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EMC Test Report

Application for FCC Grant of Equipment Authorization

FCC Part 15 Subpart C

Model: CS20101

FCC ID: 2AV6N-CS20101

APPLICANT: ConserVention
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Frisco, TX 75034

TEST SITE(S): National Technical Systems
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IC SITE REGISTRATION #: 2845B-4 and 2845B-5

PROJECT NUMBER: PR118617

REPORT DATE: July 23, 2020

REISSUE DATE: August 6, 2020

FINAL TEST DATES: June 12, 29 and July 1, 2020

TOTAL NUMBER OF PAGES: 56



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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	July 23, 2020	First release	
1	August 6, 2020	Revised report to add radiated emission data below 1 GHz	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the ConserVention model CS20101, pursuant to the following rules:

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:

ANSI C63.10-2013

FCC DTS Measurement Guidance KDB558074

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.

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 ConserVention model CS20101 complied with the requirements of the following regulations:

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 ConserVention model CS20101 and therefore apply only to the tested sample. The sample was selected and prepared by Steve Shaw of ConserVention.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)		Digital Modulation	Systems uses GFSK Modulation	System must utilize a digital transmission technology	Complies
15.247 (a) (2)		6dB Bandwidth	625 kHz	>500kHz	Complies
15.247 (b) (3)		Output Power (multipoint systems)	-1.5 dBm EIRP = 0.00095 W ^{Note 1}	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)		Power Spectral Density	> 8 dBm/3MHz	8dBm/3kHz	Complies
15.247(d)		Antenna Port Spurious Emissions 30MHz – 25 GHz	Performed Radiated		
15.247(d) / 15.209		Radiated Spurious Emissions 30MHz – 25 GHz	52.8 dBμV/m @ 7439.4 MHz (-1.2 dB)	Refer to the limits section (p18) for restricted bands, all others < -20dBc	Complies
15.247(d) / 15.209		Radiated Spurious Emissions 30 kHz – 30 MHz	No emissions observed above the noise floor of the test equipment	Refer to the limits section (p18) for restricted bands, all others < -20dBc	Complies

Note 1: EIRP calculated using antenna gains of 1.6 dBi for the highest EIRP system.

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203		RF Connector	Integral Antenna	Unique or integral antenna required	Complies
15.407 (b) (6)		AC Conducted Emissions	32.0 dBμV @ 0.55 MHz (-24.0 dB)	Refer to page 18	Complies
15.247 (i) 15.407 (f)		RF Exposure Requirements	Refer to SAR exclusion calculations and RSS 102 declaration	Refer to OET 65, FCC Part 1 and RSS 102	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
Radiated Emissions (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 ConserVention model CS20101 is a apparel attachment device that is designed to warn/help prevent a user from touching their face. Since the EUT would be placed close to the body during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3.7 VDC, supplied from a rechargeable LiPo battery.

The sample was received on June 12, 2020 and tested on June 12, 29 and July 1, 2020. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
ConserVention	SMAT	Apparel Attachment Device	Prototype	2AV6N-CS20101

OTHER EUT DETAILS

The following EUT details should be noted: The charging port does not support data.

ANTENNA SYSTEM

The antenna system consists of integral antenna.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 11 cm wide by 6 cm deep by 2 cm high.

MODIFICATIONS

The EUT required the following modifications in order to comply with the emission specifications.

Mod. #	Test	Date	Modification
1	Radiated Emissions	6/29/2020	The power setting was reduced, a new balun/harmonic filter chip was used and discrete Pi filter was installed.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Qualtek Electronic Corp	QFAW-05-05	Power Adapter	-	-

No remote support equipment was used during testing.

EUT INTERFACE PORTS

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

Port		Cable(s)		
From	To	Description	Shielded/Unshielded	Length(m)
Charging Port	Adapter	Two wire	Shielded	1.8

The charging cable is only used while charging

EUT OPERATION

During emissions testing the EUT was running special software that allowed continuous operation on a single channel.

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 6.2 of RSS-GEN, NTS has been recognized as an accredited test laboratory by the Commission and Innovation, Science and Economic Development Canada. A description of the facilities employed for testing is maintained by NTS.

Site	Company / Registration Numbers		Location
	FCC	Canada	
Chamber 4	US1031	2845B	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5		(Wireless Test Lab #US0027)	

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. Results from testing performed in this chamber have been correlated with results from an open area test site. 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.

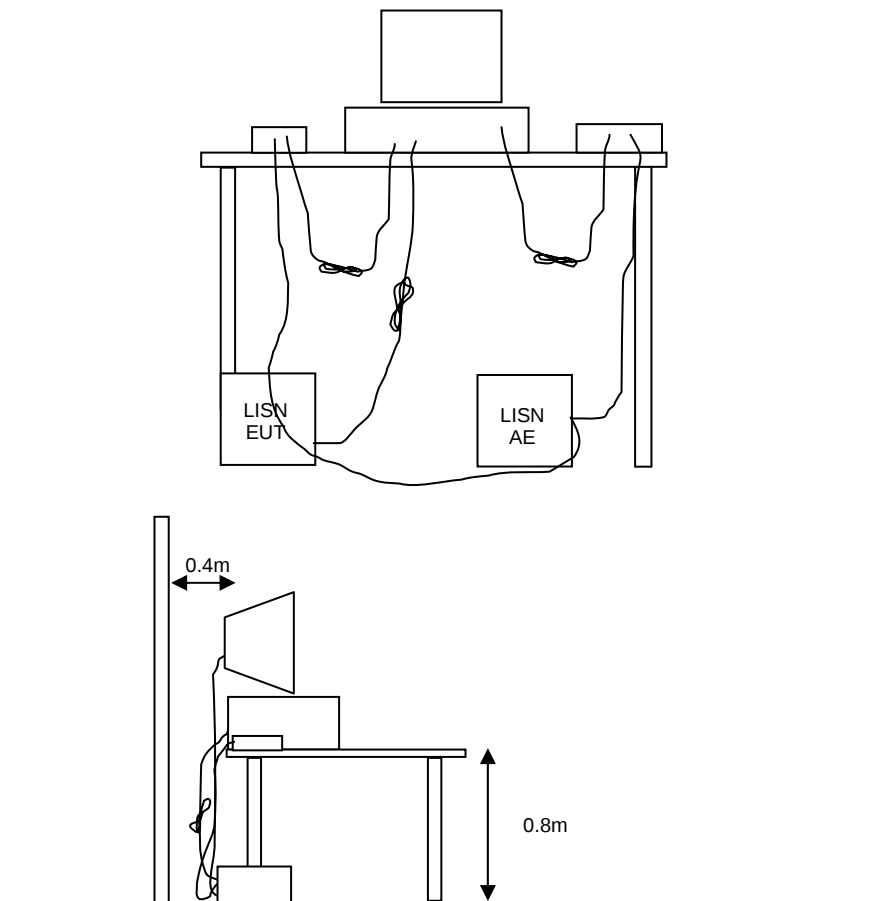


Figure 1 Typical Conducted Emissions Test Configuration

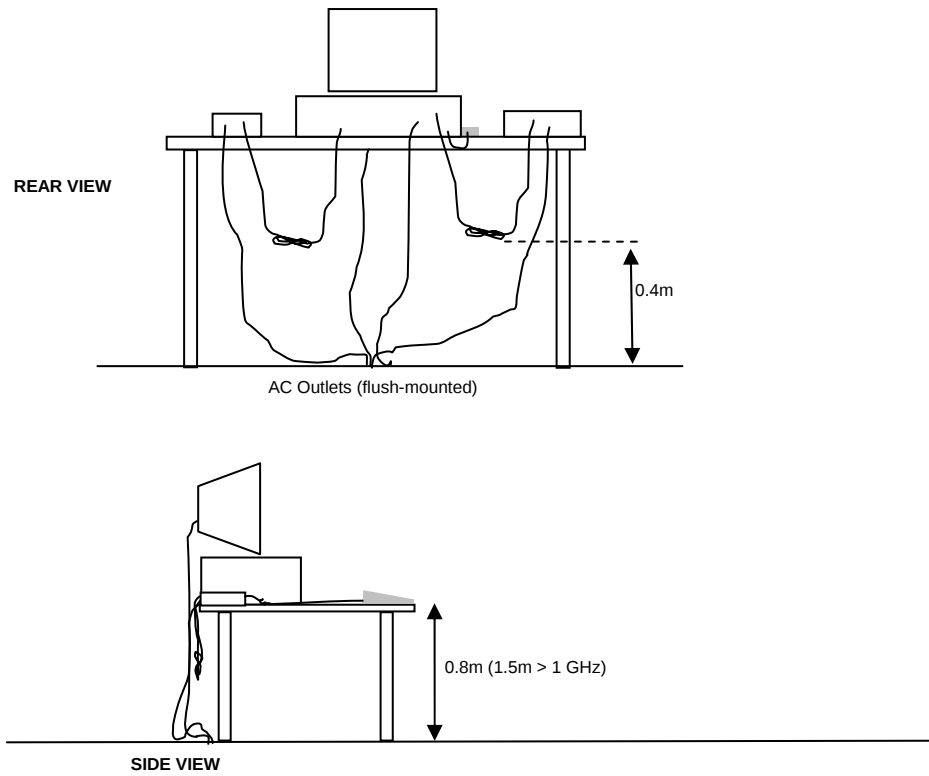
RADIATED EMISSIONS

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.

