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Test Report

Bureau Veritas Consumer Products Services Inc.

Report No	EU0436-1
Client	OSRAM SYLVANIA INC.
Address	200 Ballardvale Street Wilmington, MA 01887
Phone	978-750-3865
Items tested FCC ID IC FRN	iQ RF Controller DZO-OSREFRMG21P 23566-OSREFRMG21P 0021513163
Equipment Type Equipment Code Emission Designator	Digital Transmission System DTS 2M32G1D
FCC/IC Rule Parts	CFR Title 47 FCC Part 15.247, RSS-247 Issue 2
Test Dates	Mar 16, May 19 – 21, 2020
Results	As detailed within this report
Prepared by	 Benjamin Palazzi – EMC Engineer
Authorized by	 Anna Vancheva – EMC Wireless Engineer
Issue Date	<u>5/26/2020</u>
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 31 of this report.

Bureau Veritas Consumer Products Services Inc. is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



Bureau Veritas Consumer Products Services Inc.
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



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Summary

This test report supports an application for certification of a transmitter operating pursuant to CFR Title 47 FCC Part 15.247, ISSED Canada RSS-247 Issue 2.

The EUT is iQ RF Controller (Model: OSREFRMG21P). This is a radio that can support dual protocols i.e., Zigbee and Bluetooth Low Energy (BLE).

Zigbee operates in the 2405 – 2480MHz frequency. BLE radio operates in the 2402 – 2480MHz frequency range with DTS equipment code. Client declares that time division multiplexing is used between the Zigbee and BLE functions of the device. Therefore there's no simultaneous transmission capability between Zigbee and BLE.

This module is to be used within OSRAM products i.e., not authorized to be sold to third parties. The approved module will be used in several lighting products of OSRAM.

Antenna: Internal PCB trace antenna with max 0.2dBi gain.

We found that the product met the above requirements without modification. Test samples were received in good condition.

Test Methodology

All testing was performed according to the following rules/procedures/documents:

CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2, ISED Canada RSS-Gen Issue 5, FCC KDB 558074 D01 15.247 Measurement Guidance v05r02 and ANSI C63.10-2013.

Radiated emissions were measured by rotating the device around three orthogonal planes, as well as varying the test antenna's height and polarity. Worst case results are presented in this report. AC line conducted emissions testing was performed with a 50 Ω /50 μ H LISN. EUT operating voltage was 120VAC at 60Hz.

RF measurements were performed at the antenna port on 3 channels as follows:

Low channel = 2405 MHz

Mid channel = 2440 MHz

High channel = 2480MHz

Following bandwidths were used during radiated spurious and AC line conducted emissions tests:

Frequency	RBW	VBW
150kHz-30MHz	9kHz	30kHz
30-1000MHz	120kHz	1MHz
1-25GHz	1MHz	3MHz

Product Tested - Configuration Documentation

EUT Configuration											
Work Order:	U0436										
Company:	OSRAM SYLVANIA INC										
Company Address:	200 Ballardvale Street										
	Wilmington, MA, 01887										
Contact:	Sivakumar Thangavelu (3)										
	MN			PN			SN				
EUT:	Zigbee Conducted and Radiated samples						165,225				
EUT Description:	Zigbee										
EUT Max Frequency:	2480 MHz										
EUT Min Frequency:	38.4 MHz										
Support Equipment	MN						SN				
HP Power Supply	E3612A										
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment	
DC power	Power DC	1	1	Power DC	No	No	0.1	in	yes		
Software Operating Mode Description:											
Running high, mid and low channels at maximum power (+19dBm).											
Performance Criteria:											
N/A. Emissions tested only.											

Statement of Conformity

RSS-GEN	RSP-100	RSS 247	Part 15	Comments
6.4			15.15(b)	There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements.
	3.1		15.19	The label is shown in the label exhibit.
	3.2		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3.2			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13.2			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
6.13.1			15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
6.8			15.203	The antenna for this device is a non-detachable whisker antenna with 0.2 dBi gain.
8.10			15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209 or RSS-Gen as applicable.
			15.247	The unit complies with the requirements of 15.247
		RSS 247		The unit complies with the requirements of RSS-247
6.7				Occupied Bandwidth measurements were made.

