiated Emissions, 1000 - 18,000 MHz, 29-May-18					
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	9/29/2016	9/29/2018
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/14/2017	10/14/2018
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	8/31/2017	8/31/2018
Micro-Tronics	High Pass Filter 2700 MHz	HPM50111	2326	1/8/2018	1/8/2019
Radiated Emissions, 30 - 40,000 MHz, 30-May-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	9/29/2016	9/29/2018
HP / Miteq	SA40 R Head HF preAmplifier, 18-40 GHz (w/1148)	TTA1840-45-5P-HG-S	1145	9/8/2017	9/8/2018
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/14/2017	10/14/2018
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	5/30/2017	5/30/2019
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	8/31/2017	8/31/2018
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	8/4/2017	8/4/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	5/1/2018	5/1/2019
Micro-Tronics	High Pass Filter 2700 MHz	HPM50111	2326	1/8/2018	1/8/2019
Com-Power	Preamplifier, 1-1000 MHz	PAM-103	2885	8/30/2017	8/30/2018
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/28/2016	10/28/2018
Radiated Emissions, 30kHz - 30 MHz, 30-May-18					
Compower	Magnetic Loop Antenna, 9 kHz-30 MHz	AL-130	3003	8/9/2016	8/9/2018
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/28/2016	10/28/2018
Conducted Emissions - AC Power , 30-May-18					
EMCO	LISN, 10 kHz-100 MHz	3825/2	1292	8/8/2017	8/8/2018
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1401	1/8/2018	1/8/2019
Fischer Custom Comm	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	2000	9/25/2017	9/25/2018
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/28/2016	10/28/2018

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Frequency Stability, 04-Jun-18					
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	5/22/2017	5/22/2018
OML	WR19 Harmonic Mixer	WR19	3126		N/A
Quinstar	Standard Gain Horn	QWH-UPRR00	1972		N/A
Honeywell	Chart Recorder	DR45AT-1000-00-001-0 (Trueline)	2406	11/28/2017	11/28/2018

Appendix B Test Data

TL079234-RA Pages 25 – 62

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Product	802.11ad Transceiver	T-Log Number:	TL079234-RA
System Configuration:	-	Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Emissions Standard(s):	FCC 15.255	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Vivint, Inc.

Product

802.11ad Transceiver

Date of Last Test: 6/6/2018

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

FCC 15.255 Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/29/2018 & 5/30/18
Test Engineer: John Caizzi / R. Varelas
Test Location: Chamber 5

Config. Used: 1
Config Change: none
EUT Voltage: PoE & 48 VDC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 22.4 °C
Rel. Humidity: 37 %

Summary of Results

Run #		Channel	Power Setting		Test Performed	Limit	Result / Margin
1		1 58.32 GHz	Max (40 dBm EIRP)		Radiated Emissions, 30 MHz - 40 GHz	FCC 15.209	33.9 dBµV/m @ 54.30 MHz (-6.1 dB)
2		2 60.48 GHz					34.4 dBµV/m @ 46.957 MHz (-5.6 dB)
3b		3 62.64 GHz					44.9 dBµV/m @ 224.97 MHz (-1.1 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with ANSI C63.10
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, average levels were measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

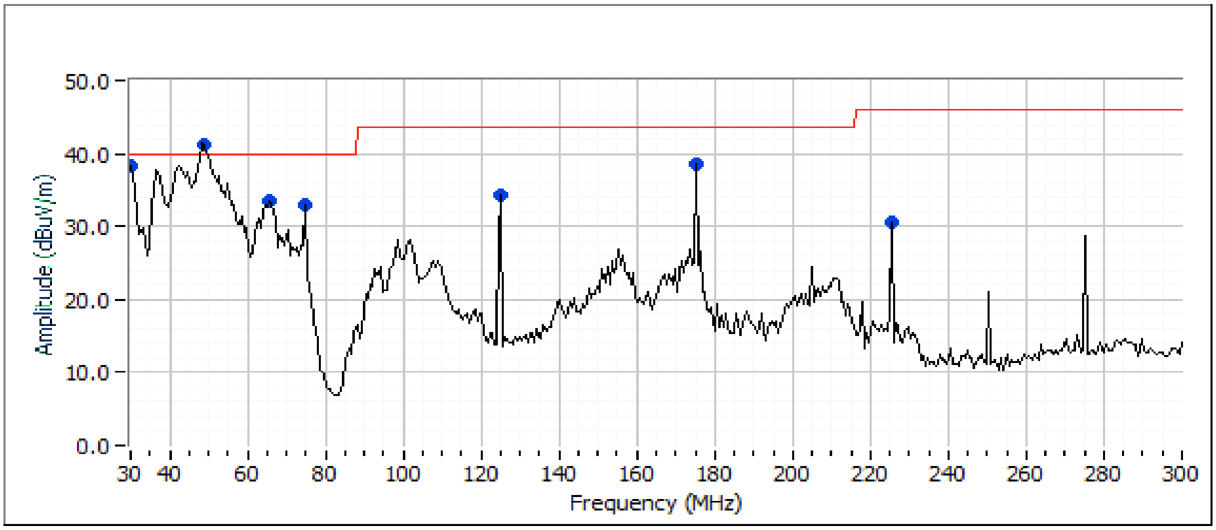
Sample Notes

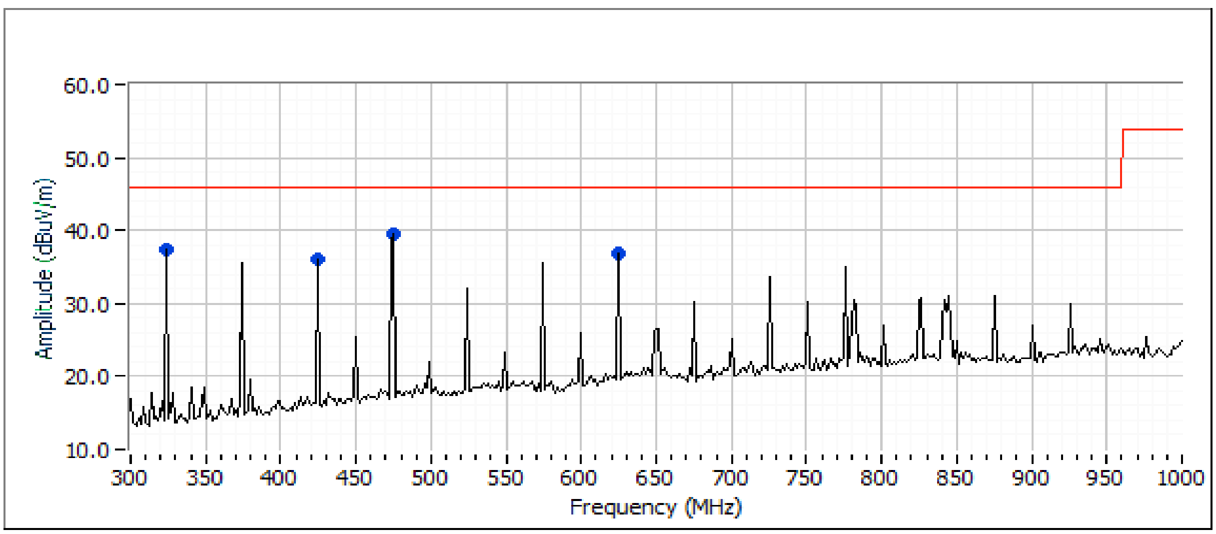
Sample S/N: 0191803100041B
Driver:
Antenna: Internal

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

Run #1, Radiated Spurious Emissions, 30 - 40,000 MHz

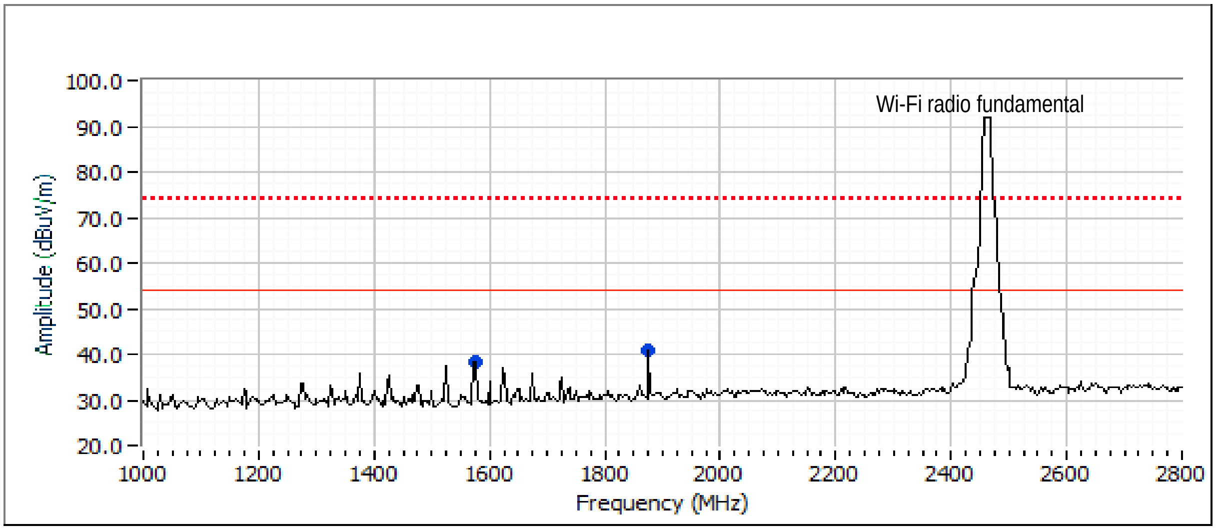
Run #1: Low Channel. All 4 radios on channel 1, at max power.

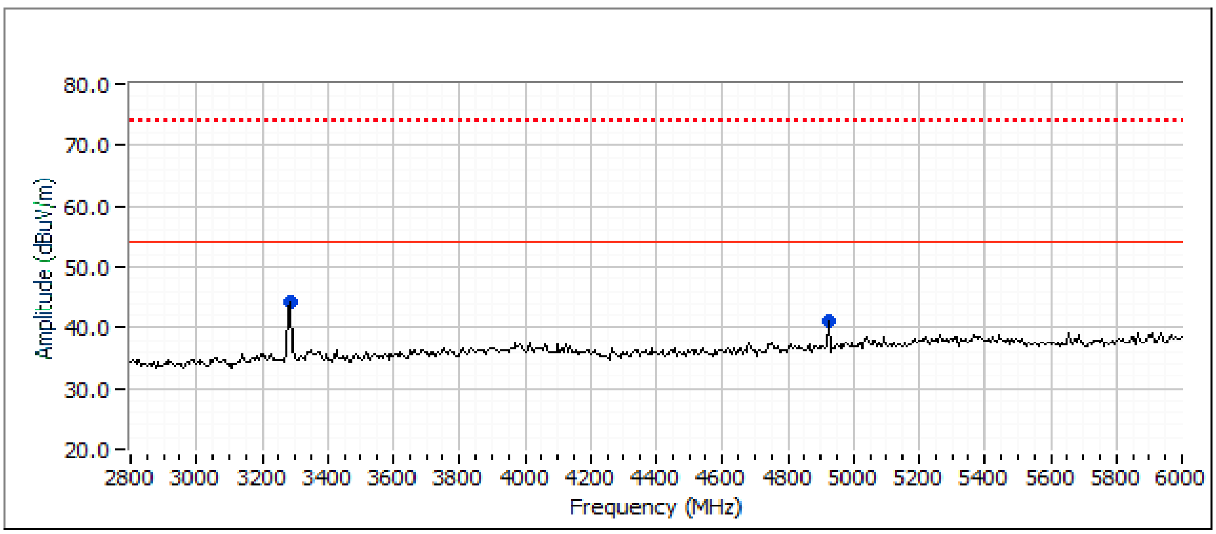




EMC Test Data

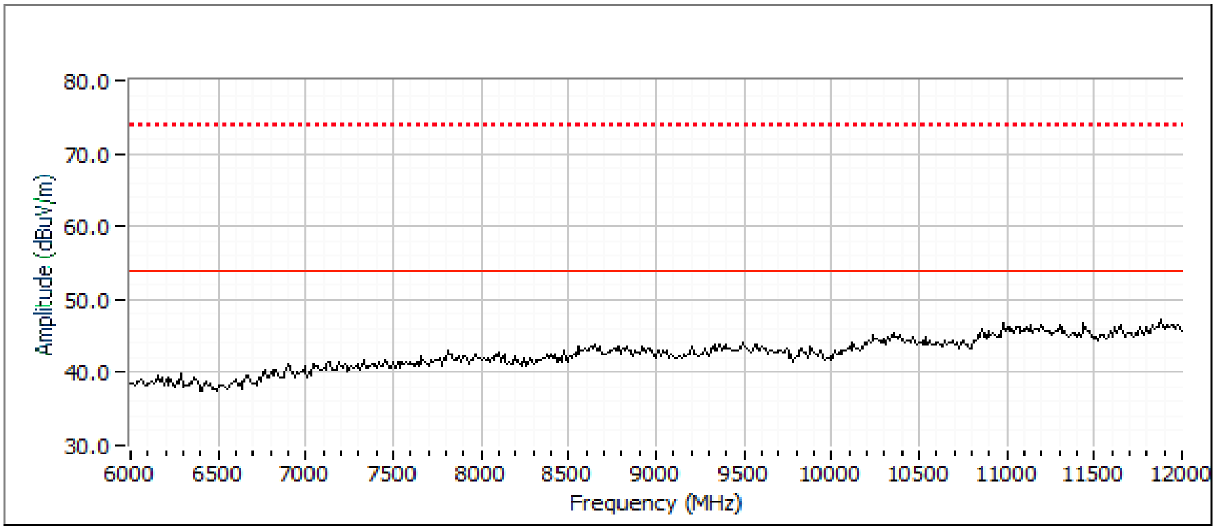
Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