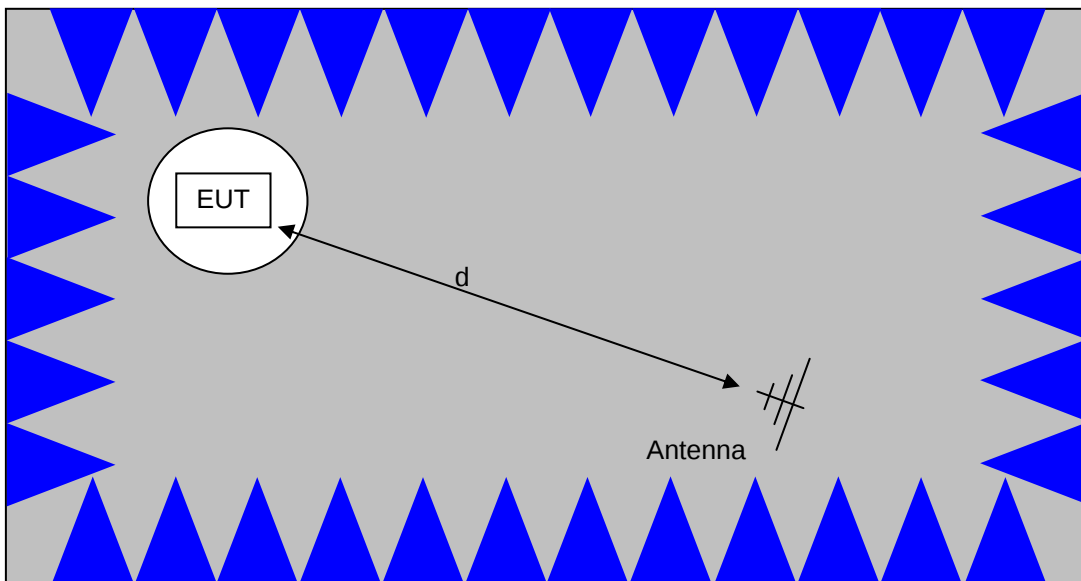
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

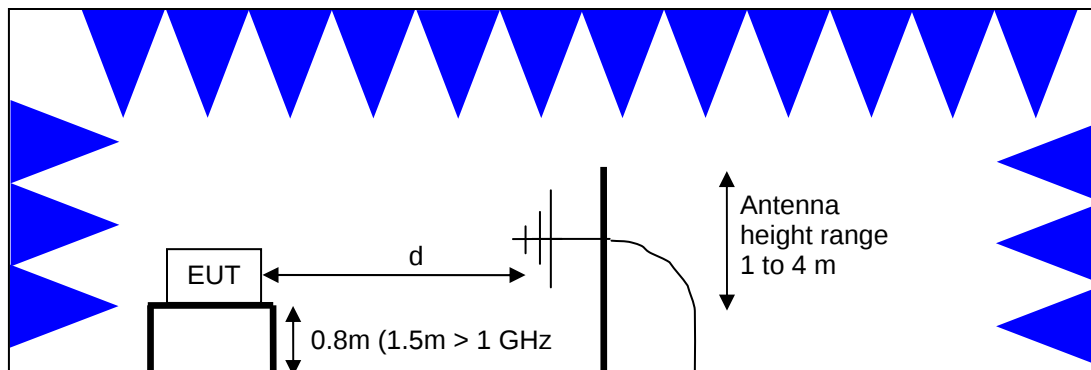


Typical Test Configuration for Radiated Field Strength Measurements



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.

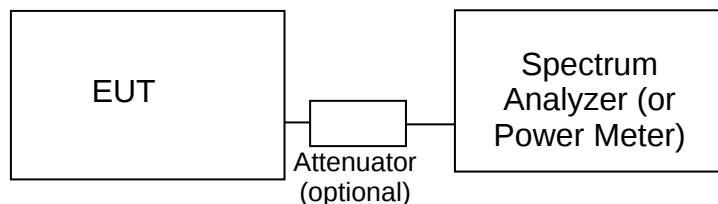
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

**Test Configuration for Antenna Port Measurements**

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

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; 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 bands¹.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{\text{KHz}} @ 300\text{m}$	$67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$
0.490-1.705	$24000/F_{\text{KHz}} @ 30\text{m}$	$87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$
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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. For FCC, fixed point to point applications using the 2400-2483.5 MHz band may use antennas with more than 6 dBi gain but output power is reduced by 1 dB for every 3dB that the antenna gain exceeds 6 dBi. For Canada, fixed point-to-point applications using the 2400-2483.5 MHz band are not subject to this restriction. Fixed point-to-point applications using the 5725 – 5850 MHz band are also not subject to this restriction. Certification of DTS systems operating in the 5725-5850 MHz band is no longer allowed under FCC Rules per §15.37(h).

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS GEN. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

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

<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Radiated Emissions, Fundamental & Band Edge, 11-Jun-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
National Technical Systems	NTS Capture Analyzer Software (rev 4.0)	N/A	WC022706	N/A	
EMCO	Horn Antenna	3115	WC062583	7/9/2018	7/9/2020
Rhode & Schwarz	EMI Test Receiver 20Hz-26.5GHz	ESI	WC071498	5/4/2020	5/4/2021
Radiated Emissions, 1,000 - 25,000 MHz, 12-Jun-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Hewlett Packard	Spectrum Analyzer (Red)	8564E (84125C)	WC055584	10/10/2019	10/10/2020
Hewlett Packard	Microwave Preamplifier Head, 18-40 GHz (Red)	84125C EMI Test Head	WC055586	10/4/2019	10/4/2020
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	WC064442	10/8/2018	10/8/2020
A. H. Systems	Antenna, Horn, 18-40GHz	SAS-574	WC064555	7/8/2019	7/8/2021
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC064574	7/19/2019	7/19/2020
Radiated Emissions, 30 kHz - 1,000 MHz, 12-Jun-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	WC064478	10/31/2018	10/31/2021
Com-Power	Preamplifier, 30-1000 MHz	PA-103	WC064693	5/13/2020	5/13/2021
Rhode & Schwarz	Loop Antenna	HFH2-Z2	WC062457	1/23/2020	1/23/2022
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	WC064989	11/4/2019	11/4/2020
Conducted Emissions - AC Power Ports, 12-Jun-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Com-Power	9KHz-30MHz, 50uH, 15Aac, 10Adc, max CISPR 15	LI-215A	WC064688	8/1/2019	8/1/2020
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	WC064989	11/4/2019	11/4/2020
Rohde & Schwarz	Pulse Limiter	ESH3-Z2	WC072358	6/24/2019	6/24/2020
Radiated Emissions, 1,000 - 25,000 MHz, 29-Jun-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Hewlett Packard	Microwave Preamplifier Head, 18-40 GHz (Purple)	84125C Head	WC055610	8/13/2019	8/13/2020
Hewlett Packard	Spectrum Analyzer (Purple)	8564E	WC055660	7/24/2019	7/24/2020
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC064416	7/18/2019	7/18/2020
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	WC064432	9/18/2018	9/18/2020



<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Hewlett Packard	High Pass filter, 3.5 GHz	P/N 84300-80038	WC064434	1/7/2020	1/7/2021
A. H. Systems	Antenna, Horn, 18-40GHz	SAS-574	WC064554	8/30/2018	8/30/2020
Radiated Emissions, 1,000 - 25,000 MHz, 01-Jul-20					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Hewlett Packard	Spectrum Analyzer (Red)	8564E (84125C)	WC055584	10/10/2019	10/10/2020
Hewlett Packard	Microwave Preamplifier Head, 18-40 GHz (Red)	84125C EMI Test Head	WC055586	10/4/2019	10/4/2020
Hewlett Packard	High Pass filter, 3.5 GHz	P/N 84300-80038	WC064434	1/7/2020	1/7/2021
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	WC064442	10/8/2018	10/8/2020
A. H. Systems	Antenna, Horn, 18-40GHz	SAS-574	WC064555	7/8/2019	7/8/2021
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC064574	7/19/2019	7/19/2020

Appendix B Test Data

TL118617-RA Pages 25 – 55



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Product	SMAT	T-Log Number:	TL118617-RA
System Configuration:	Body Worn	Project Manager:	Christine Krebill
Contact:	Thomas Shaw	Project Engineer:	David Bare
Emissions Standard(s):	FCC Part 15	Class:	B
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

ConserVention

Product

SMAT

Date of Last Test: 7/1/2020



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

RSS-247 and FCC 15.247 (DTS) Antenna Port Measurements Power, PSD and Bandwidth

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: 6/29/2020
Test Engineer: David Bare
Test Location: Fremont Chamber #5

Config. Used: 1
Config Change: None
EUT Voltage: Battery

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 41 %

Summary of Results

Run #		Test Performed	Limit	Pass / Fail	Result / Margin
1		Output Power	15.247(b)	Pass	-1.5 dBm
2		Power spectral Density (PSD)	15.247(d)	Pass	> 8 dBm/3MHz
3		Minimum 6dB Bandwidth	15.247(a)	Pass	625 kHz
3		99% Bandwidth	RSS GEN	-	1.206 MHz

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



EMC Test Data

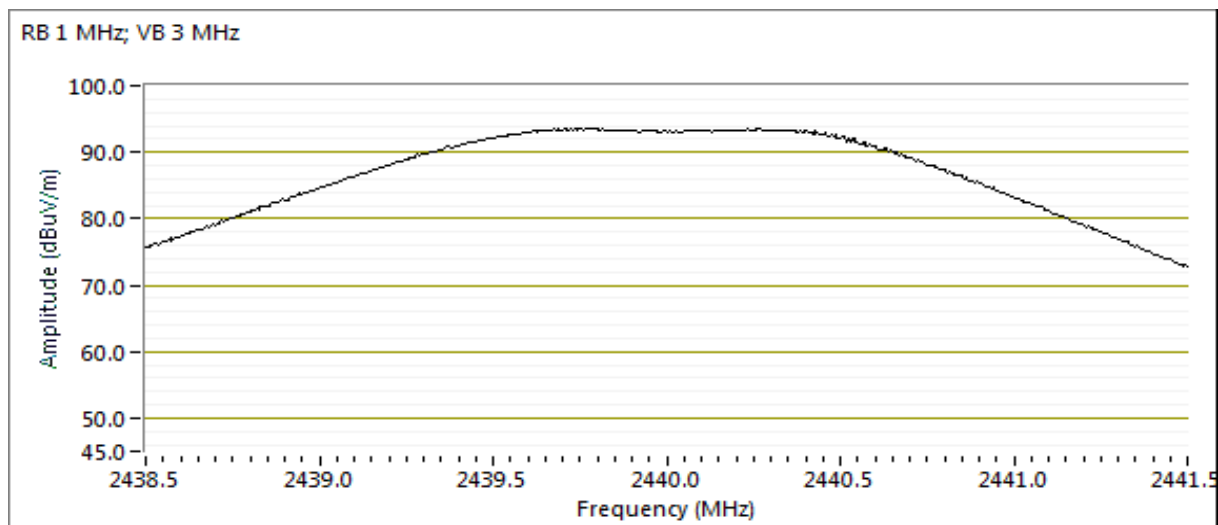
Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1: Output Power

Mode: BLE

Power Setting	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP			
		(dBm) ¹	mW			dBm	W		
-	2402	-1.5	0.7	1.3	Pass	-0.2	0.00095		
-	2440	-2.5	0.6	1.6	Pass	-0.9	0.00081		
-	2480	-1.7	0.7	1.2	Pass	-0.5	0.00089		

Note 1: Output power calculated from the measured field strength using a spectrum analyzer with RBW = 3 MHz and RBW = 10 MHz and peak detector, spurious limit is **-20dBc**. Output power = Field strength - 95.2 - antenna gain.