Modifications Required for Compliance

None.

Test Results

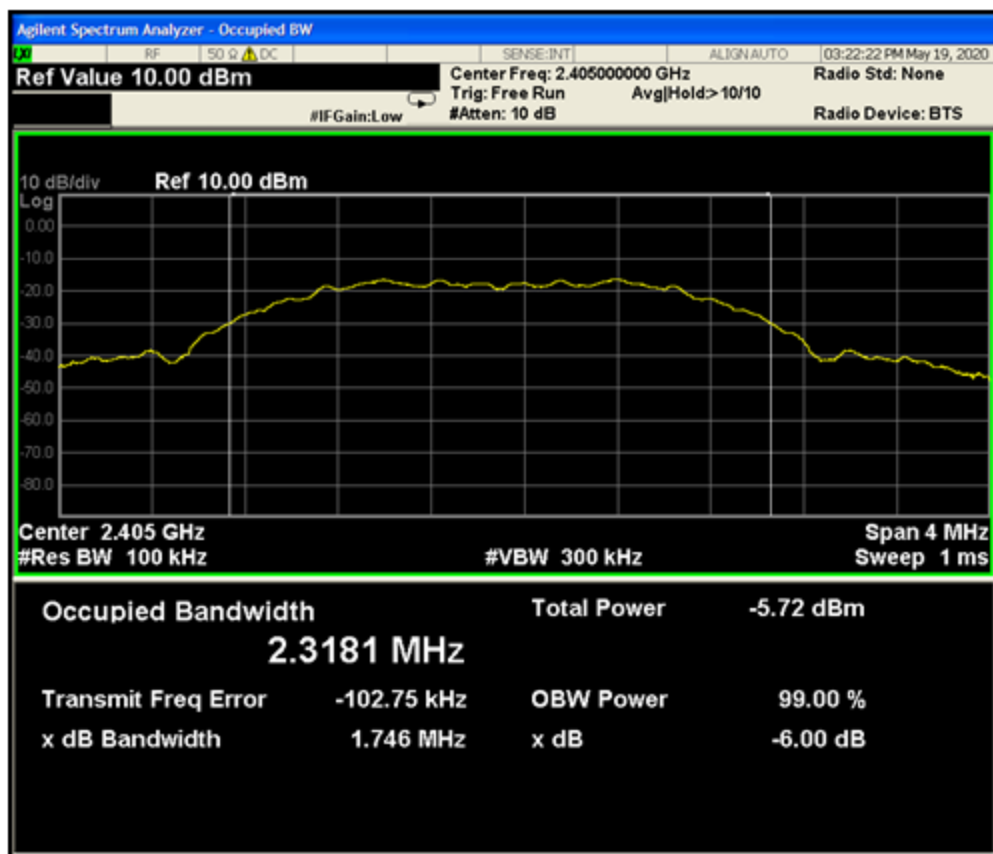
DTS (6dB) Bandwidth

LIMIT

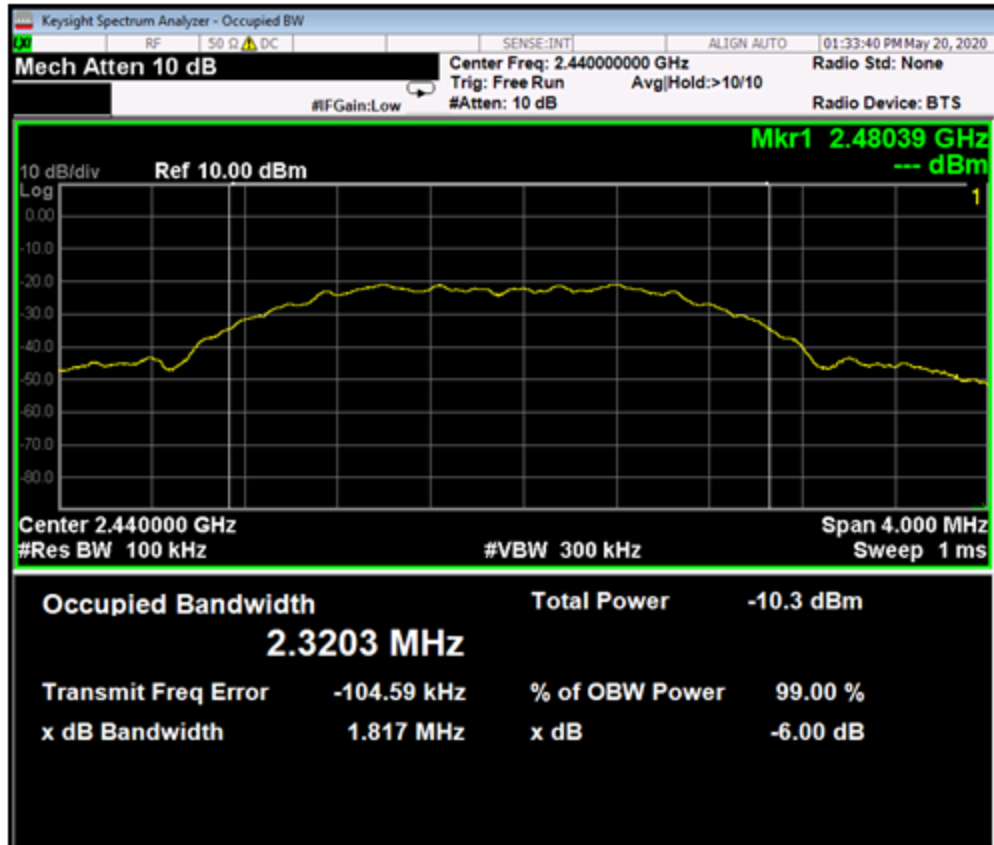
The minimum 6 dB bandwidth shall be at least 500 kHz. [15.247(a) (2)]

MEASUREMENTS / RESULTS

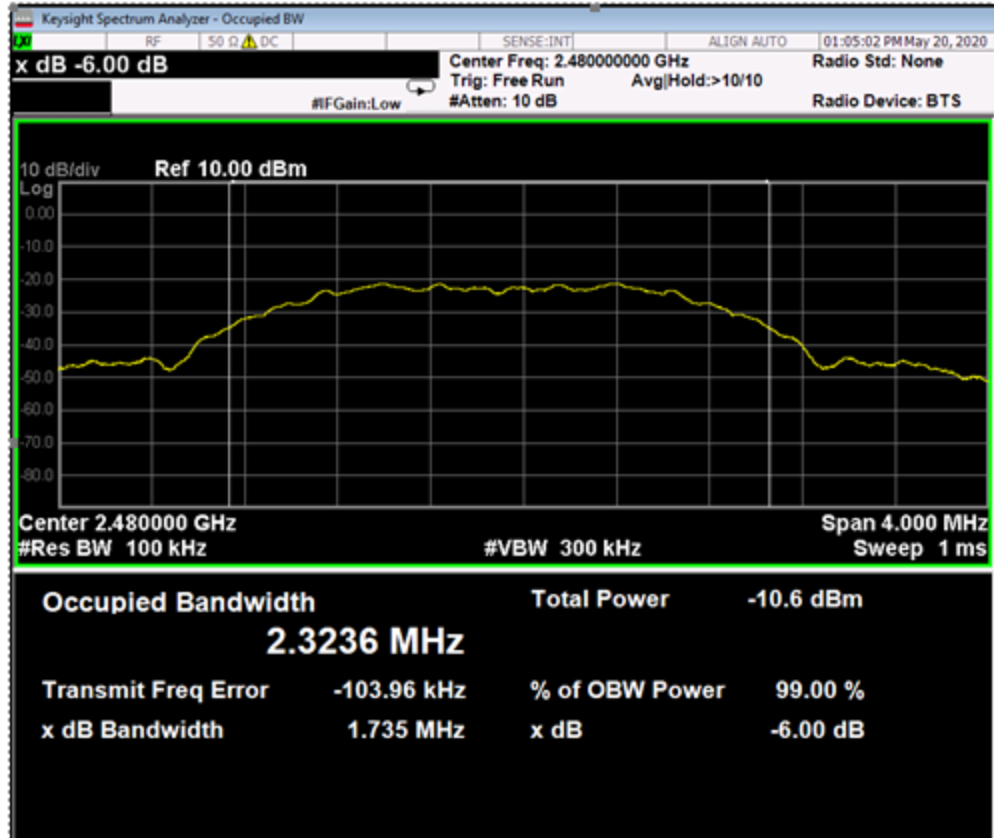
6dB Bandwidth				
Date: 5/19/2020		Company: Osram		Work Order: U0436
Engineer: AV		Operating Voltage/Frequency: Battery		
Temp: 23.5°C		Humidity: 32.8%	Pressure: 1018mBar	
Frequency Range: 2400-2480MHz		Measurement Type: Conducted		
Measurement Method: FCC KDB 558074 D01 15.247 Meas Guidance v05r02				
Notes: Zigbee mode				
Frequency (MHz)	Reading (kHz)	6dB Bandwidth		
		Limit (kHz)	Margin (kHz)	Result (Pass/Fail)
2405.0	1746.0	≥500	1246	Pass
2440.0	1817.0	≥500	1317	Pass
2480.0	1735.0	≥500	1235	Pass
Test Site: CEMI-2		Cable: none		Attenuator: Asset # 2121
Analyzer: 1118473		Copyright Curtis-Straus LLC 2000		