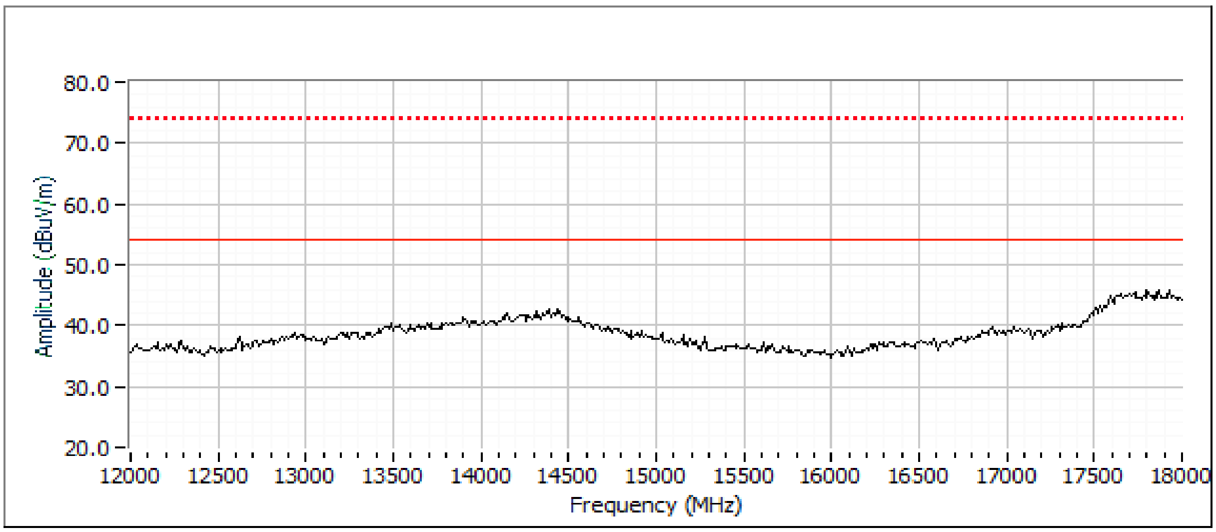




NTS | *EMC Test Data*

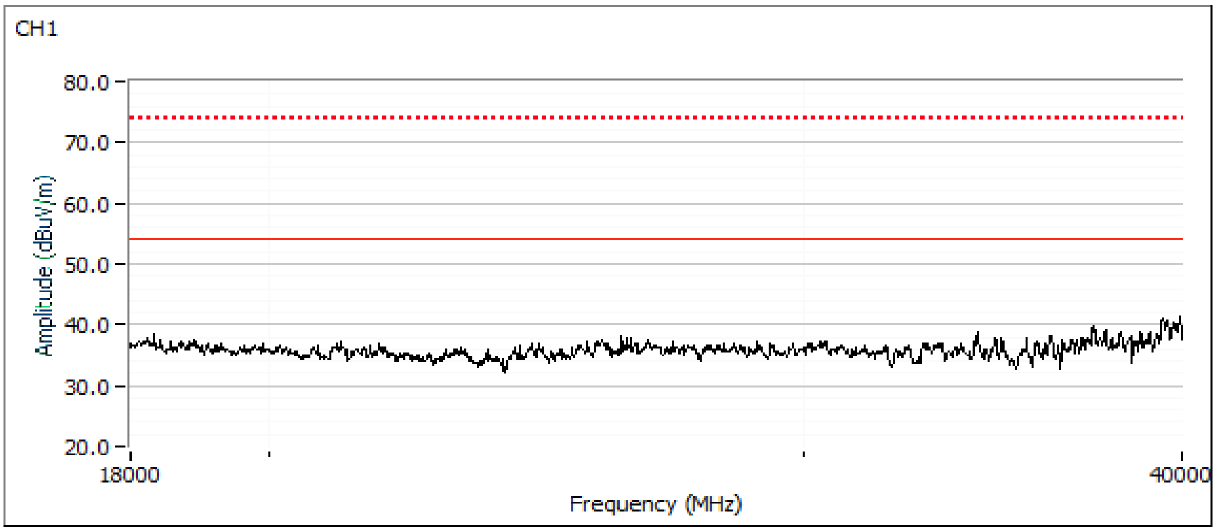
Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A





EMC Test Data

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A



Preliminary readings captured during prescan

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
54.304	41.2	V	40.0	1.2	Peak	0	1.5	
30.097	38.3	V	40.0	-1.7	Peak	216	1.5	
175.010	*38.6*	*V*	*43.5*	*-4.9*	*Peak*	*224*	*1.0*	*Measured in run 2.*
474.975	39.5	H	46.0	-6.5	Peak	162	1.0	
64.575	33.5	V	40.0	-6.5	Peak	184	1.0	
74.986	33.1	V	40.0	-6.9	Peak	172	1.5	
324.976	37.5	V	46.0	-8.5	Peak	176	1.0	
625.451	*36.8*	*H*	*46.0*	*-9.2*	*Peak*	*207*	*1.5*	*Measured in run 2.*
125.230	*34.3*	*V*	*43.5*	*-9.2*	*Peak*	*211*	*1.0*	*Measured in run 2.*
424.850	*36.1*	*H*	*46.0*	*-9.9*	*Peak*	*157*	*1.0*	*Measured in run 2.*
225.331	*30.7*	*V*	*46.0*	*-15.3*	*Peak*	*151*	*1.0*	
1574.980	38.1	V	54.0	-15.9	Peak	63	1.0	
1876.720	40.8	V	54.0	-13.2	Peak	299	1.3	Random signal - not found.
3283.380	44.2	H	54.0	-9.8	Peak	106	1.6	
4922.240	41.0	H	54.0	-13.0	Peak	137	1.3	

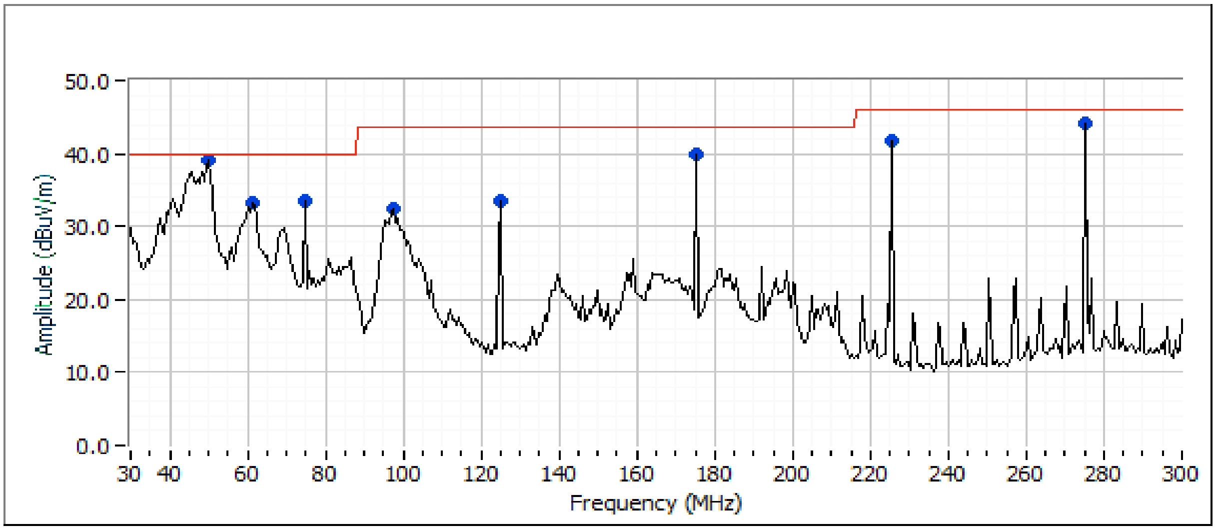
Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

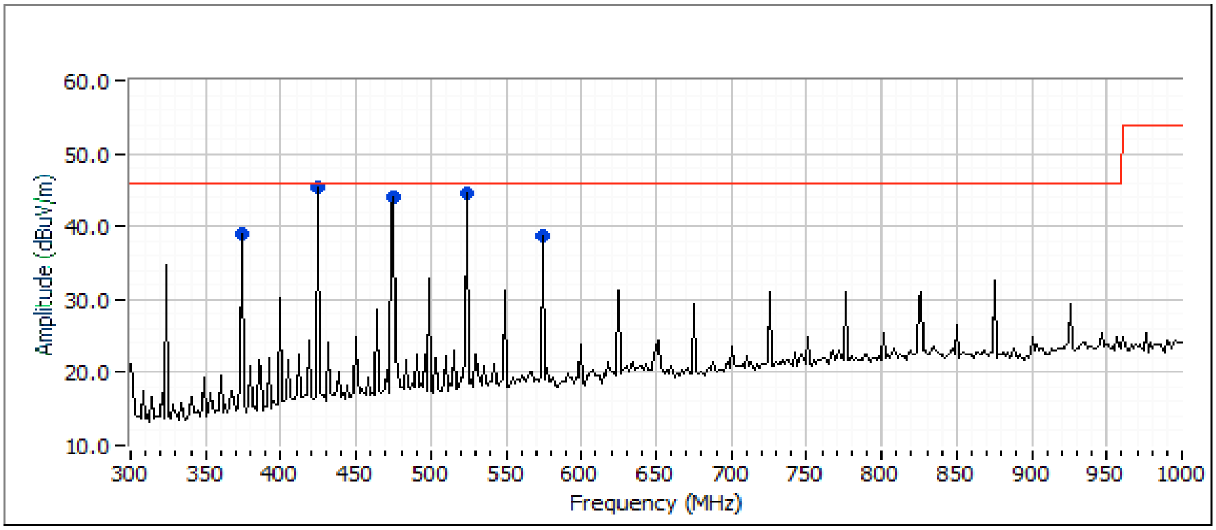
Final QP & average readings

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.097	32.9	V	40.0	-7.1	QP	260	1.50	
54.304	33.9	V	40.0	-6.1	QP	47	1.00	
64.575	24.2	V	40.0	-15.8	QP	245	1.10	
74.986	31.3	V	40.0	-8.7	QP	237	1.29	
324.976	31.1	V	46.0	-14.9	QP	198	1.00	
474.975	39.1	H	46.0	-6.9	QP	148	1.00	
1575.070	36.9	V	54.0	-17.1	AVG	57	1.00	
1574.730	42.6	V	74.0	-31.4	PK	57	1.00	
3282.680	47.0	H	54.0	-7.0	AVG	124	1.28	
3283.300	49.9	H	74.0	-24.1	PK	124	1.28	
4923.720	39.1	H	54.0	-14.9	AVG	136	1.08	
4923.000	46.5	H	74.0	-27.5	PK	136	1.08	

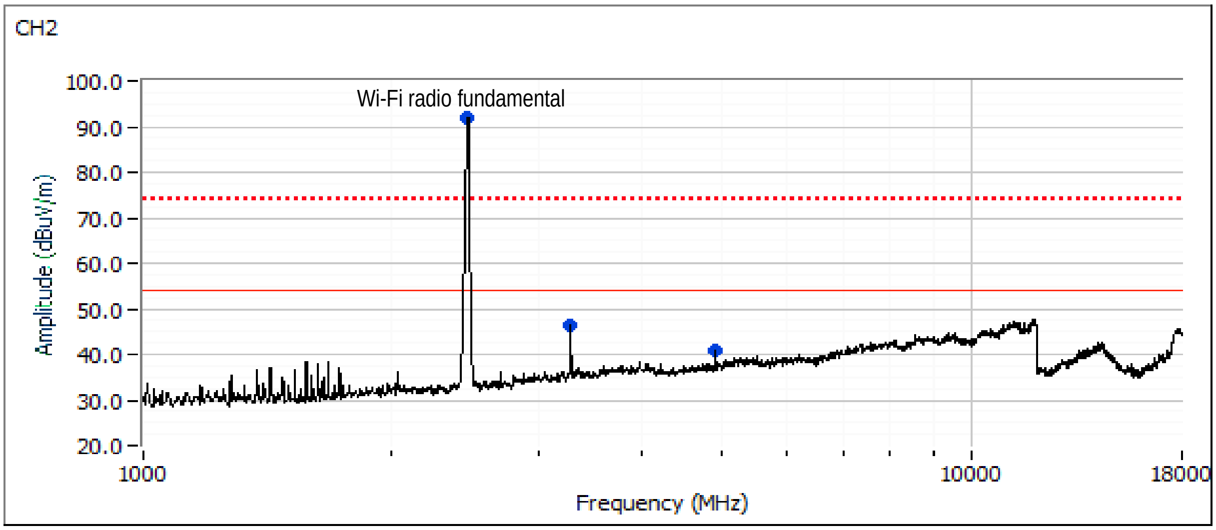
Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

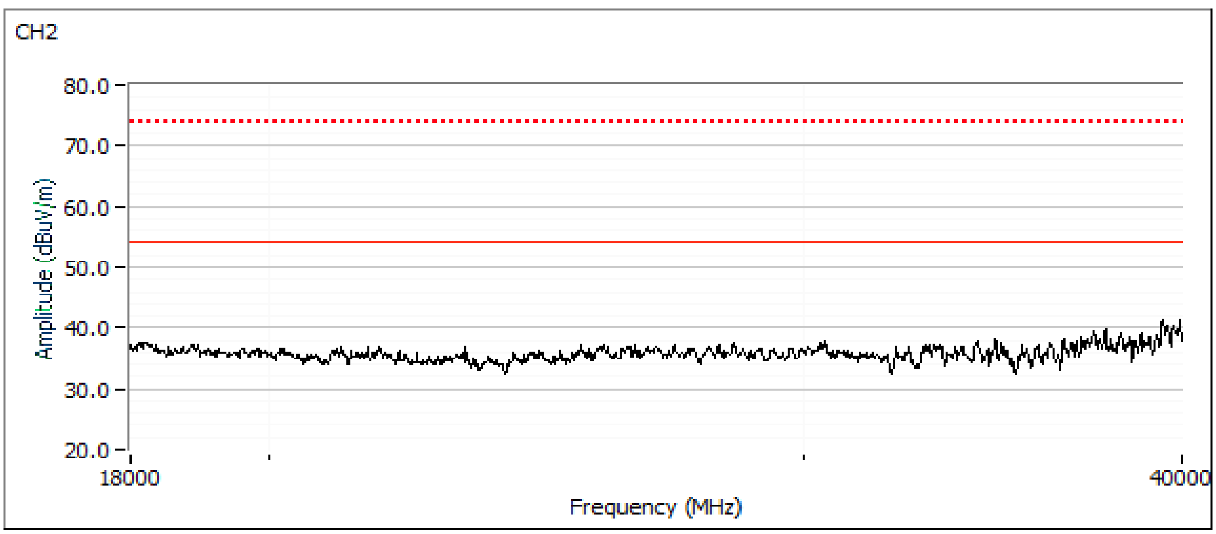
Run #2: Center Channel. All 4 radios on channel 2, at max power.





Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A





Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

Preliminary readings captured during prescan

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
46.957	*39.2*	*V*	*40.0*	*-0.8*	*Peak*	*331*	*1.0*	
60.203	33.3	V	40.0	-6.7	Peak	253	1.0	
74.981	33.5	V	40.0	-6.5	Peak	360	1.5	
97.635	*32.5*	*V*	*43.5*	*-11.0*	*Peak*	*288*	*1.0*	
125.230	*33.5*	*V*	*43.5*	*-10.0*	*Peak*	*180*	*1.0*	
174.982	40.0	V	43.5	-3.5	Peak	219	2.5	
224.978	41.7	V	46.0	-4.3	Peak	211	1.0	
274.982	*44.2*	*H*	*46.0*	*-1.8*	*Peak*	*128*	*1.0*	
374.983	39.0	H	46.0	-7.0	Peak	77	2.0	
424.979	45.3	V	46.0	-0.7	Peak	281	1.0	
474.975	44.0	V	46.0	-2.0	Peak	213	1.0	
524.982	44.6	V	46.0	-1.4	Peak	213	1.0	
574.978	38.6	V	46.0	-7.4	Peak	124	1.0	
3280.000	*46.2*	*H*	*54.0*	*-7.8*	*Peak*	*138*	*1.0*	
4922.670	*40.7*	*H*	*54.0*	*-13.3*	*Peak*	*136*	*2.0*	

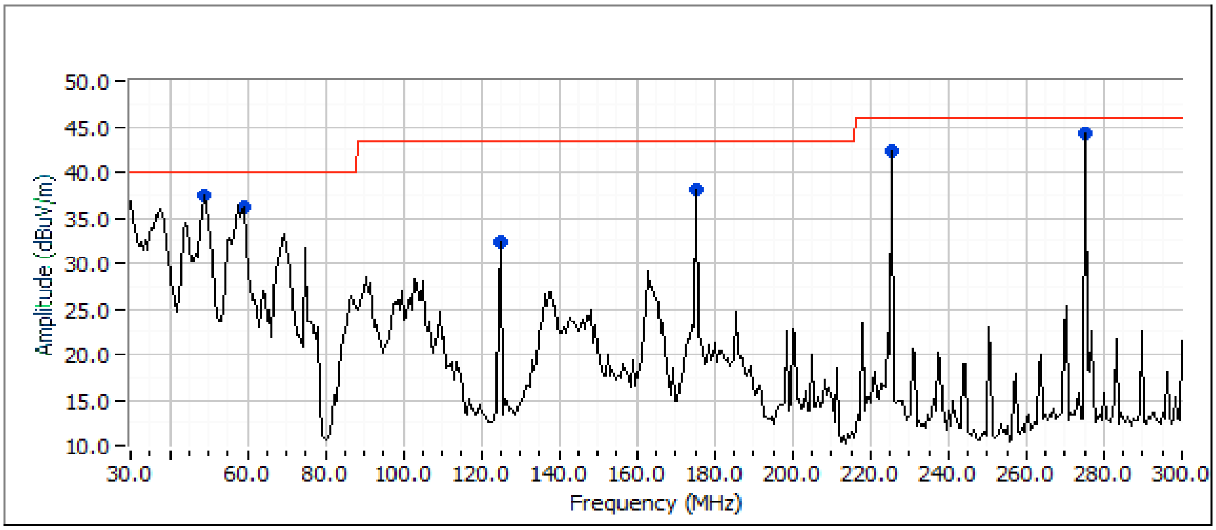
Final QP & average readings

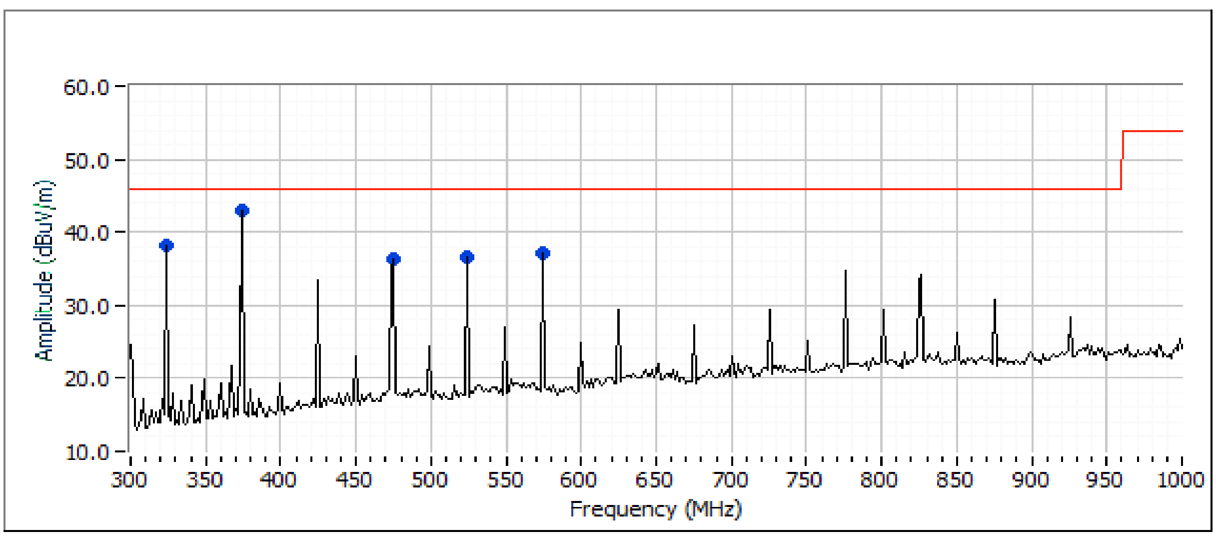
Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
46.957	34.4	V	40.0	-5.6	QP	265	1.00	
60.203	31.4	V	40.0	-8.6	QP	213	1.00	
74.981	22.8	V	40.0	-17.2	QP	360	1.00	
174.982	30.3	V	43.5	-13.2	QP	206	2.20	
224.978	35.0	V	46.0	-11.0	QP	186	1.00	
274.982	37.5	H	46.0	-8.5	QP	122	1.23	
374.983	29.6	H	46.0	-16.4	QP	52	1.65	
424.979	37.2	V	46.0	-8.8	QP	308	1.00	
474.975	37.1	V	46.0	-8.9	QP	360	1.00	
524.982	40.3	V	46.0	-5.7	QP	222	1.00	
574.978	35.7	V	46.0	-10.3	QP	80	1.00	
3282.530	46.9	H	54.0	-7.1	AVG	130	1.47	
3288.130	47.9	H	74.0	-26.1	PK	130	1.47	

EMC Test Data

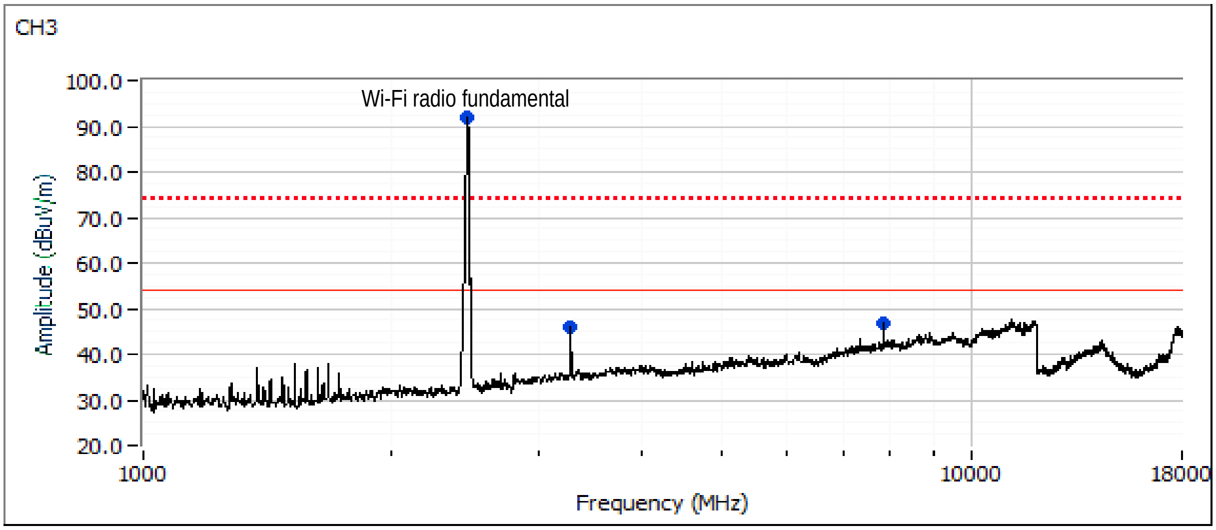
Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

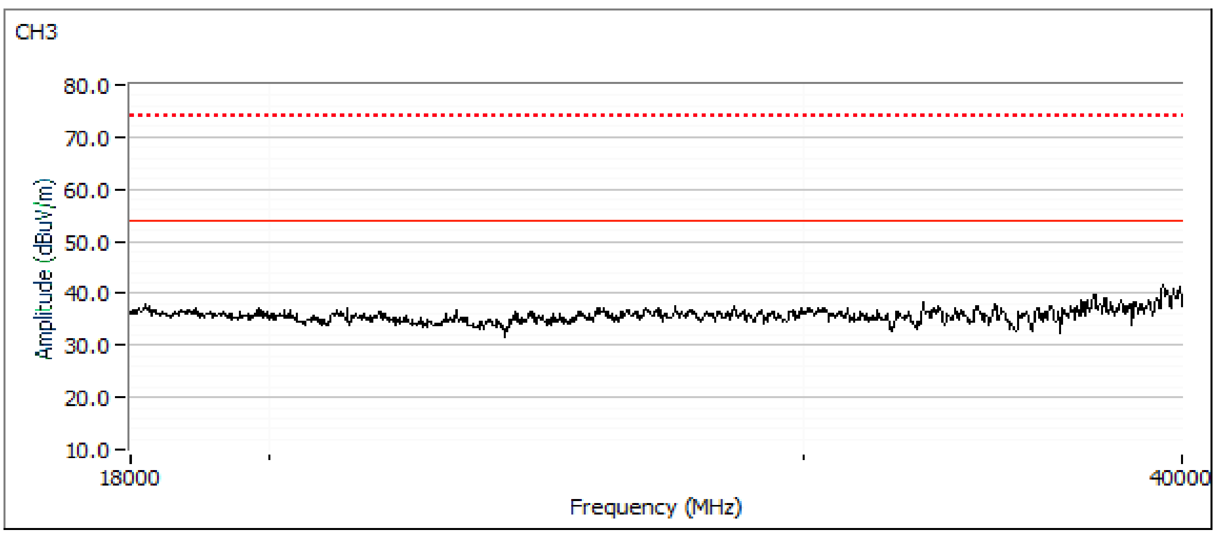
Run #3: High Channel. All 4 radios on channel 3, at max power.
replaced Shielded ethernet cable for POE from 3 segment to 2 segment





Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A





EMC Test Data

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

Preliminary readings captured during prescan

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
48.533	37.4	V	40.0	-2.6	Peak	298	1.0	
58.311	36.2	V	40.0	-3.8	Peak	138	1.5	
124.964	32.3	H	43.5	-11.2	Peak	260	1.5	
174.973	38.1	V	43.5	-5.4	Peak	141	1.0	
224.974	42.4	H	46.0	-3.6	Peak	277	1.5	
274.978	44.2	V	46.0	-1.8	Peak	165	1.0	
324.976	38.1	V	46.0	-7.9	Peak	233	1.5	
374.972	43.1	V	46.0	-2.9	Peak	84	1.5	
474.986	36.3	V	46.0	-9.7	Peak	161	1.0	
524.982	36.5	V	46.0	-9.5	Peak	137	1.0	
574.989	37.0	V	46.0	-9.0	Peak	171	1.0	
3285.330	*45.9*	*H*	*54.0*	*-8.1*	*Peak*	*129*	*2.0*	
7830.000	*46.7*	*V*	*54.0*	*-7.3*	*Peak*	*140*	*1.5*	

Final QP & average readings

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
48.533	34.2	V	40.0	-5.8	QP	313	1.0	QP (1.00s)
58.311	33.2	V	40.0	-6.8	QP	157	1.0	QP (1.00s)
124.964	31.0	H	43.5	-12.5	QP	259	2.0	QP (1.00s)
174.973	38.2	V	43.5	-5.3	QP	151	1.0	QP (1.00s)
224.974	44.9	H	46.0	-1.1	QP	276	1.3	QP (1.00s)
274.978	42.9	V	46.0	-3.1	QP	178	1.0	QP (1.00s)
324.976	34.9	V	46.0	-11.1	QP	183	1.3	QP (1.00s)
374.972	43.2	V	46.0	-2.8	QP	86	1.3	QP (1.00s)
474.986	37.2	V	46.0	-8.8	QP	163	1.0	QP (1.00s)
524.982	37.2	V	46.0	-8.8	QP	142	1.0	QP (1.00s)
574.989	36.2	V	46.0	-9.8	QP	176	1.0	QP (1.00s)
3282.660	45.5	H	54.0	-8.5	AVG	130	2.5	
3287.000	49.4	H	74.0	-24.6	PK	130	2.5	
7830.080	45.0	V	54.0	-9.0	AVG	148	1.5	
7830.290	52.9	V	74.0	-21.1	PK	148	1.5	