Run #2: Power spectral Density

Power is less than 8 dBm, no separate PSD measurement required as the limit is 8 dBm



EMC Test Data

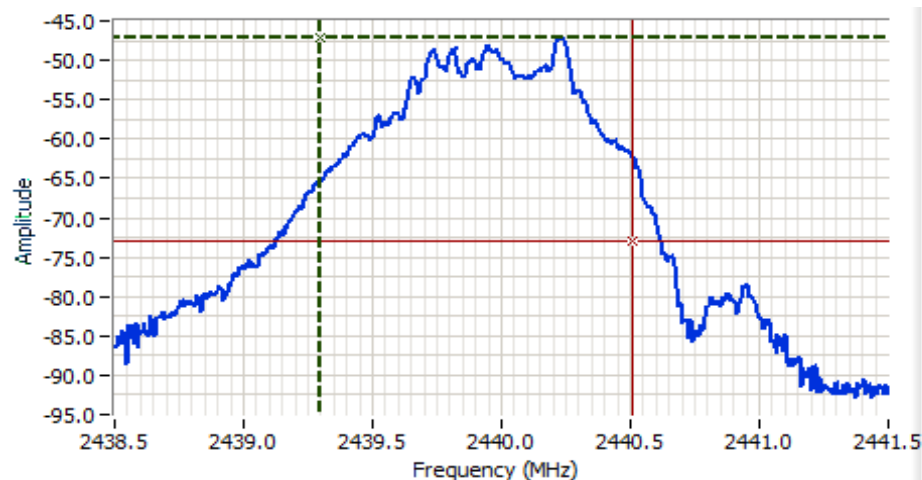
Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #3: Signal Bandwidth

Mode: BLE

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
-	2402	0.625	1.098	0.1	0.05
-	2440	0.625	1.206	0.1	0.05
-	2480	0.667	1.17	0.1	0.05

Note 1: DTS BW: RBW=100kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time, Span 2-5 times measured BW.
99% BW: RBW=1-5% of 99%BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time. Span 1.5-5 times OBW.



Analyzer Settings

Rohde&Schwarz,ESI
CF: 2440.000 MHz
SPAN: 3.000 MHz
RB: 50.0 kHz
VB: 200 kHz
Detector: POS
Attn: 10 DB
RL Offset: 0.0 DB
Sweep Time: 5.0ms
Ref Lvl: -37.0 DBM

Comments

99% power BW: 1.206 MHz

Cursor 1	2439.298000	-47.1	
Cursor 2	2440.504000	-73.1	

Delta Freq. 1.206

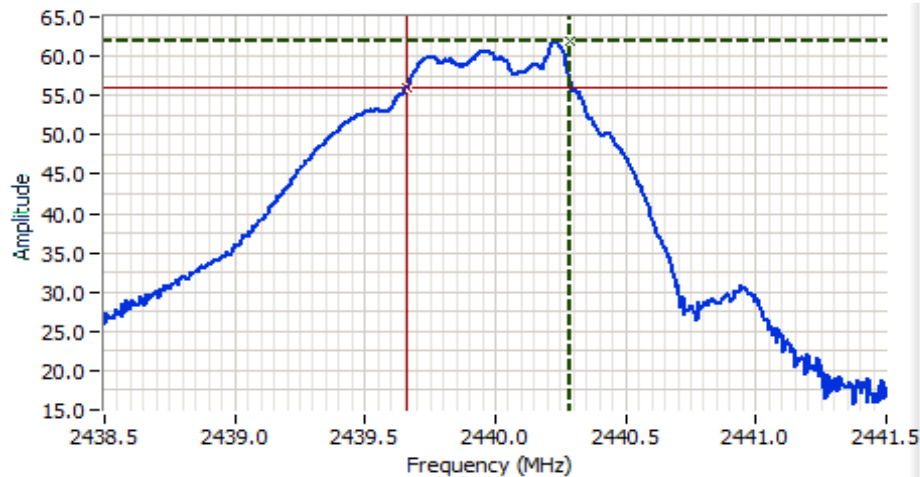
Delta Amplitude 26.0





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A



Analyzer Settings

Rohde&Schwarz,ESI
CF: 2440.000 MHz
SPAN: 3.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 10 DB
RL Offset: 0.0 DB
Sweep Time: 5.0ms
Ref Lvl: 70.0 DBUV

Comments

6dB BW: 625 kHz

Cursor 1	2440.285571	61.9	
Cursor 2	2439.660321	55.9	

Delta Freq. 625 kHz
Delta Amplitude 6.0





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

RSS-247 and FCC 15.247 (DTS) Radiated Fundamental 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.

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: 21 °C
Rel. Humidity: 42 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel			Test Performed	Limit	Result / Margin
1a	BLE	low			Radiated Emissions, Fundamental	FCC Part 15.209 / 15.247(c)	95.0 dBμV/m
1b	BLE	center			Radiated Emissions, Fundamental	FCC Part 15.209 / 15.247(c)	94.3 dBμV/m
1c	BLE	high			Radiated Emissions, Fundamental	FCC Part 15.209 / 15.247(c)	94.7 dBμV/m

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 = 100kHz, VBW = 300kHz and RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1: Radiated Spurious Emissions, Fundamental. Operating Mode: BLE

Date of Test: 6/29/2020 15:50

Config. Used: 1

Test Engineer: David Bare

Config Change: None

Test Location: Fremont Chamber #5

EUT Voltage: Battery

Run #1a: Low Channel @ 2402 MHz

Fundamental Signal Field Strength: Peak values measured in 100 kHz and 3 MHz bandwidths

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT upright								
2402.000	95.0	v	-	-	Pk	302	1.6	RB = 100kHz, VB = 300kHz
2402.000	85.2	h	-	-	Pk	247	2.0	RB = 100kHz, VB = 300kHz
2402.000	95.0	v	-	-	Pk	302	1.6	RB = 3 MHz, VB = 10MHz
EUT flat								
2402.000	85.2	v	-	-	Pk	292	2.2	RB = 100kHz, VB = 300kHz
2402.000	94.0	h	-	-	Pk	0	2.1	RB = 100kHz, VB = 300kHz
2402.000	94.1	h	-	-	Pk	0	2.1	RB = 3 MHz, VB = 10MHz
EUT side								
2402.000	86.6	v	-	-	Pk	72	2.2	RB = 100kHz, VB = 300kHz
2402.000	92.3	h	-	-	Pk	0	2.0	RB = 100kHz, VB = 300kHz
2402.000	92.4	h	-	-	Pk	0	2.0	RB = 3 MHz, VB = 10MHz

Fundamental emission level @ 3m in 100kHz RBW:	95.0	dB μ V/m	
Limit for emissions outside of restricted bands:	75	dB μ V/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	65	dB μ V/m	Limit is -30dBc (UNII power measurement)



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1b: Center Channel @ 2440 MHz

Fundamental Signal Field Strength: Peak values measured in 100 kHz and 3 MHz bandwidths

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT upright								
2440.000	93.7	v	-	-	Pk	12	1.3	RB = 100kHz, VB = 300kHz
2440.000	86.2	h	-	-	Pk	215	2.5	RB = 100kHz, VB = 300kHz
2440.000	94.3	v	-	-	Pk	12	1.3	RB = 3 MHz, VB = 10MHz
EUT flat								
2440.000	87.8	v	-	-	Pk	118	2.2	RB = 100kHz, VB = 300kHz
2440.000	93.5	h	-	-	Pk	0	1.6	RB = 100kHz, VB = 300kHz
2440.000	94.1	h	-	-	Pk	0	1.6	RB = 3 MHz, VB = 10MHz
EUT side								
2440.000	86.5	v	-	-	Pk	50	2.1	RB = 100kHz, VB = 300kHz
2440.000	93.1	h	-	-	Pk	347	1.7	RB = 100kHz, VB = 300kHz
2440.000	93.6	h	-	-	Pk	347	1.7	RB = 3 MHz, VB = 10MHz

Fundamental emission level @ 3m in 100kHz RBW:	94.3	dB μ V/m	
Limit for emissions outside of restricted bands:	74.3	dB μ V/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	64.3	dB μ V/m	Limit is -30dBc (UNII power measurement)

Run #1c: High Channel @ 2480 MHz

Fundamental Signal Field Strength: Peak values measured in 100 kHz and 3 MHz bandwidths

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT upright								
2480.000	93.0	v	-	-	Pk	0	1.0	RB = 100kHz, VB = 300kHz
2480.000	87.8	h	-	-	Pk	147	1.7	RB = 100kHz, VB = 300kHz
2480.000	93.3	v	-	-	Pk	0	1.0	RB = 3 MHz, VB = 10MHz
EUT flat								
2480.000	86.6	v	-	-	Pk	112	2.4	RB = 100kHz, VB = 300kHz
2480.000	94.0	h	-	-	Pk	359	2.4	RB = 100kHz, VB = 300kHz
2480.000	94.7	h	-	-	Pk	359	2.4	RB = 3 MHz, VB = 10MHz
EUT side								
2480.000	89.4	v	-	-	Pk	111	2.4	RB = 100kHz, VB = 300kHz
2480.000	94.2	h	-	-	Pk	171	2.4	RB = 100kHz, VB = 300kHz
2480.000	94.4	h	-	-	Pk	171	2.4	RB = 3 MHz, VB = 10MHz

Fundamental emission level @ 3m in 100kHz RBW:	94.7	dB μ V/m	
Limit for emissions outside of restricted bands:	74.7	dB μ V/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	64.7	dB μ V/m	Limit is -30dBc (UNII power measurement)



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

RSS-247 and FCC 15.247 (DTS) 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: 7/1/2020 10:00
Test Engineer: David Bare
Test Location: Fremont Chamber #4

Config. Used: 1
Config Change: None
EUT Voltage: Battery

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: 21 °C
Rel. Humidity: 41 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel			Test Performed	Limit	Result / Margin
1	BLE	37 - 2402MHz			Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	44.5 dBµV/m @ 2370.8 MHz (-9.5 dB)
	BLE	39 - 2480MHz			Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	42.8 dBµV/m @ 2483.8 MHz (-11.2 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:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

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, emission has a duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear voltage average, auto sweep time, max hold.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	2 Mbps	0.18	Yes	0.438	7.5	15.0	2283

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 3:	Emission has a duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 4:	Emission has constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$ but not less than 10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear voltage correction factor
Note 5:	Emission has constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
Note 6:	Emission has non constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear voltage average, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 7:	Emission has non constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$, RMS detector, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 8:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

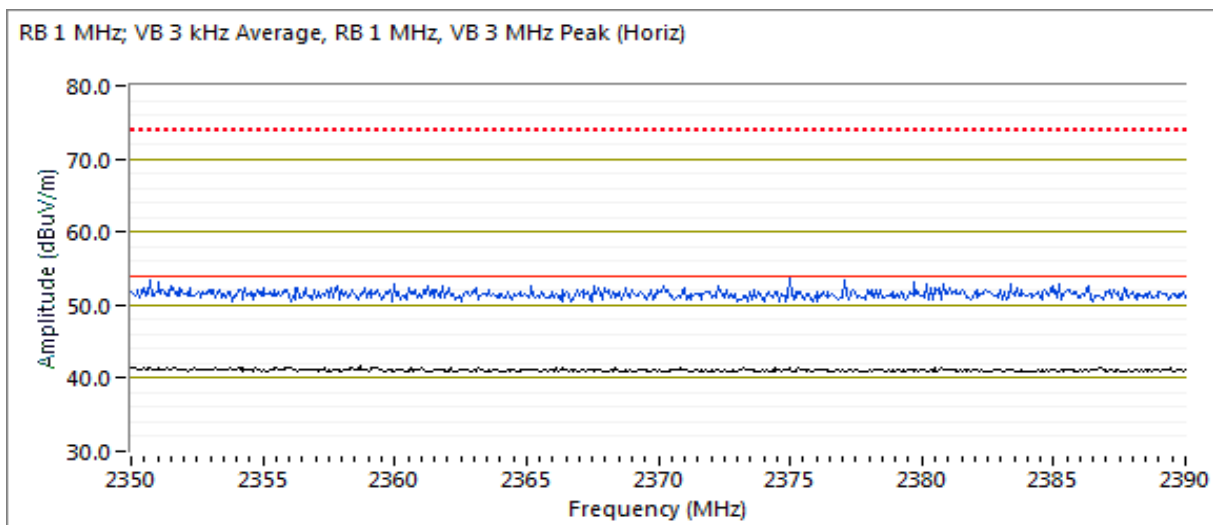
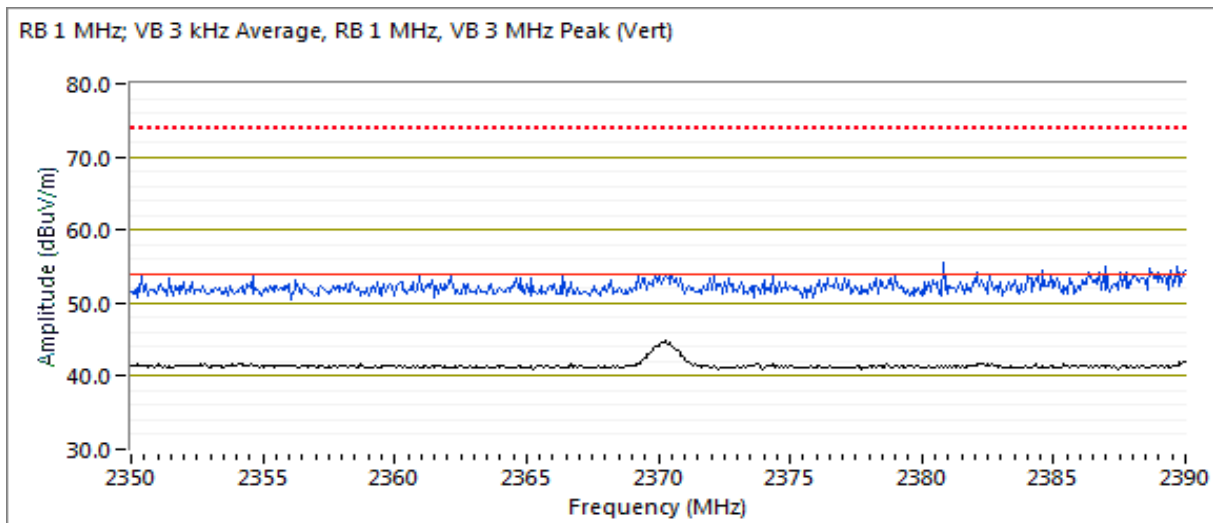


EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1: Radiated Bandedge Measurements (Worst case orientation)

Channel: 37 Mode: BLE Worst case orientation



Band Edge Signal Field Strength - Direct measurement of field strength

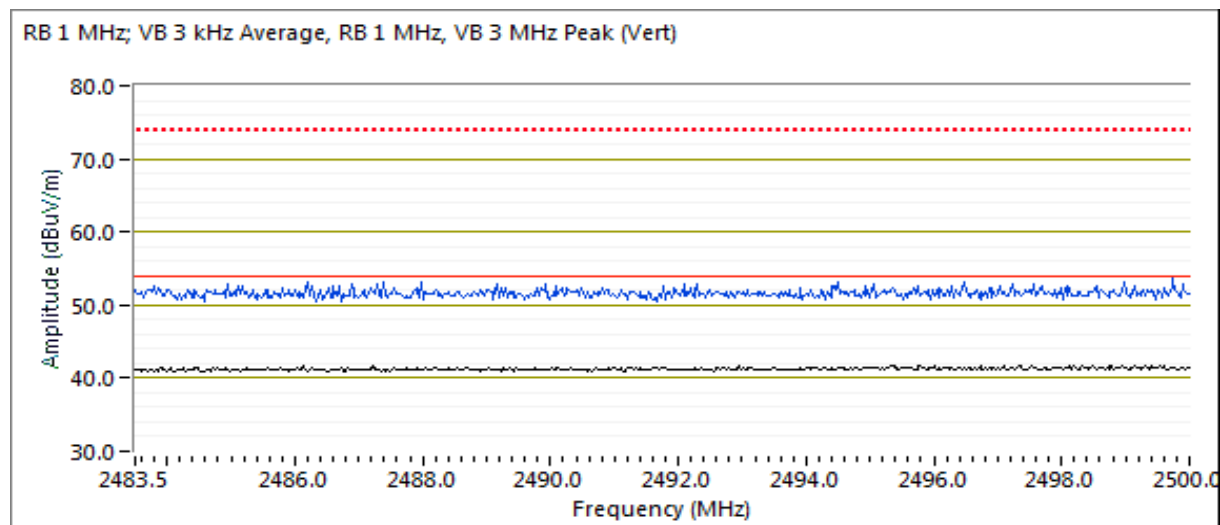
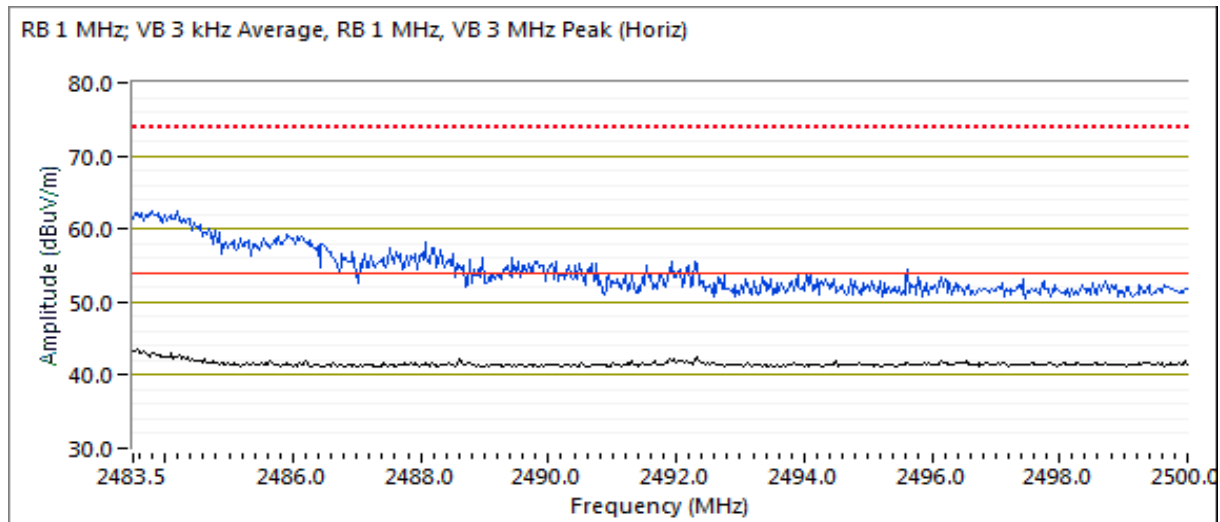
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2370.800	44.5	V	54.0	-9.5	Avg	136	1.7	RB 1 MHz;VB 3 kHz;Peak, Note 6
2368.670	55.0	V	74.0	-19.0	PK	136	1.7	RB 1 MHz;VB 3 MHz;Peak



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Channel: 39 Mode: BLE
At worst case orientation



Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	PK/QP/Avg	degrees	meters	
2483.800	42.8	H	54.0	-11.2	Avg	0	1.8	RB 1 MHz;VB 3 kHz;Peak, Note 6
2483.750	62.5	H	74.0	-11.5	PK	0	1.8	RB 1 MHz;VB 3 MHz;Peak



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

RSS-247 and FCC 15.247 (DTS) 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.

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: 20 °C

Rel. Humidity: 41 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel			Test Performed	Limit	Result / Margin
1	BLE	37 - 2402MHz			Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	46.8 dBµV/m @ 4803.9 MHz (-7.2 dB)
	BLE	17 - 2440MHz			Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	52.0 dBµV/m @ 12198.8 MHz (-2.0 dB)
	BLE	39 - 2480MHz			Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	52.8 dBµV/m @ 7439.4 MHz (-1.2 dB)

Modifications Made During Testing

The following modifications were made to the EUT during testing:

The power setting was reduced, a new balun/harmonic filter chip was used and discrete Pi filter was installed.

Deviations From The Standard

No deviations were made from the requirements of the standard.



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

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, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear voltage average, auto sweep time, max hold.