NTS

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Radiated Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/30/2018
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Remote support equipment was located outside the chamber.
The test distance and extrapolation factor (if used) are detailed under each run description.
Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 22.6 °C
Rel. Humidity: 38 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	30kHz - 30 MHz	FCC 15.209	Pass	18.8 dBμV/m @ 30.00 MHz (-10.7 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

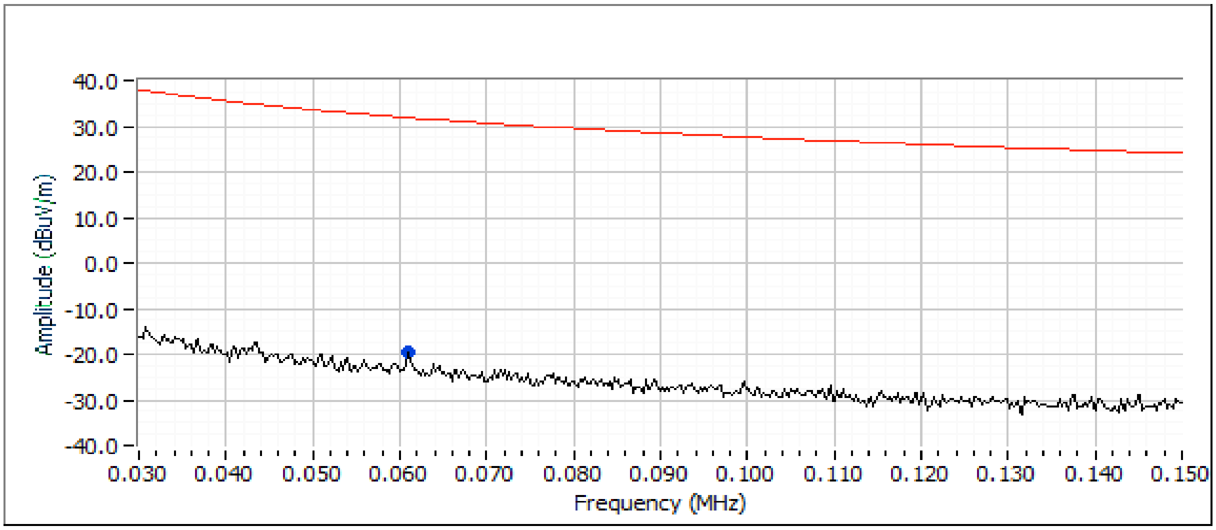
No deviations were made from the requirements of the standard.

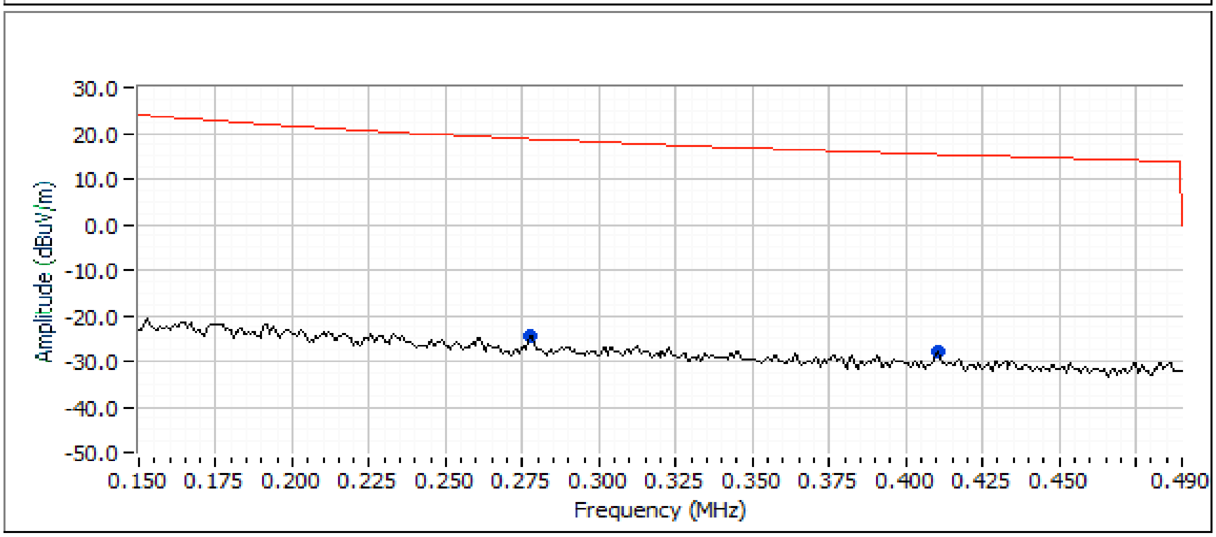
EMC Test Data			
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Run #1a: Radiated Emissions, 30kHz - 30 MHz, FCC 15.209
Low Channel. All 4 radios on channel 1, at max power.

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.009 - 0.490 MHz	3	300	-80.0
0.490 - 1.705 MHz	3	30	-40.0
1.705 - 30.0 MHz	3	30	-40.0

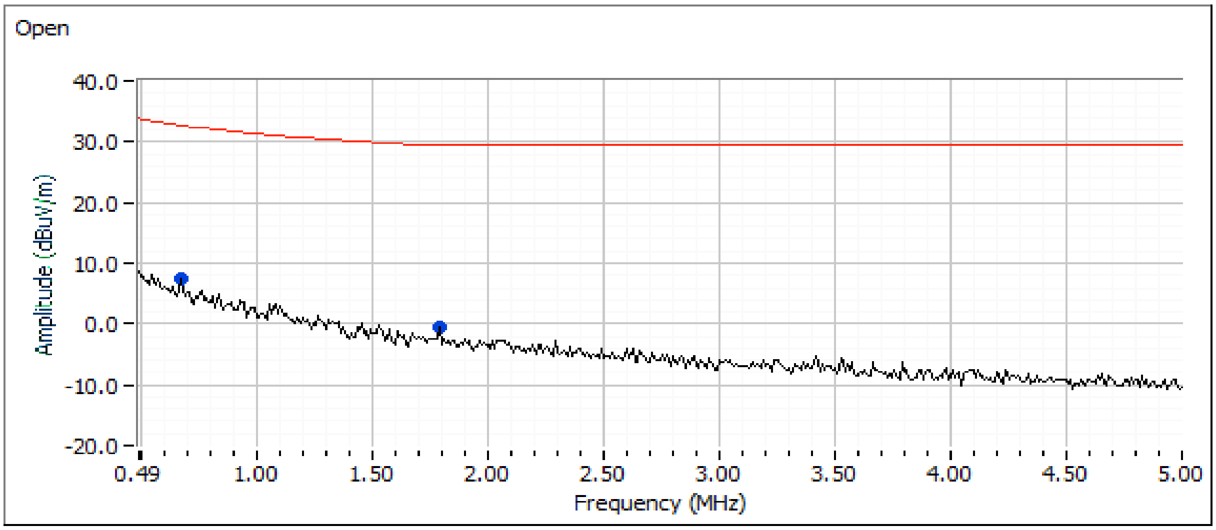
Note - the extrapolation factor is based on 40log(test distance/limit distance) as permitted by FCC 15.31

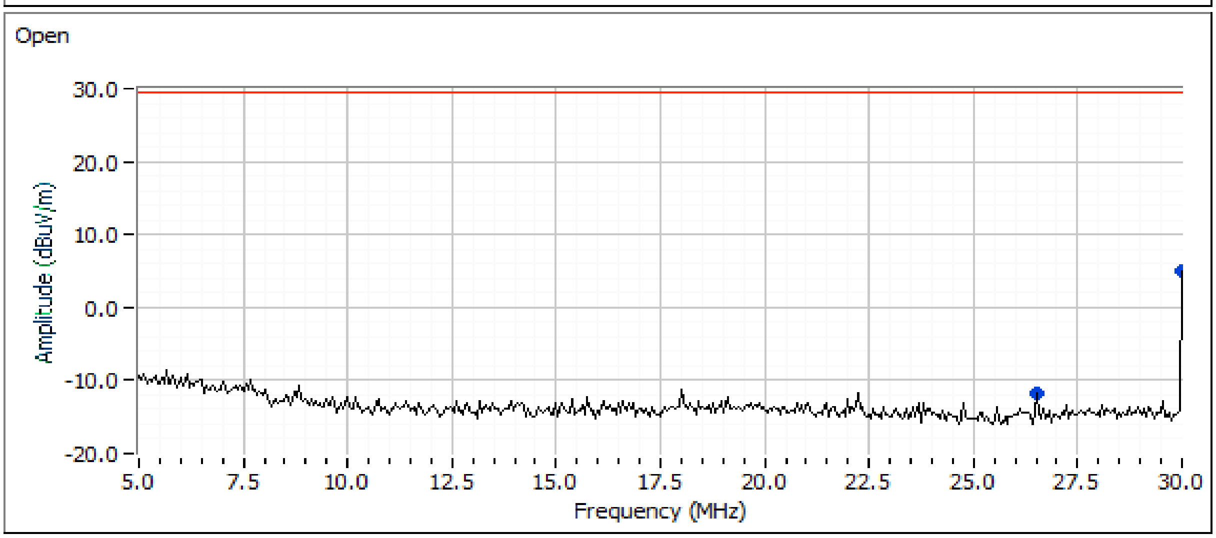




EMC Test Data

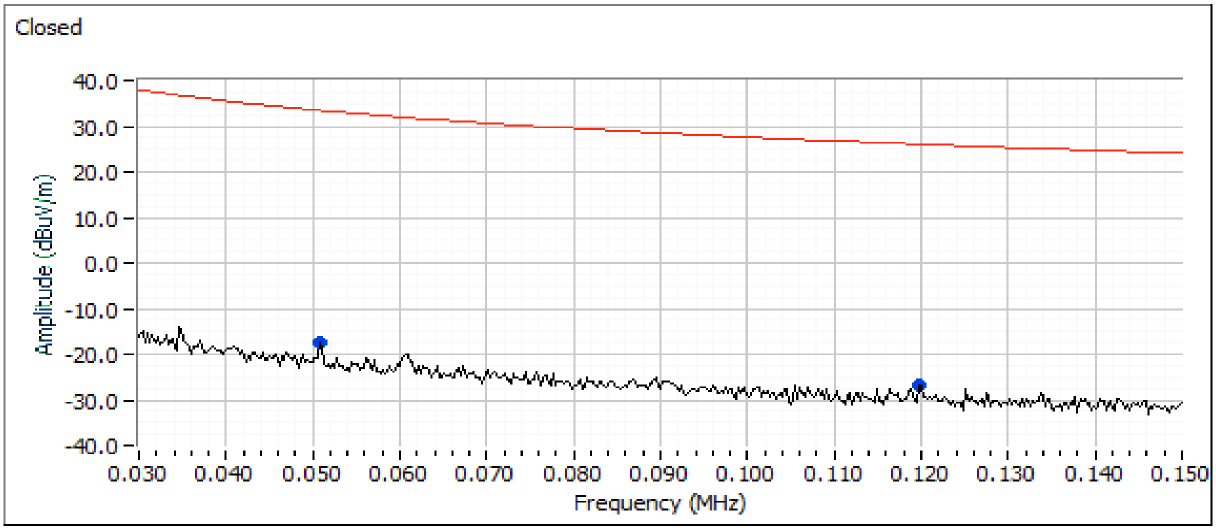
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

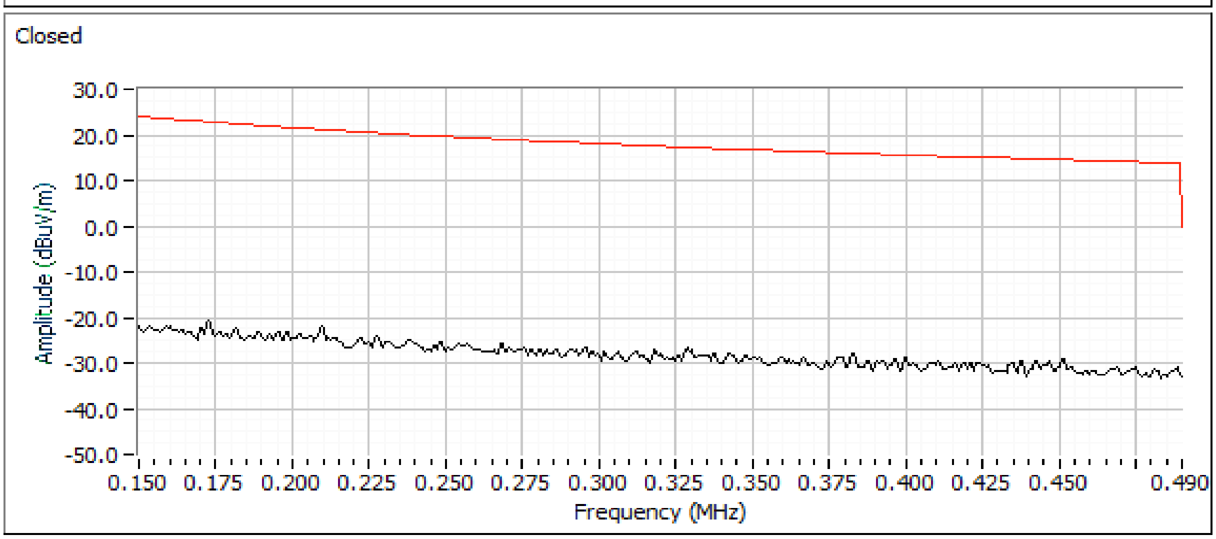




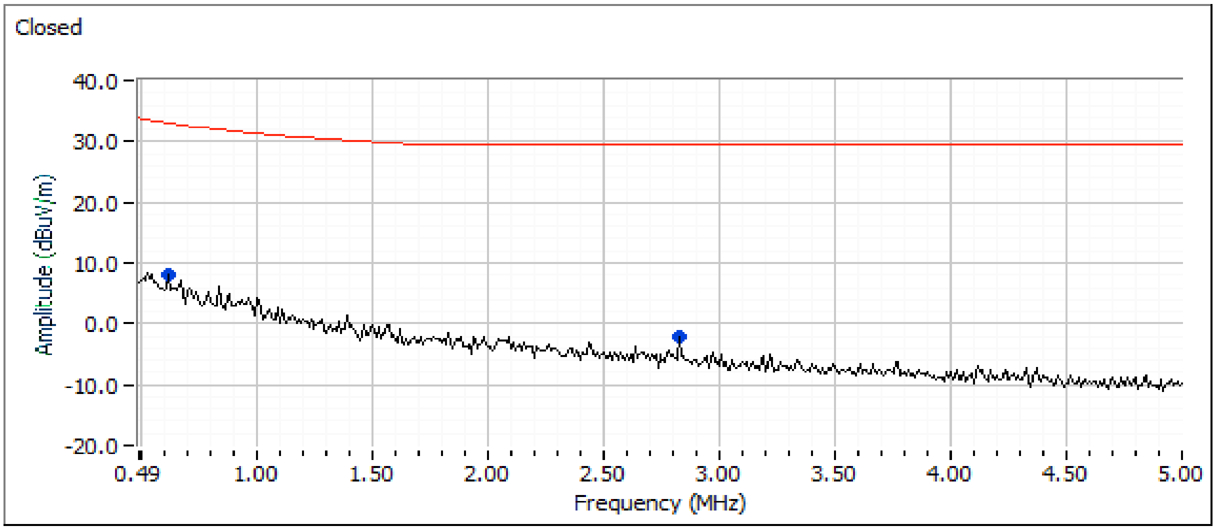
EMC Test Data

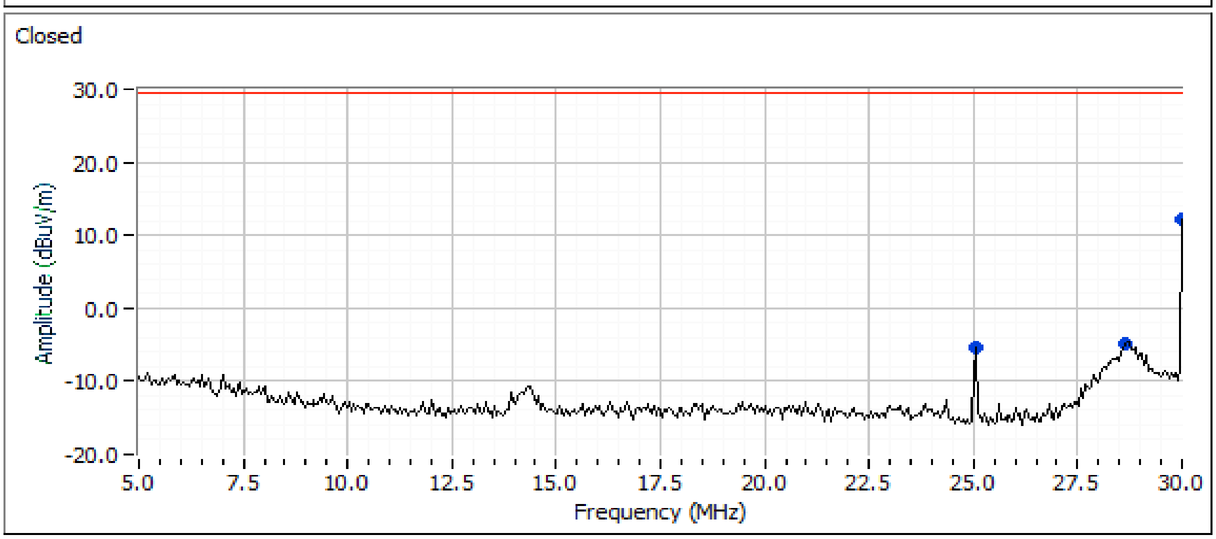
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	o/c	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.061	-19.6	O	31.9	-51.5	Peak	320	1.3	
0.277	-24.6	O	18.7	-43.3	Peak	84	1.3	
0.410	-28.0	O	15.3	-43.3	Peak	253	1.3	
0.671	7.4	O	32.7	-25.3	Peak	156	1.3	
1.791	-0.6	O	29.5	-30.1	Peak	2	1.3	
26.543	-11.8	O	29.5	-41.3	Peak	16	1.3	
30.000	5.0	O	29.5	-24.5	Peak	207	1.3	
0.051	-17.6	C	33.5	-51.1	Peak	317	1.3	
0.120	-26.8	C	26.0	-52.8	Peak	127	1.3	
0.617	8.2	C	33.0	-24.8	Peak	143	1.3	
2.831	-2.0	C	29.5	-31.5	Peak	96	1.3	
25.040	-5.5	C	29.5	-35.0	Peak	197	1.3	
28.647	-4.8	C	29.5	-34.3	Peak	176	1.3	
30.000	12.1	C	29.5	-17.4	Peak	335	1.3	

Note 1:	The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

NTS

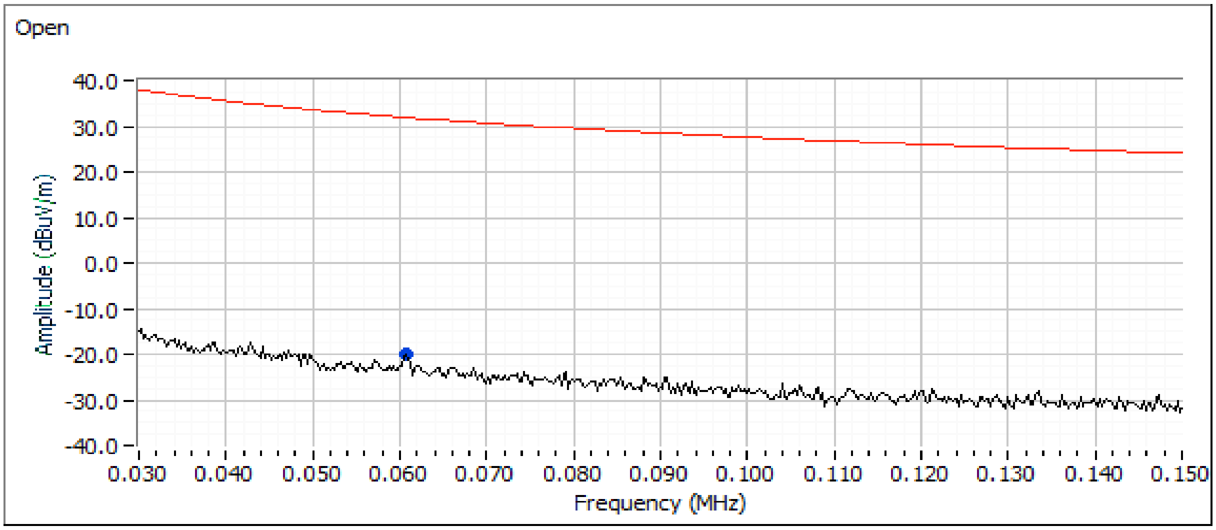
EMC Test Data

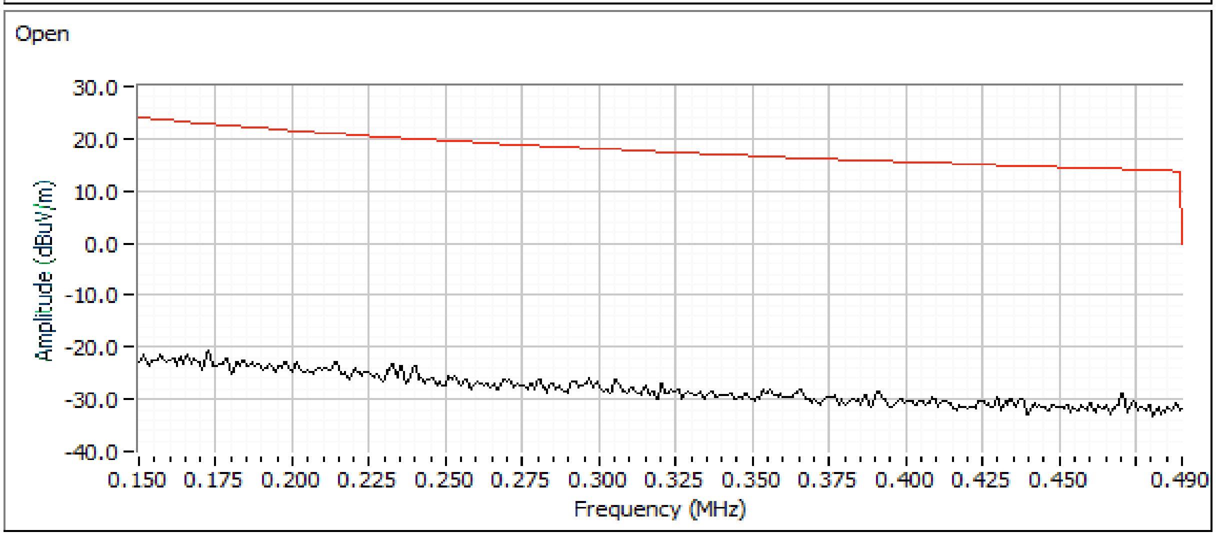
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Run #1b: Radiated Emissions, 30kHz - 30 MHz, FCC 15.209
Center Channel. All 4 radios on channel 2, at max power.

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.009 - 0.490 MHz	3	300	-80.0
0.490 - 1.705 MHz	3	30	-40.0
1.705 - 30.0 MHz	3	30	-40.0

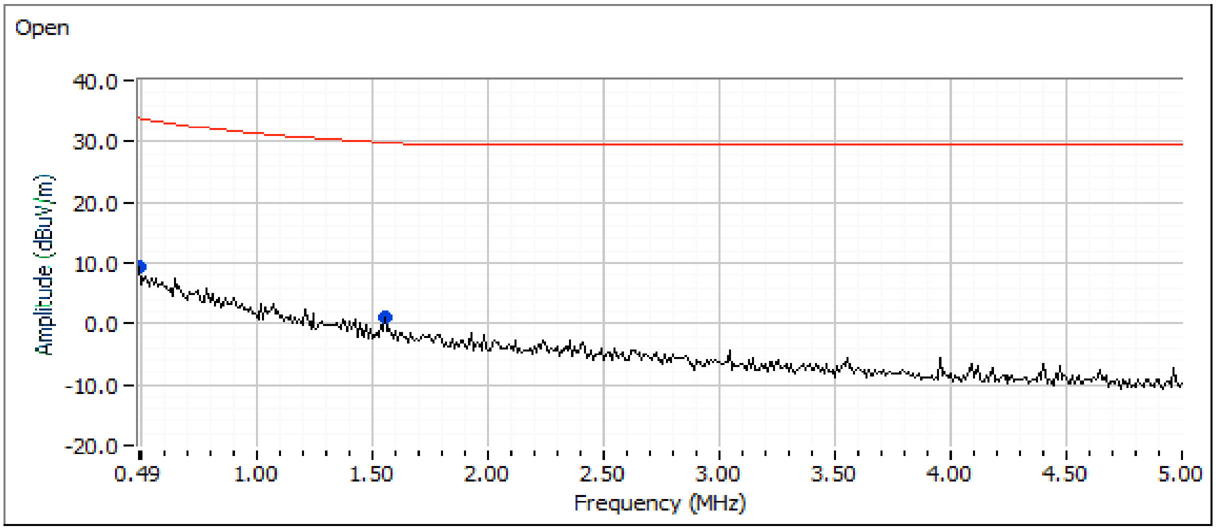
Note - the extrapolation factor is based on 40log(test distance/limit distance) as permitted by FCC 15.31