2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	2 Mbps	0.18	Yes	0.438	7.5	15.0	2283

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 20dB below the level of the fundamental and measured in 100kHz.
Note 3:	Emission has a duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 4:	Emission has constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$ but not less than 10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear voltage correction factor
Note 5:	Emission has constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
Note 6:	Emission has non constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear voltage average, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 7:	Emission has non constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$, RMS detector, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: BLE

Date of Test: 6/29 & 7/1/2020

Config. Used: 1

Test Engineer: David Bare

Config Change: Nne

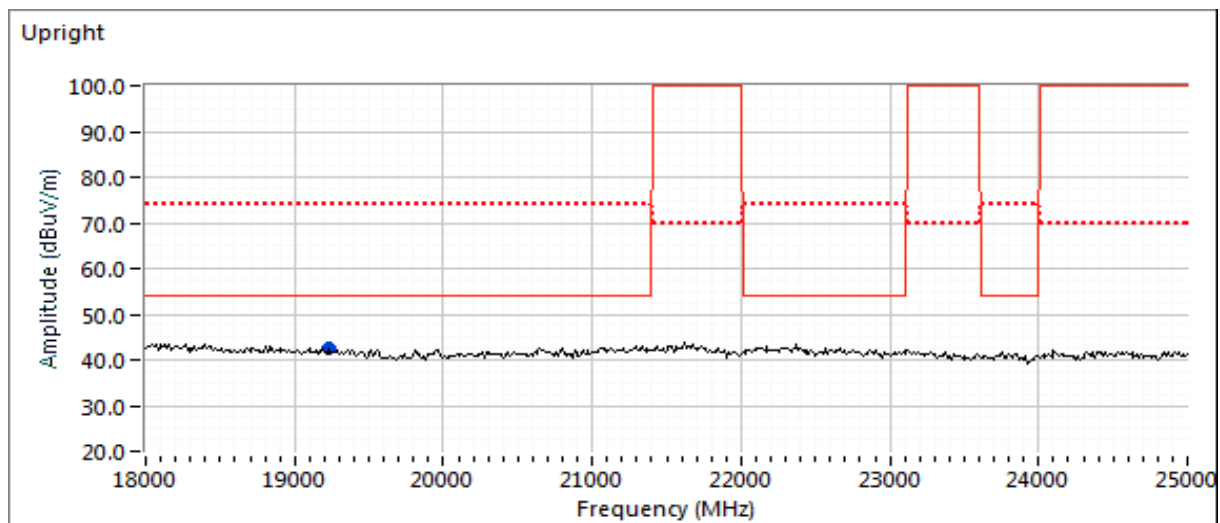
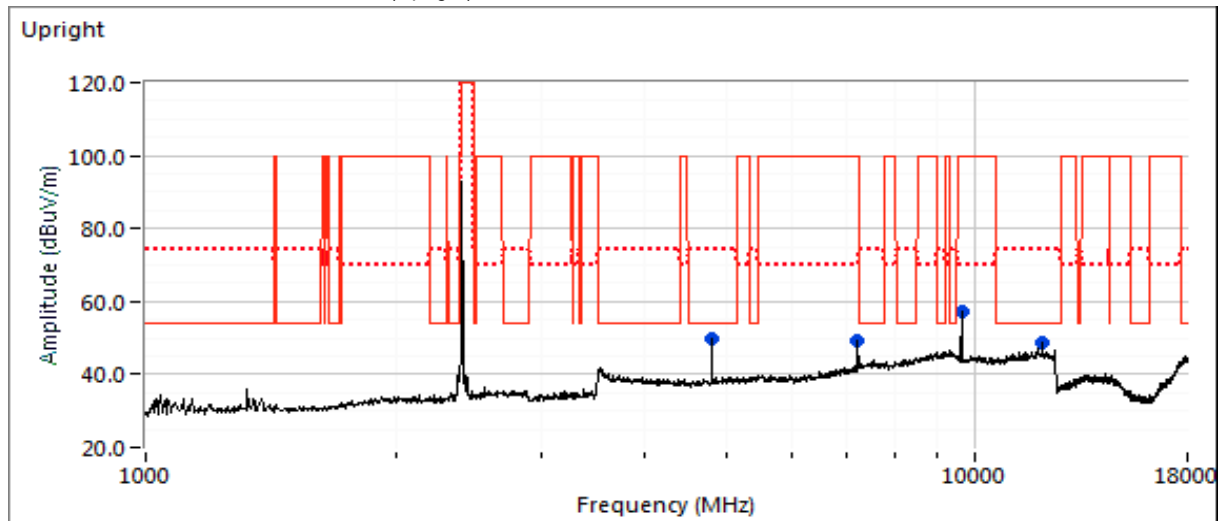
Test Location: Fremont Chamber #5

EUT Voltage: Battery

Run #1a: Low Channel

Channel: 37 Mode: BLE

At worst case orientation from Run # 1b (Upright)





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4803.910	46.8	V	54.0	-7.2	Avg	171	1.6	RB 1 MHz;VB 3 kHz;Peak, Note 6
4803.580	52.2	V	74.0	-21.8	PK	171	1.6	RB 1 MHz;VB 3 MHz;Peak
7205.250	52.5	V	75.0	-22.5	PK	349	2.2	RB 100 kHz;VB 300 kHz;Peak
9607.040	59.8	H	75.0	-15.2	PK	183	1.9	RB 100 kHz;VB 300 kHz;Peak
12008.950	44.8	H	54.0	-9.2	Avg	133	1.9	RB 1 MHz;VB 3 kHz;Peak, Note 6
12008.970	53.9	H	74.0	-20.1	PK	133	1.9	RB 1 MHz;VB 3 MHz;Peak
19217.410	40.1	V	54.0	-13.9	Avg	145	1.9	RB 1 MHz;VB 3 kHz;Peak, Note 6
19214.970	51.2	V	74.0	-22.8	PK	145	1.9	RB 1 MHz;VB 3 MHz;Peak

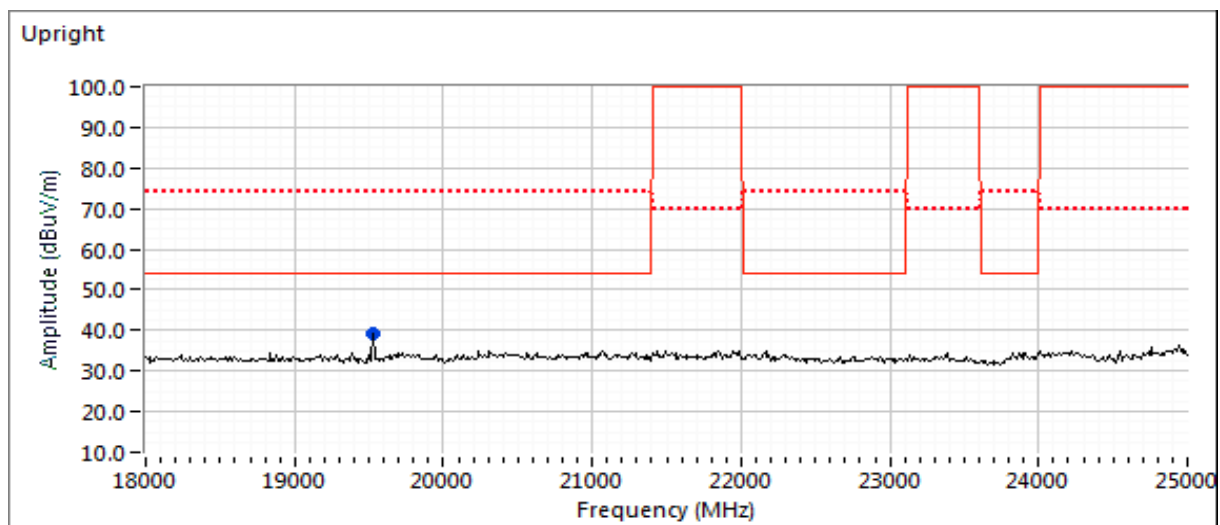
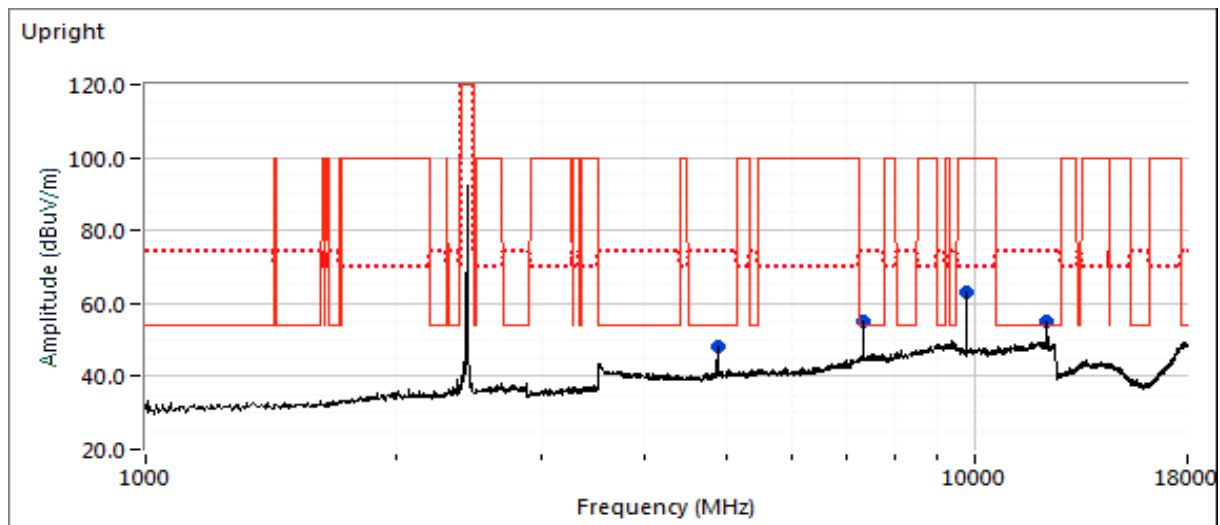


EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1b: Center Channel

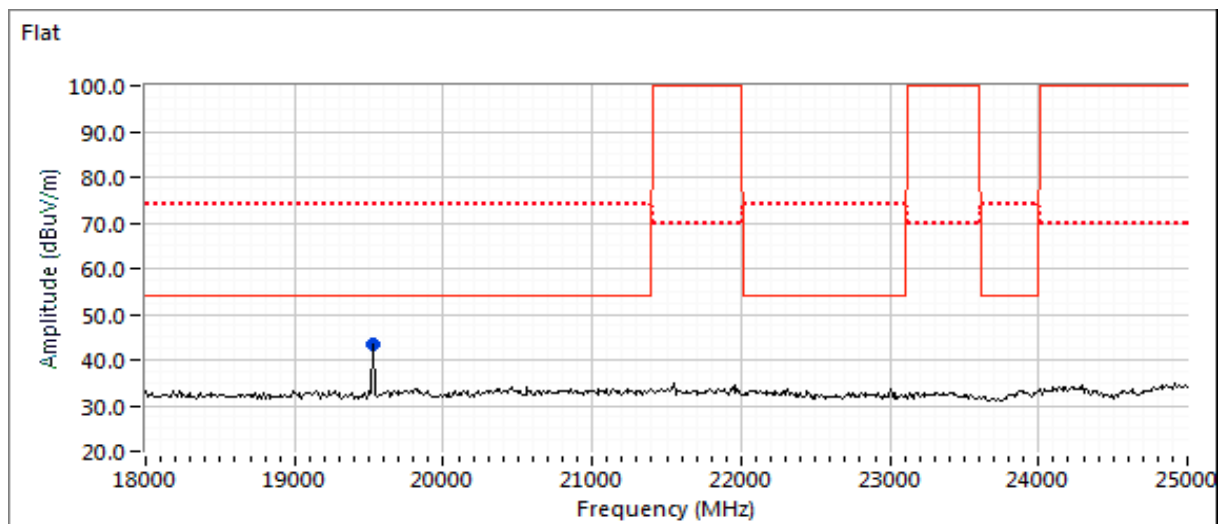
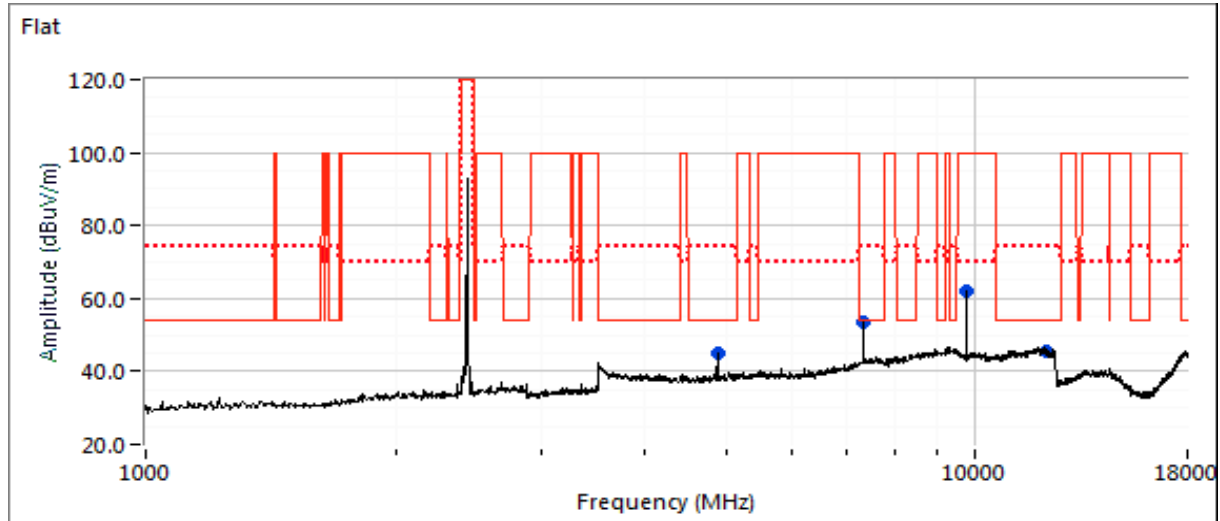
Channel: 17 Mode: BLE





EMC Test Data

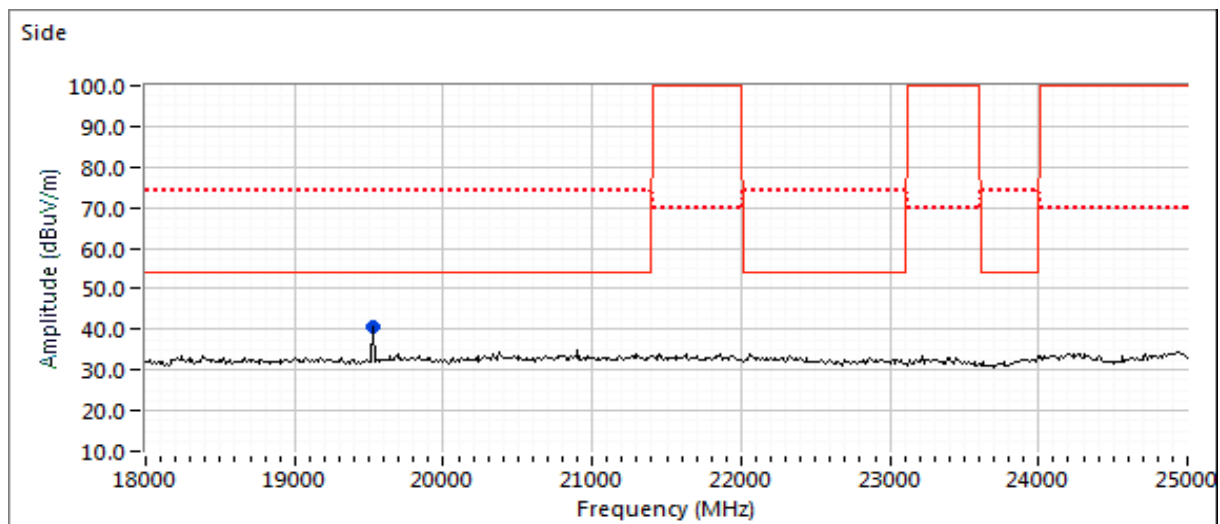
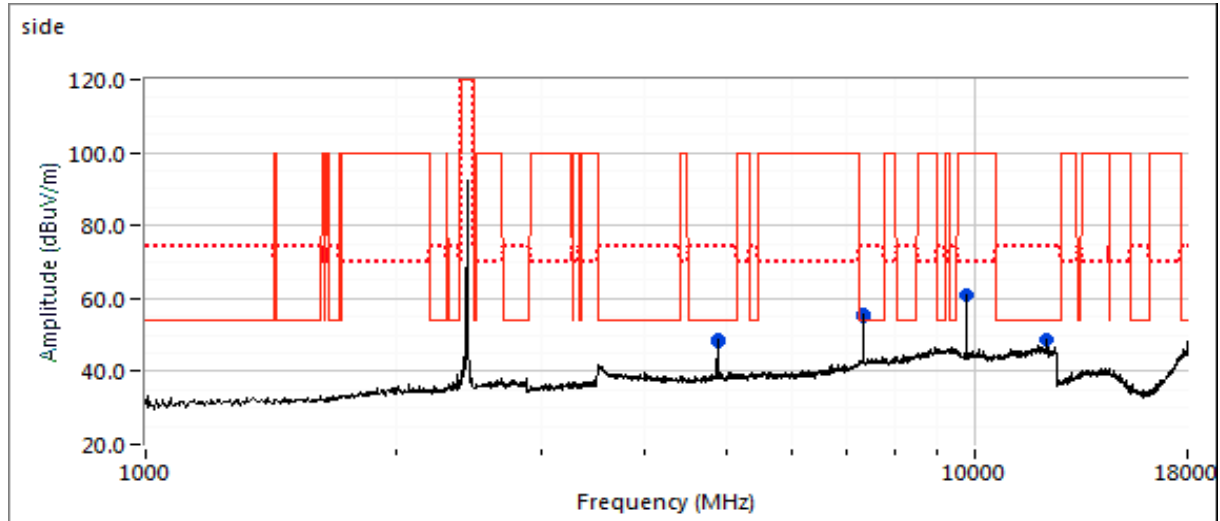
Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT upright								
4879.760	44.5	V	54.0	-9.5	Avg	93	2.2	RB 1 MHz;VB 3 kHz;Peak, Note 6
4880.460	51.1	V	74.0	-22.9	PK	93	2.2	RB 1 MHz;VB 3 MHz;Peak
7319.270	52.1	V	54.0	-1.9	Avg	348	2.2	RB 1 MHz;VB 3 kHz;Peak, Note 6
7319.190	58.7	V	74.0	-15.3	PK	348	2.2	RB 1 MHz;VB 3 MHz;Peak
9760.900	64.8	V	74.3	-9.5	PK	354	1.9	RB 100 kHz;VB 300 kHz;Peak
12198.780	52.0	H	54.0	-2.0	Avg	141	2.2	RB 1 MHz;VB 3 kHz;Peak, Note 6
12198.670	60.0	H	74.0	-14.0	PK	141	2.2	RB 1 MHz;VB 3 MHz;Peak
19520.040	40.2	V	54.0	-13.8	PK	94	1.9	RB 1 MHz;VB 3 MHz;Peak
EUT flat								
4879.920	43.5	H	54.0	-10.5	Avg	49	1.6	RB 1 MHz;VB 3 kHz;Peak, Note 6
4879.600	50.4	H	74.0	-23.6	PK	49	1.6	RB 1 MHz;VB 3 MHz;Peak
7319.230	47.4	H	54.0	-6.6	Avg	124	1.0	RB 1 MHz;VB 3 kHz;Peak, Note 6
7320.700	54.5	H	74.0	-19.5	PK	124	1.0	RB 1 MHz;VB 3 MHz;Peak
9760.880	64.0	H	74.3	-10.3	PK	263	1.0	RB 100 kHz;VB 300 kHz;Peak
12198.850	39.9	H	54.0	-14.1	Avg	360	1.3	RB 1 MHz;VB 3 kHz;Peak, Note 6
12198.780	51.7	H	74.0	-22.3	PK	360	1.3	RB 1 MHz;VB 3 MHz;Peak
19521.240	43.6	V	54.0	-10.4	PK	77	1.0	RB 1 MHz;VB 3 MHz;Peak
EUT side								
4879.890	45.2	H	54.0	-8.8	Avg	119	1.3	RB 1 MHz;VB 3 kHz;Peak, Note 6
4880.230	50.7	H	74.0	-23.3	PK	119	1.3	RB 1 MHz;VB 3 MHz;Peak
7319.420	50.8	H	54.0	-3.2	Avg	315	1.3	RB 1 MHz;VB 3 kHz;Peak, Note 6
7319.330	57.0	H	74.0	-17.0	PK	315	1.3	RB 1 MHz;VB 3 MHz;Peak
9761.040	62.4	V	74.3	-11.9	PK	253	1.0	RB 100 kHz;VB 300 kHz;Peak
12198.730	42.6	V	54.0	-11.4	Avg	214	2.2	RB 1 MHz;VB 3 kHz;Peak, Note 6
12198.870	53.1	V	74.0	-20.9	PK	214	2.2	RB 1 MHz;VB 3 MHz;Peak
19521.460	43.1	H	54.0	-10.9	PK	268	1.6	RB 1 MHz;VB 3 MHz;Peak



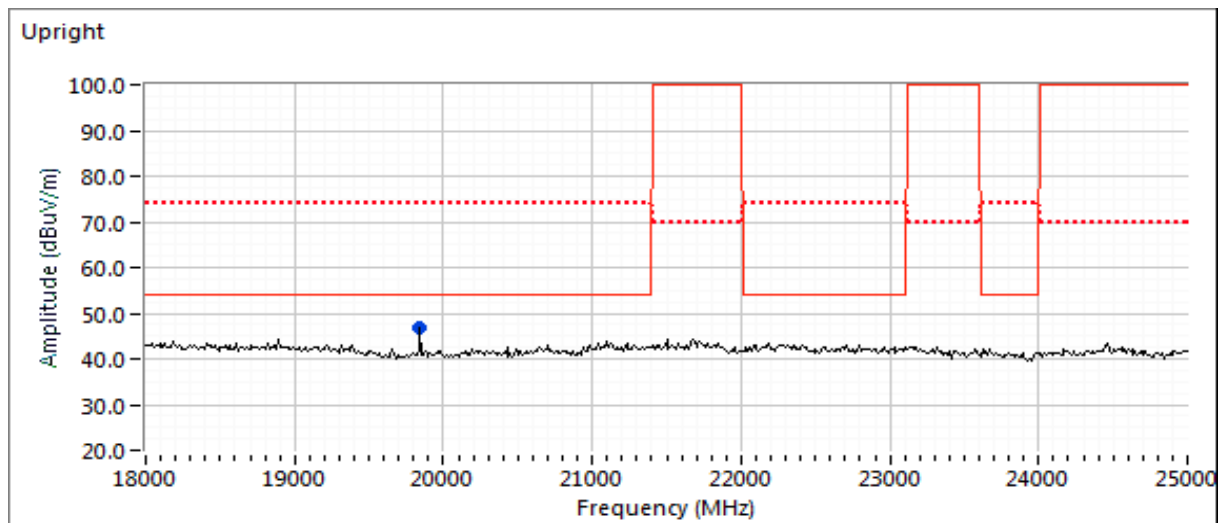
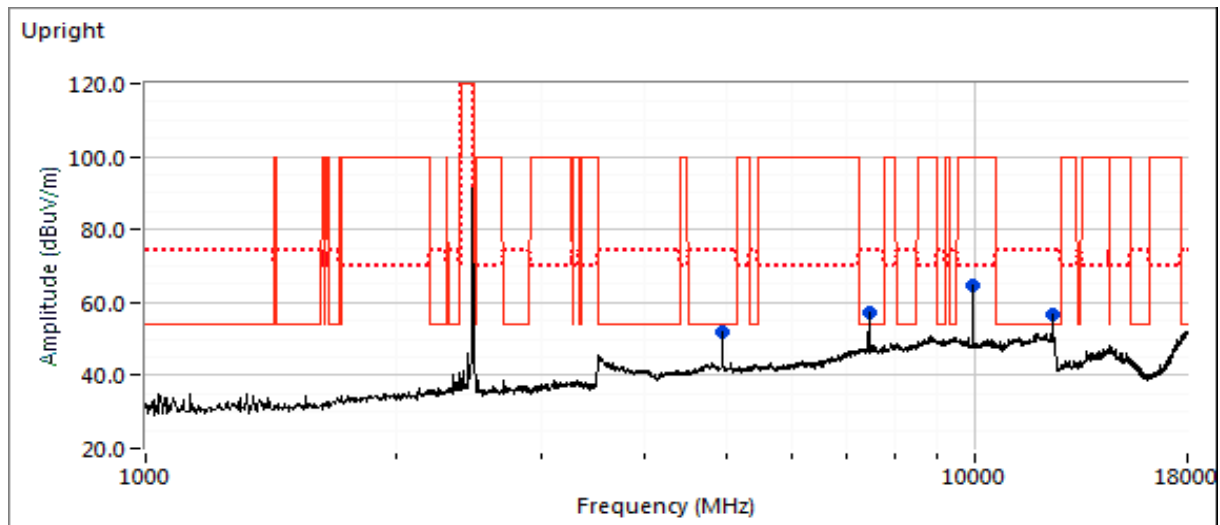
EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Run #1c: High Channel

Channel: 39 Mode: BLE

At worst case orientation from Run # 1b





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4960.040	52.0	V	54.0	-2.0	Avg	302	1.3	RB 1 MHz;VB 3 kHz;Peak, Note 6
4960.560	56.1	V	74.0	-17.9	PK	302	1.3	RB 1 MHz;VB 3 MHz;Peak
7439.400	52.8	H	54.0	-1.2	Avg	208	1.3	RB 1 MHz;VB 3 kHz;Peak, Note 6
7439.170	60.9	H	74.0	-13.1	PK	208	1.3	RB 1 MHz;VB 3 MHz;Peak
9920.880	66.6	H	70.0	-3.4	PK	187	2.2	RB 1 MHz;VB 3 MHz;Peak
12398.840	50.0	H	54.0	-4.0	Avg	132	2.1	RB 1 MHz;VB 3 kHz;Peak, Note 6
12400.280	59.1	H	74.0	-14.9	PK	132	2.1	RB 1 MHz;VB 3 MHz;Peak
19838.610	40.8	V	54.0	-13.2	Avg	97	1.9	RB 1 MHz;VB 3 kHz;Peak, Note 6
19841.250	51.5	V	74.0	-22.5	PK	97	1.9	RB 1 MHz;VB 3 MHz;Peak



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

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: 6/12/2020
Test Engineer: M. Birgani
Test Location: Fremont Chamber #5

Config. Used: 1
Config Change: -
Power Adapter Voltage: 120V/60Hz

General Test Configuration

The EUT was located on a table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature:	20-22 °C
Rel. Humidity:	38-40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	Class B	Pass	32.0 dBμV @ 0.55 MHz (-24.0 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

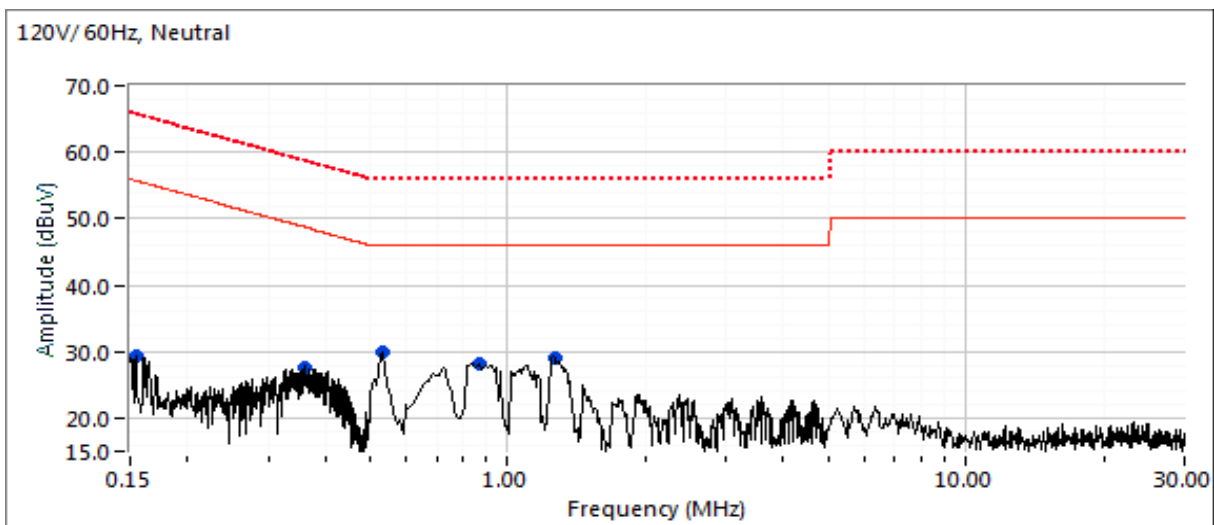
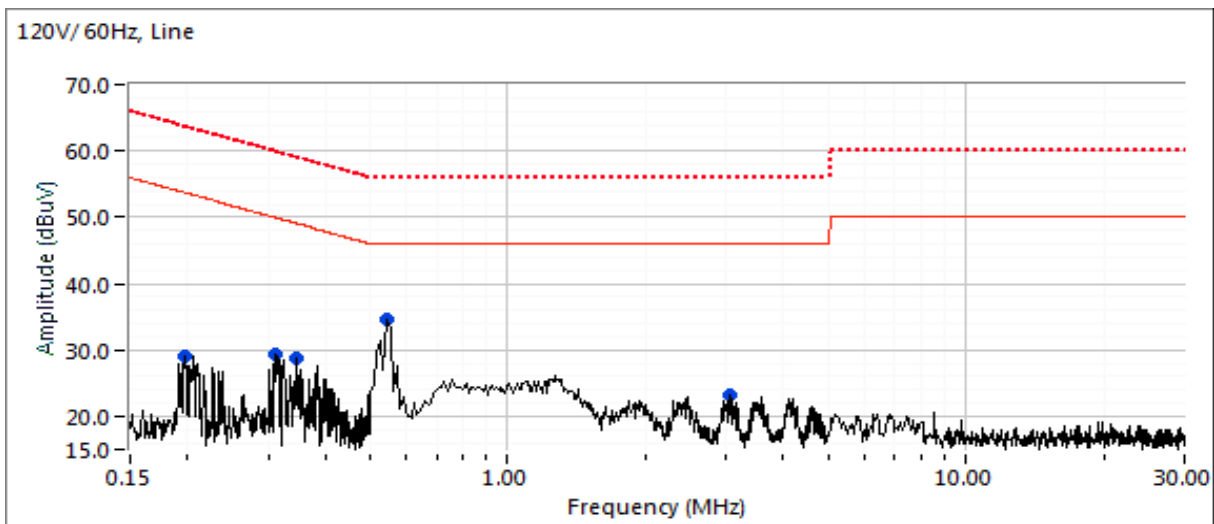
No deviations were made from the requirements of the standard.