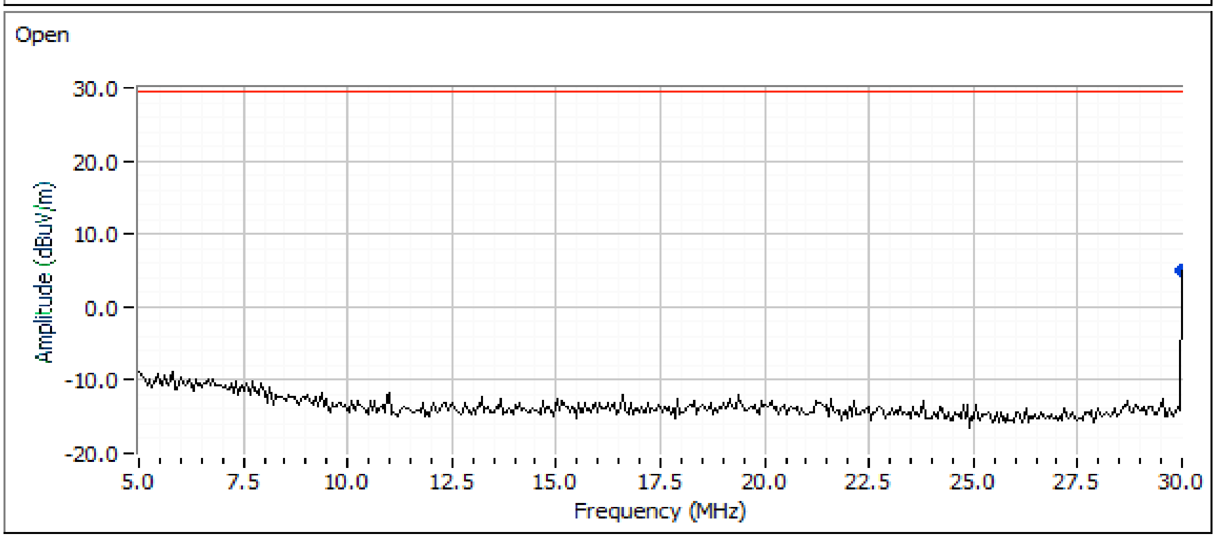




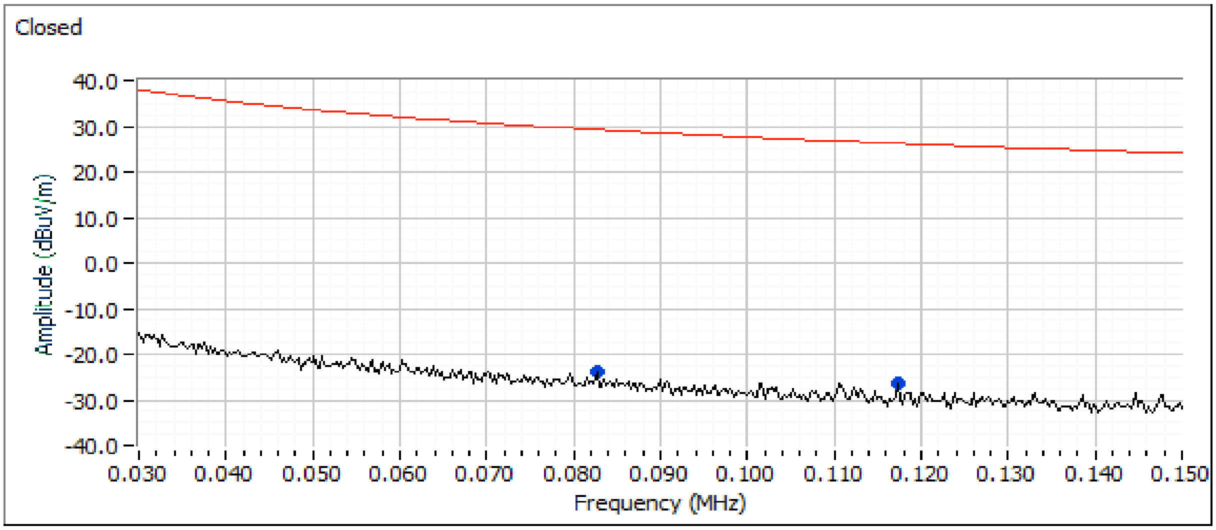
EMC Test Data

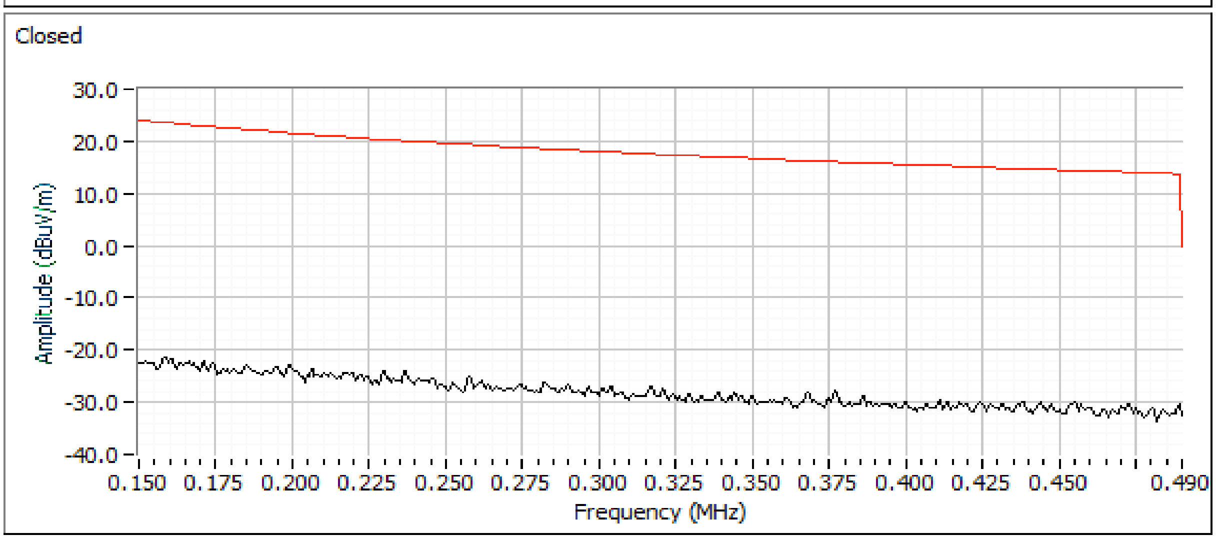
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-



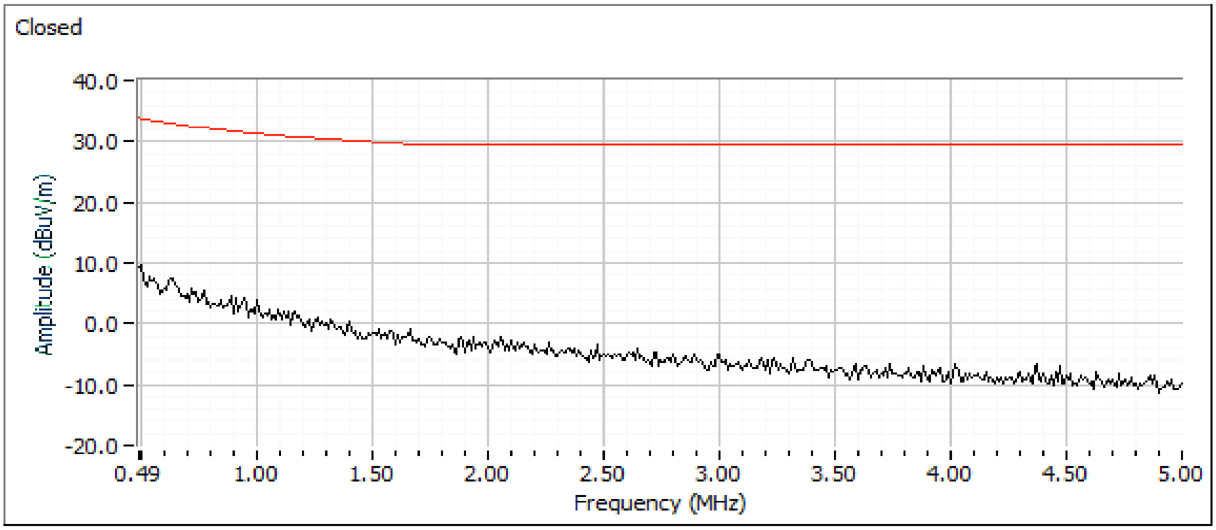


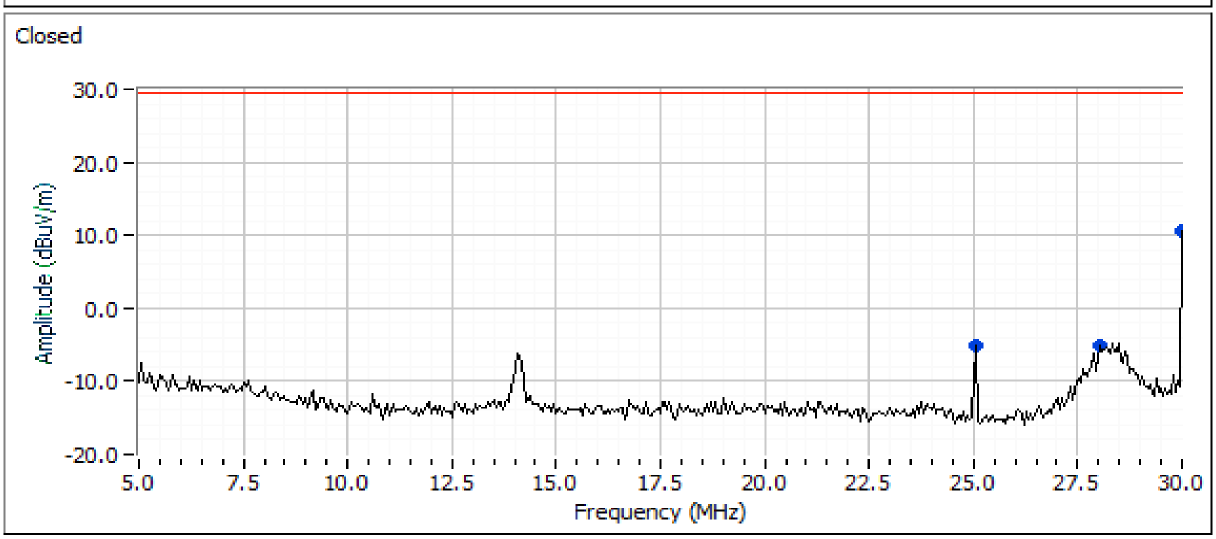
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.061	-20.0	O	31.9	-51.9	Peak	20	1.3	
0.489	9.5	O	33.8	-24.3	Peak	280	1.3	
1.544	1.2	O	29.8	-28.6	Peak	350	1.3	
30.000	5.1	O	29.5	-24.4	Peak	116	1.3	
0.083	-23.7	C	29.2	-52.9	Peak	85	1.3	
0.117	-26.3	C	26.2	-52.5	Peak	95	1.3	
30.000	10.7	C	29.5	-18.8	Peak	314	1.3	
28.087	-5.0	C	29.5	-34.5	Peak	276	1.3	
25.001	-5.2	C	29.5	-34.7	Peak	54	1.3	

Note 1: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

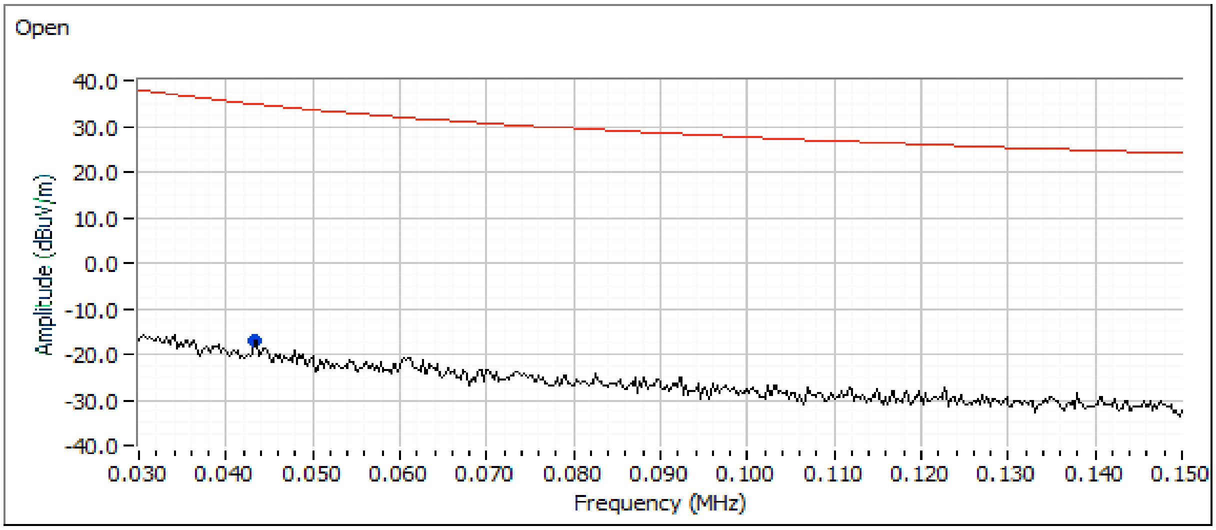
NTS **_EMC Test Data_**

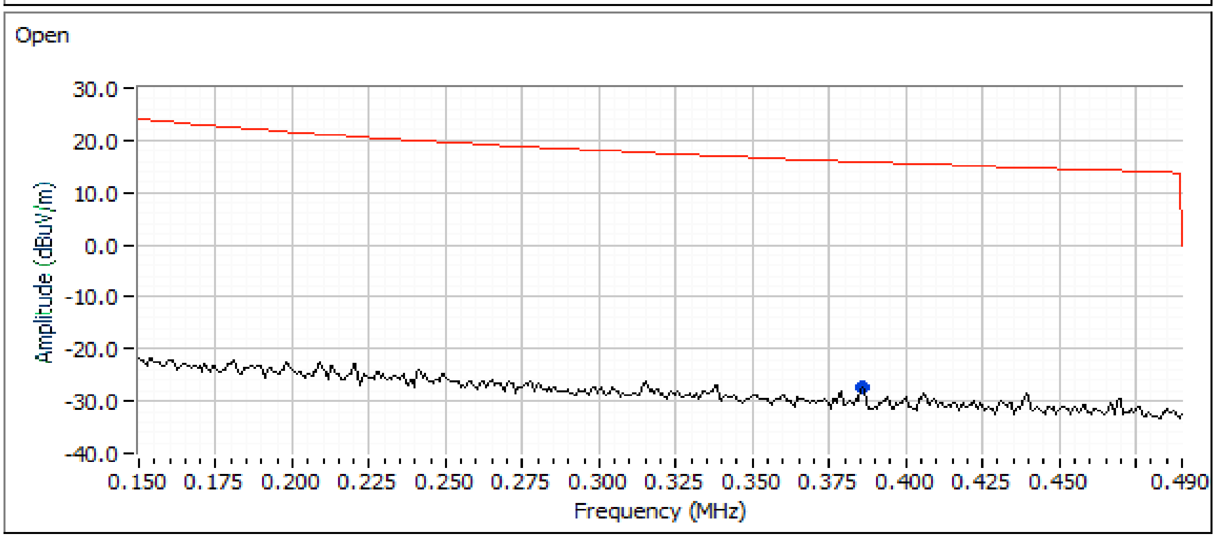
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Run #1c: Radiated Emissions, 30kHz - 30 MHz, FCC 15.209
High Channel. All 4 radios on channel 3, at max power.

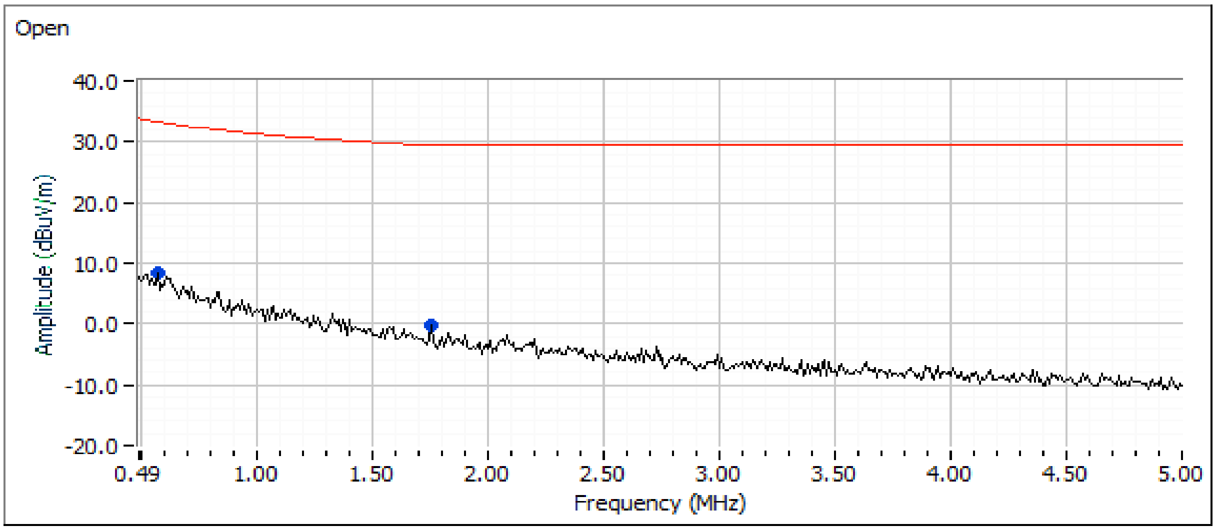
Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.009 - 0.490 MHz	3	300	-80.0
0.490 - 1.705 MHz	3	30	-40.0
1.705 - 30.0 MHz	3	30	-40.0

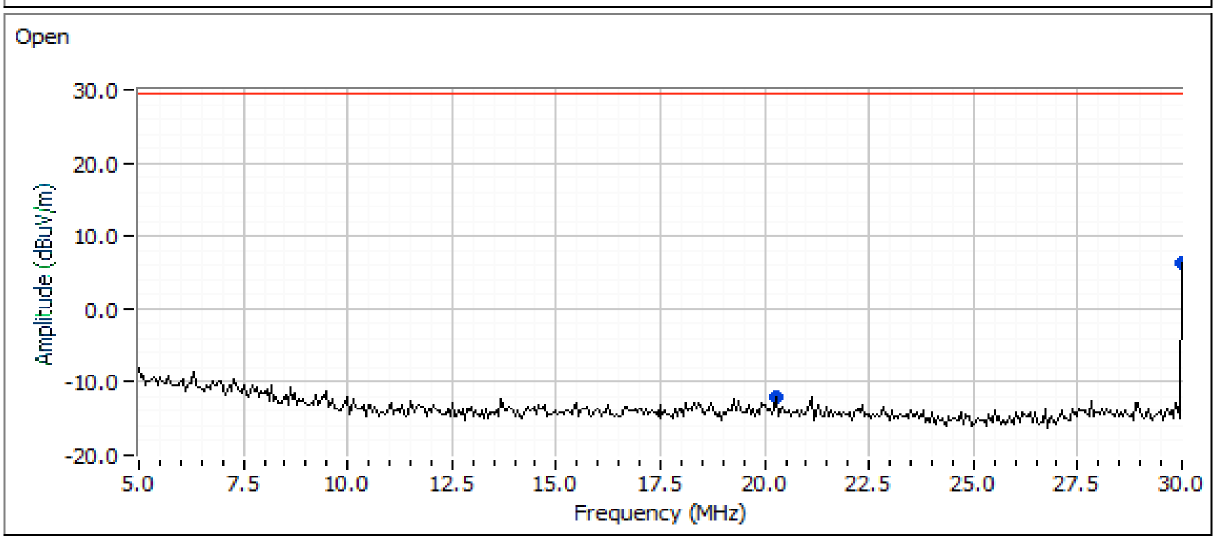
Note - the extrapolation factor is based on 40log(test distance/limit distance) as permitted by FCC 15.31





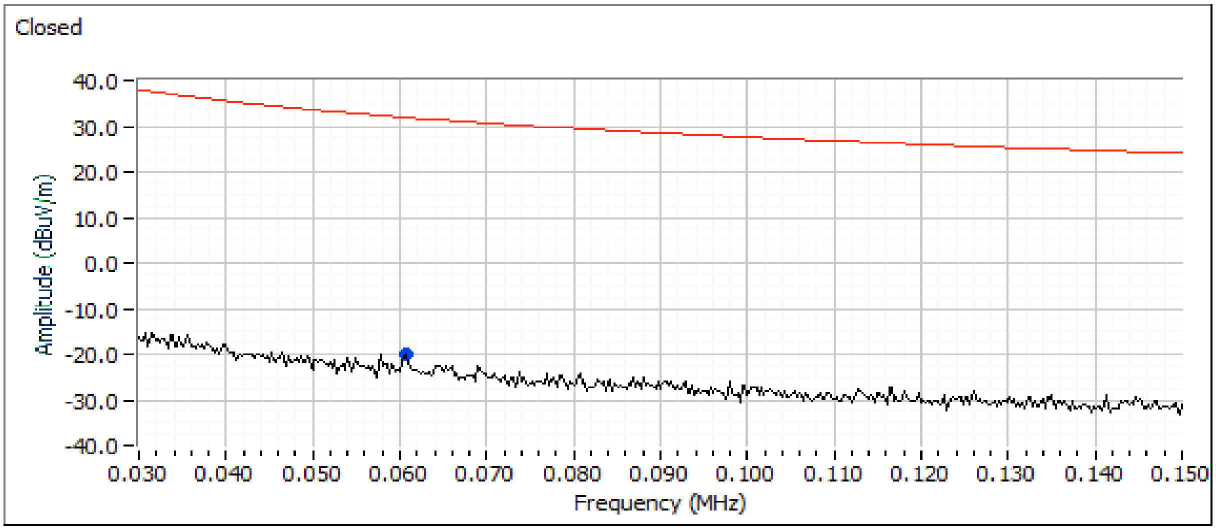
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

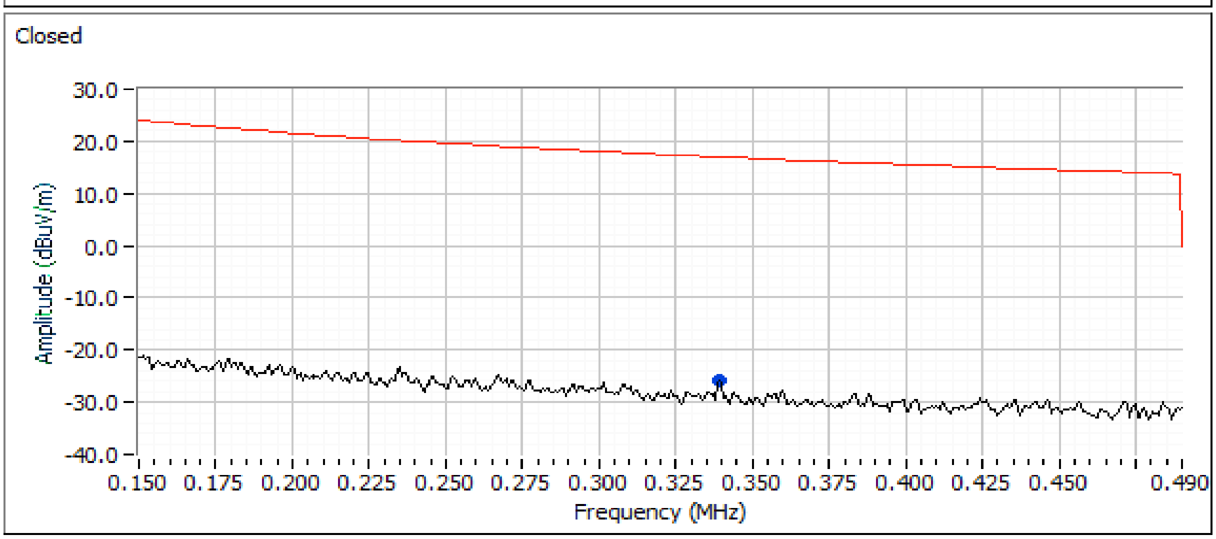




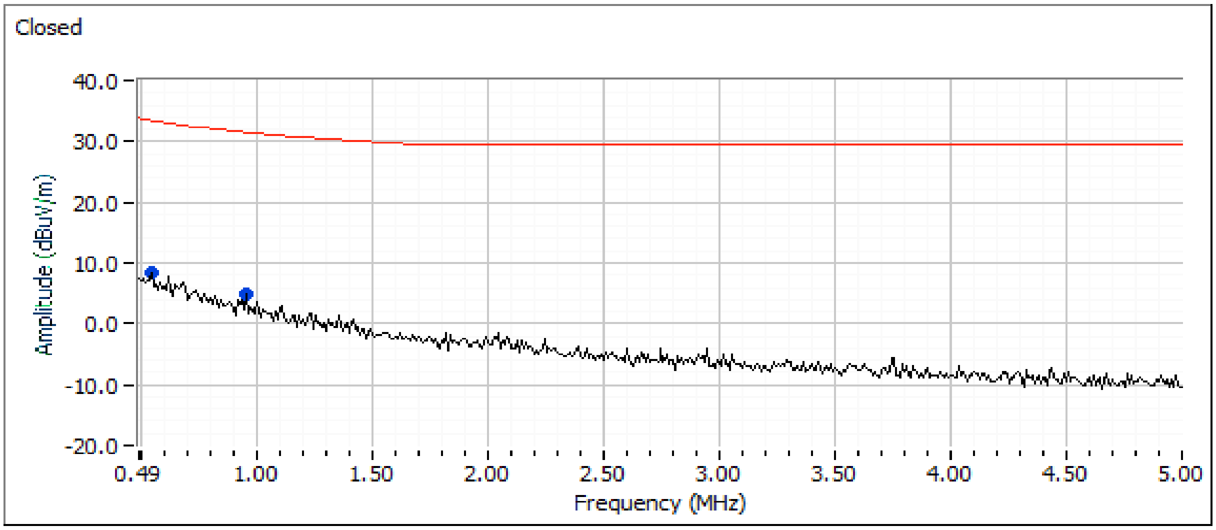
EMC Test Data

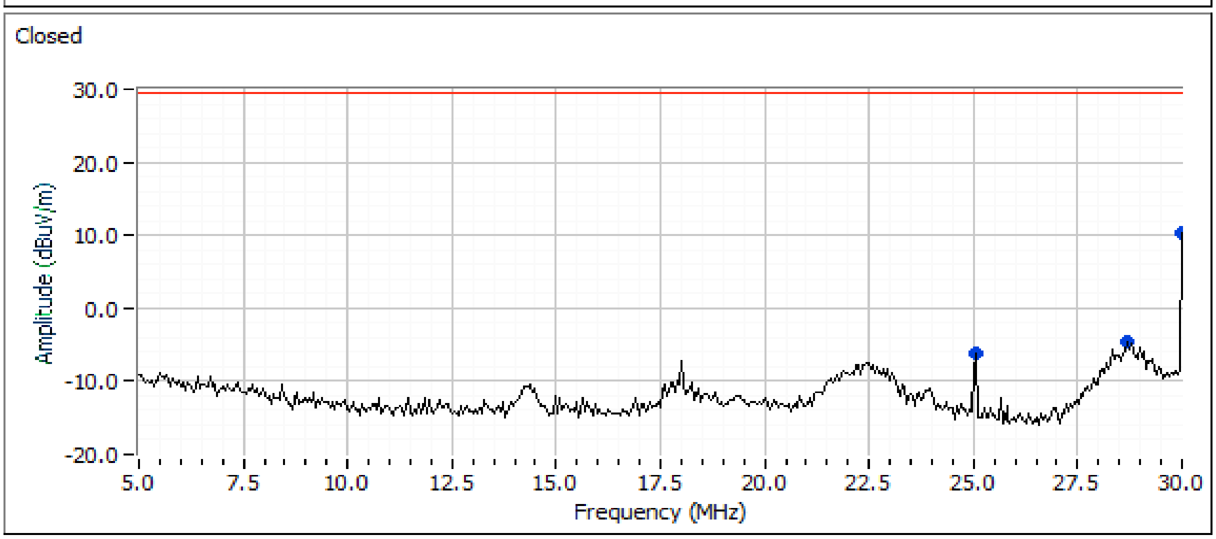
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





			EMC Test Data
Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-





EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	o/c	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.043	-16.9	O	34.9	-51.8	Peak	360	1.3	
0.386	-27.3	O	15.9	-43.2	Peak	335	1.3	
0.571	8.4	O	33.3	-24.9	Peak	154	1.3	
1.755	-0.1	O	29.5	-29.6	Peak	194	1.3	
20.281	-12.0	O	29.5	-41.5	Peak	117	1.3	
30.000	6.3	O	29.5	-23.2	Peak	203	1.3	
0.061	-19.9	C	31.9	-51.8	Peak	38	1.3	
0.339	-25.8	C	17.0	-42.8	Peak	166	1.3	
0.544	8.3	C	33.4	-25.1	Peak	255	1.3	
0.951	4.8	C	31.5	-26.7	Peak	2	1.3	
25.040	-6.2	C	29.5	-35.7	Peak	287	1.3	
28.697	-4.5	C	29.5	-34.0	Peak	287	1.3	
30.000	10.4	C	29.5	-19.1	Peak	304	1.3	

Note 1:	The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Maximized readings for 3 channels (includes manipulation of EUT interface cables)

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBμV/m	o/c	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	18.8	C	29.5	-10.7	QP	315	1.3	Channel 2
30.000	18.7	C	29.5	-10.8	QP	332	1.3	Channel 1
30.000	18.7	C	29.5	-10.8	QP	301	1.3	Channel 3
30.000	14.3	O	29.5	-15.2	QP	198	1.3	Channel 3
30.000	14.1	O	29.5	-15.4	QP	208	1.3	Channel 1
30.000	13.7	O	29.5	-15.8	QP	112	1.3	Channel 2
0.489	4.6	O	33.8	-29.2	QP	276	1.3	Channel 2