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

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

Frequency MHz	Level dB μ V	AC Line	Class B		Detector QP/Ave	Comments
			Limit	Margin		
0.154	29.2	Neutral	55.8	-26.6	Peak	
0.198	29.1	Line	53.7	-24.6	Peak	
0.313	29.2	Line	49.9	-20.7	Peak	
0.344	28.8	Line	49.1	-20.3	Peak	
0.362	27.7	Neutral	48.7	-21.0	Peak	
0.540	34.7	Line	46.0	-11.3	Peak	
0.546	29.9	Neutral	46.0	-16.1	Peak	
0.854	28.2	Neutral	46.0	-17.8	Peak	
1.262	29.0	Neutral	46.0	-17.0	Peak	
3.041	23.1	Line	46.0	-22.9	Peak	

Final quasi-peak and average readings

Frequency MHz	Level dB μ V	AC Line	Class B		Detector QP/Ave	Comments
			Limit	Margin		
0.546	32.0	Neutral	56.0	-24.0	QP	QP (1.00s)
0.546	19.2	Neutral	46.0	-26.8	AVG	AVG (0.10s)
0.540	28.0	Line	56.0	-28.0	QP	QP (1.00s)
1.262	23.9	Neutral	56.0	-32.1	QP	QP (1.00s)
0.854	23.5	Neutral	56.0	-32.5	QP	QP (1.00s)
1.262	11.9	Neutral	46.0	-34.1	AVG	AVG (0.10s)
0.540	11.7	Line	46.0	-34.3	AVG	AVG (0.10s)
0.854	11.7	Neutral	46.0	-34.3	AVG	AVG (0.10s)
0.362	22.5	Neutral	58.7	-36.2	QP	QP (1.00s)
0.362	12.1	Neutral	48.7	-36.6	AVG	AVG (0.10s)
0.344	20.7	Line	59.1	-38.4	QP	QP (1.00s)
0.313	20.6	Line	59.9	-39.3	QP	QP (1.00s)
0.344	9.3	Line	49.1	-39.8	AVG	AVG (0.10s)
0.313	9.1	Line	49.9	-40.8	AVG	AVG (0.10s)
3.041	5.1	Line	46.0	-40.9	AVG	AVG (0.10s)
3.041	13.3	Line	56.0	-42.7	QP	QP (1.00s)
0.198	20.1	Line	63.7	-43.6	QP	QP (1.00s)
0.154	21.7	Neutral	65.8	-44.1	QP	QP (1.00s)
0.198	9.3	Line	53.7	-44.4	AVG	AVG (0.10s)
0.154	10.6	Neutral	55.8	-45.2	AVG	AVG (0.10s)



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Radiated 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: 6/12/2020
Test Engineer: M. Birgani
Test Location: Fremont Chamber #5

Config. Used: 1
Config Change: Unit was charging
EUT Voltage: 120V/ 60Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Any remote support equipment was located outside the semi-anechoic chamber. Any cables running to remote support equipment were routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

The test distance and extrapolation factor (if applicable) 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: 20-22 °C
Rel. Humidity: 38-40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 30 - 1000 MHz, Preliminary	Class B	PASS	Refer to individual runs
2	Radiated Emissions 30 - 1000 MHz, Maximized	Class B	PASS	26.9 dBμV/m @ 39.96 MHz (Margin: -13.1 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.

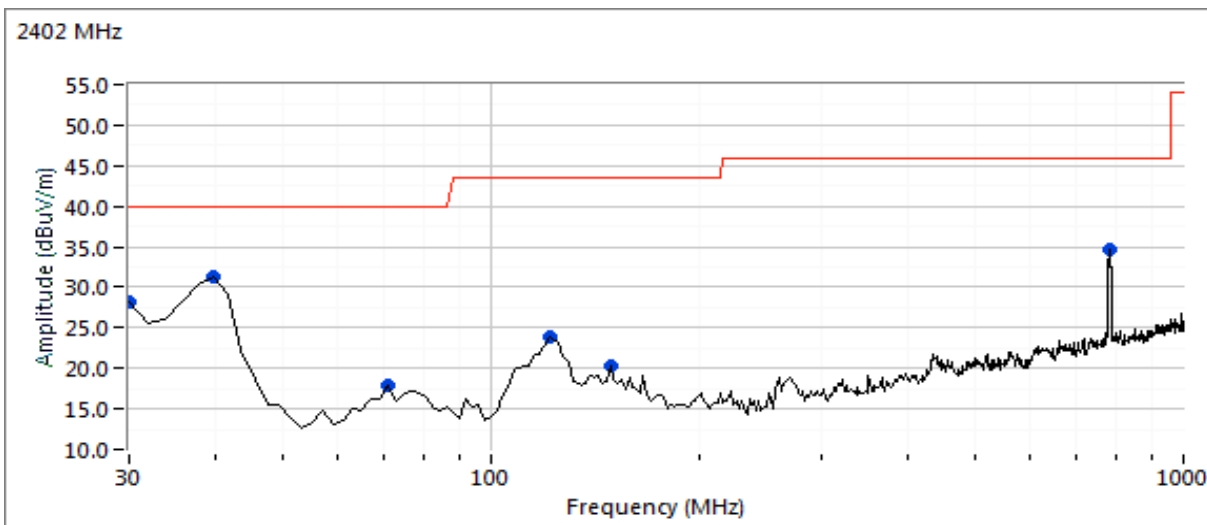


EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #1a: Preliminary Radiated Emissions, 30 - 1000 MHz

Low Channel with Flat Orientation



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.280	28.2	H	40.0	-11.8	Peak	0	1.0	
39.964	31.2	V	40.0	-8.8	Peak	323	1.0	
72.000	17.9	V	40.0	-22.1	Peak	117	1.0	
122.261	24.0	V	43.5	-19.5	Peak	56	1.0	
152.088	20.3	V	43.5	-23.2	Peak	152	1.0	
781.650	34.6	V	46.0	-11.4	Peak	319	1.0	

Note 1: No emissions related the BLE radio were observed so additional tests on other channels are not necessary to demonstrate compliance.

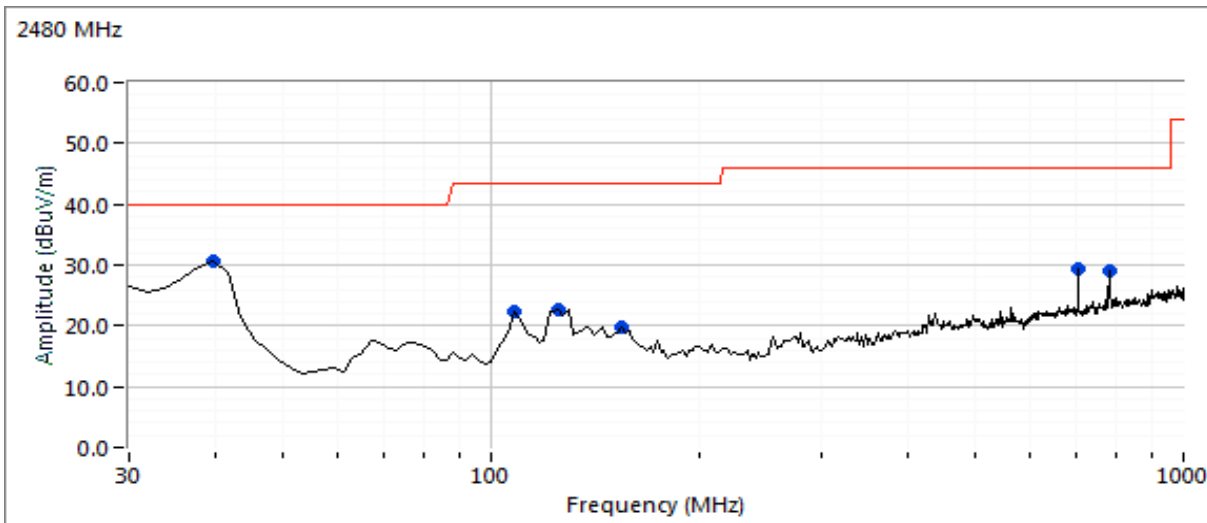


EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #1b: Preliminary Radiated Emissions, 30 - 1000 MHz

High Channel with Upright Orientation



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
40.664	30.7	V	40.0	-9.3	Peak	73	1.0	
109.261	22.4	V	43.5	-21.1	Peak	85	1.0	
124.703	22.7	V	43.5	-20.8	Peak	303	1.0	
152.275	19.9	V	43.5	-23.6	Peak	94	1.0	
706.220	29.4	V	46.0	-16.6	Peak	294	1.0	
786.138	28.9	V	46.0	-17.1	Peak	154	1.0	

Note 1: No emissions related the BLE radio were observed so additional tests on other channels are not necessary to demonstrate compliance.



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #2: Maximized Readings From Run #1

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments	
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
39.964	26.9	V	40.0	-13.1	QP	321	1.0	QP (1.00s)	2402
30.280	21.3	H	40.0	-18.7	QP	0	1.0	QP (1.00s)	2402
781.650	26.0	V	46.0	-20.0	QP	315	1.0	QP (1.00s)	2402
122.261	20.8	V	43.5	-22.7	QP	54	1.0	QP (1.00s)	2402
72.000	16.6	V	40.0	-23.4	QP	115	1.0	QP (1.00s)	2402
152.088	14.8	V	43.5	-28.7	QP	150	1.0	QP (1.00s)	2402



EMC Test Data

Client:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

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: 6/12/2020
Test Engineer: M. Birgani
Test Location: Fremont Chamber #5

Config. Used: 1
Config Change: Unit was charging
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 ????

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: 20-22 °C
Rel. Humidity: 38-40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	30 kHz - 30 MHz	FCC 15.209	Pass	No emissions observed above the noise floor

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:	ConserVention	PR Number:	PR118617
Model:	SMAT	T-Log Number:	TL118617-RA
Contact:	Thomas Shaw	Project Manager:	Christine Krebill
Standard:	FCC Part 15	Project Engineer:	David Bare
		Class:	B

Run #1: Radiated Emissions, 30 kHz - 30 MHz

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.03 - 0.490 MHz	3	300	-80.0
0.490 - 30 MHz	3	30	-40.0

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

Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	O/C	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.515	7.9	O	33.4	-25.5	Pk	137	1.0	Noise Floor

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.



End of Report

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