Note 1: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Conducted Emissions

(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/30/2018
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 22.6 °C
Rel. Humidity: 38 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207	Pass	39.3 dBµV @ 0.487 MHz (-6.9 dB)
2	CE, AC Power,120V/60Hz	FCC 15.207	Pass	40.1 dBµV @ 0.485 MHz (-6.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

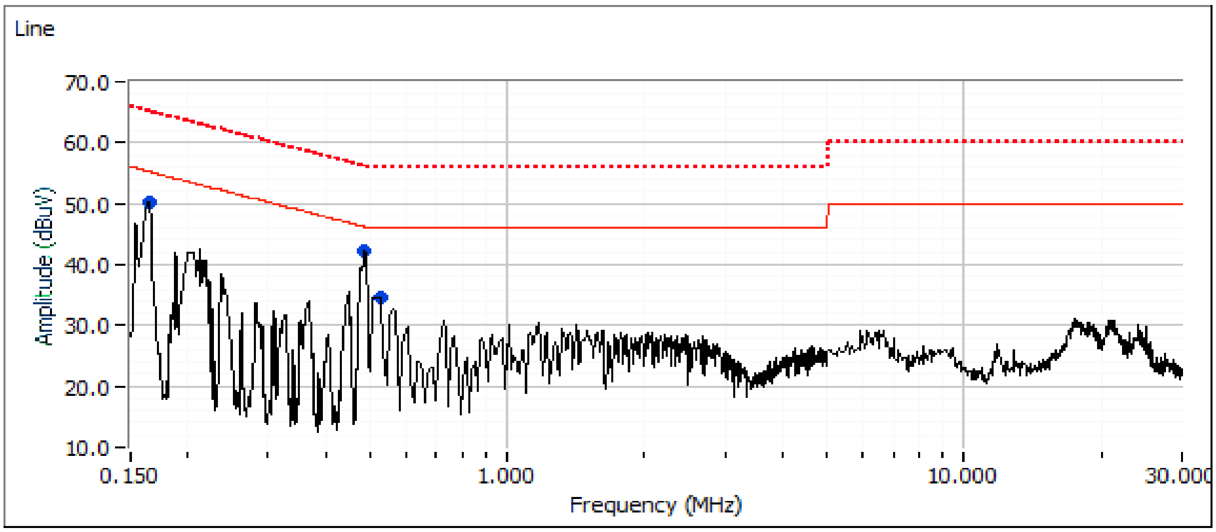
Deviations From The Standard

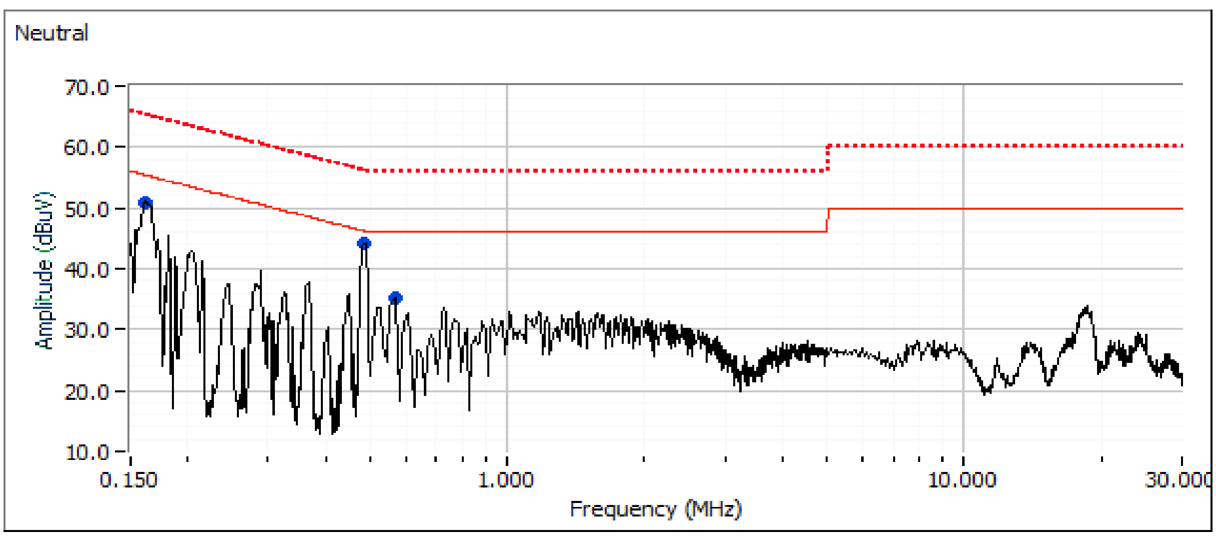
No deviations were made from the requirements of the standard.

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz, POE Adapter providing power
EUT was configured for 2.4GHz Wifi and Ch2 during testing





Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBμV	Line	Limit	Margin	QP/Ave	
0.162	50.9	Neutral	55.4	-4.5	Peak	
0.487	44.2	Neutral	46.2	-2.0	Peak	
0.564	35.1	Neutral	46.0	-10.9	Peak	
0.164	50.3	Line 1	55.2	-4.9	Peak	
0.485	42.3	Line 1	46.2	-3.9	Peak	
0.520	34.6	Line 1	46.0	-11.4	Peak	

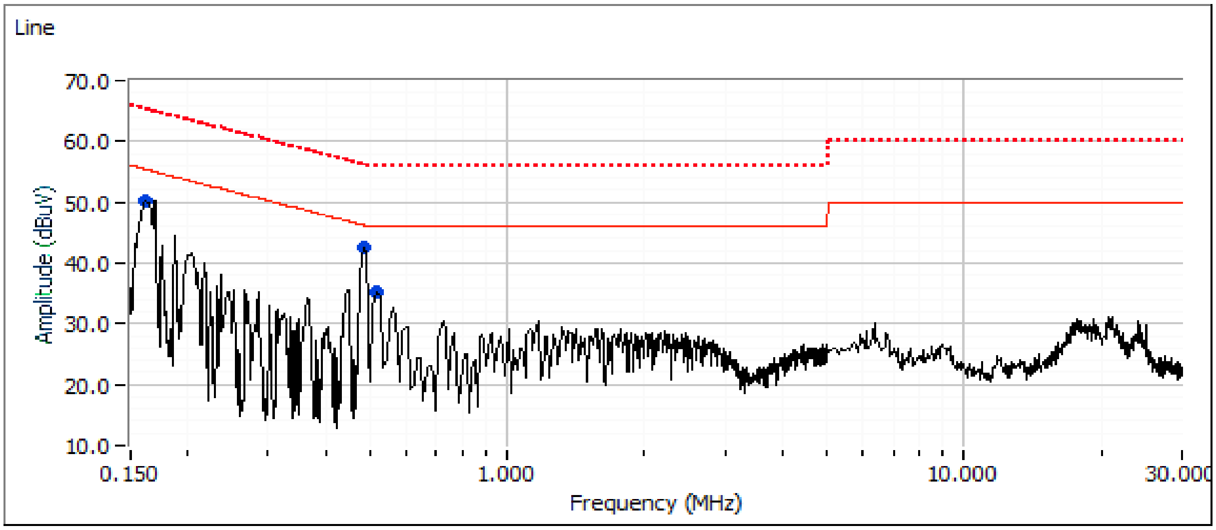
Final quasi-peak and average readings

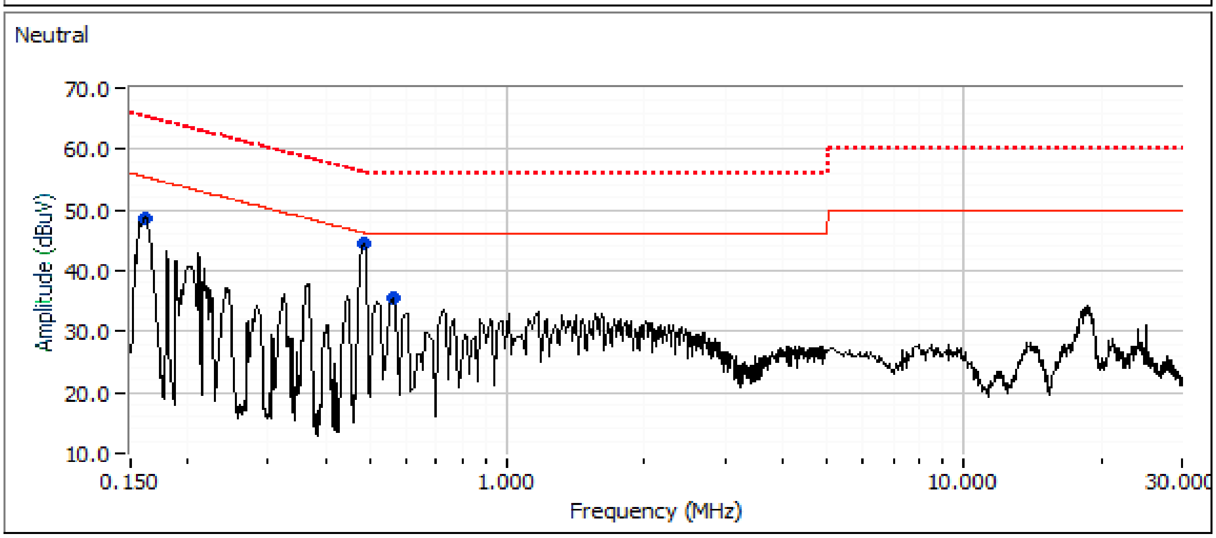
Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBμV	Line	Limit	Margin	QP/Ave	
0.487	39.3	Neutral	46.2	-6.9	AVG	AVG (0.10s)
0.485	37.9	Line 1	46.3	-8.4	AVG	AVG (0.10s)
0.487	43.8	Neutral	56.2	-12.4	QP	QP (1.00s)
0.485	42.1	Line 1	56.3	-14.2	QP	QP (1.00s)
0.564	31.3	Neutral	46.0	-14.7	AVG	AVG (0.10s)
0.162	49.5	Neutral	65.3	-15.8	QP	QP (1.00s)
0.520	30.0	Line 1	46.0	-16.0	AVG	AVG (0.10s)
0.162	38.9	Neutral	55.3	-16.4	AVG	AVG (0.10s)
0.164	47.5	Line 1	65.2	-17.7	QP	QP (1.00s)
0.164	36.0	Line 1	55.2	-19.2	AVG	AVG (0.10s)
0.564	34.3	Neutral	56.0	-21.7	QP	QP (1.00s)
0.520	33.4	Line 1	56.0	-22.6	QP	QP (1.00s)

EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz, Power Supply providing DC
EUT was configured for 2.4GHz Wifi and Ch2 during testing





EMC Test Data

Client:	Vivint, Inc.	PR Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Engineer:	David Bare
Standard:	FCC 15.255	Class:	-

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBμV	Line	Limit	Margin	QP/Ave	
0.162	50.1	Line 1	55.4	-5.3	Peak	
0.486	42.4	Line 1	46.2	-3.8	Peak	
0.523	35.3	Line 1	46.0	-10.7	Peak	
0.161	48.7	Neutral	55.4	-6.7	Peak	
0.485	44.6	Neutral	46.2	-1.6	Peak	
0.568	35.4	Neutral	46.0	-10.6	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBμV	Line	Limit	Margin	QP/Ave	
0.485	40.1	Neutral	46.3	-6.2	AVG	AVG (0.10s)
0.486	36.4	Line 1	46.2	-9.8	AVG	AVG (0.10s)
0.485	44.3	Neutral	56.3	-12.0	QP	QP (1.00s)
0.486	42.0	Line 1	56.2	-14.2	QP	QP (1.00s)
0.522	31.3	Line 1	46.0	-14.7	AVG	AVG (0.10s)
0.162	39.4	Line 1	55.4	-16.0	AVG	AVG (0.10s)
0.162	49.0	Line 1	65.4	-16.4	QP	QP (1.00s)
0.161	38.0	Neutral	55.4	-17.4	AVG	AVG (0.10s)
0.161	47.9	Neutral	65.4	-17.5	QP	QP (1.00s)
0.568	27.5	Neutral	46.0	-18.5	AVG	AVG (0.10s)
0.522	34.5	Line 1	56.0	-21.5	QP	QP (1.00s)
0.568	33.9	Neutral	56.0	-22.1	QP	QP (1.00s)

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

RSS-210 and FCC Part 15.255
Frequency Stability

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

With the exception of the radiated spurious emissions tests, all measurements are made with the EUT's rf port connected to the measurement instrument via an attenuator or dc-block if necessary. All amplitude measurements are adjusted to account for the attenuation between EUT and measuring instrument. For frequency stability measurements the EUT was place inside an environmental chamber.

Radiated measurements are made with the EUT located on a non-conductive table, 3m from the measurement antenna.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 43 %

Summary of Results

Run #			Test Performed	Limit	Pass / Fail	Result / Margin
1			Frequency Stability	Remain in band	-	10.3 ppm

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Vivint, Inc.	Job Number:	PR079234
Model:	CE04	T-Log Number:	TL079234-RA
		Project Manager:	Deepa Shetty
Contact:	Greg Hansen	Project Coordinator:	David Bare
Standard:	FCC 15.255	Class:	N/A

Run #1: Frequency Stability (FCC §15.255(f))

Date of Test: 06/04/18
Test Engineer: Mehran Birgani
Test Location: Lab 3
EUT Voltage: -48VDC

Nominal Frequency: 58320 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
-40	58320.3784	378400	6.5
-30	58320.3812	381200	6.5
-20	58320.5561	556100	9.5
-10	58320.6021	602100	10.3
0	58320.5698	569800	9.8
10	58320.4491	449100	7.7
20	58320.2614	261400	4.5
30	58320.1725	172500	3.0
40	58320.1045	104500	1.8
55	58320.1359	135900	2.3
	Worst case:	602100	10.3

Frequency Stability Over Input Voltage

Nominal Voltage is 48Vdc. Declared extremes at 42.5 to 57 V

Voltage	Frequency Measured	Drift	
(DC)	(MHz)	(Hz)	(ppm)
42.5	58320.253100	253100	4.3
57.0	58320.247500	247500	4.2
	Worst case:	253100	10.3

End of Report

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