6dB Bandwidth – Low Channel



6dB Bandwidth – Mid Channel



6dB Bandwidth – High Channel

99% Occupied Bandwidth

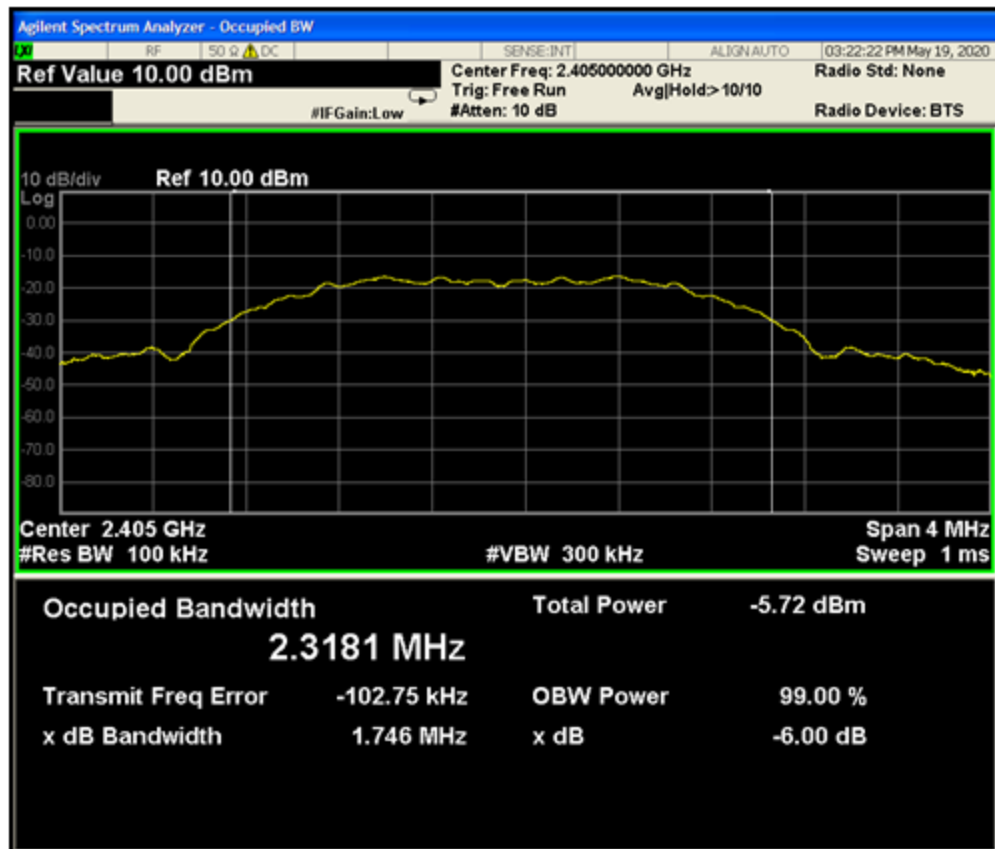
REQUIREMENT

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is its 99% emission bandwidth, as calculated or measured.

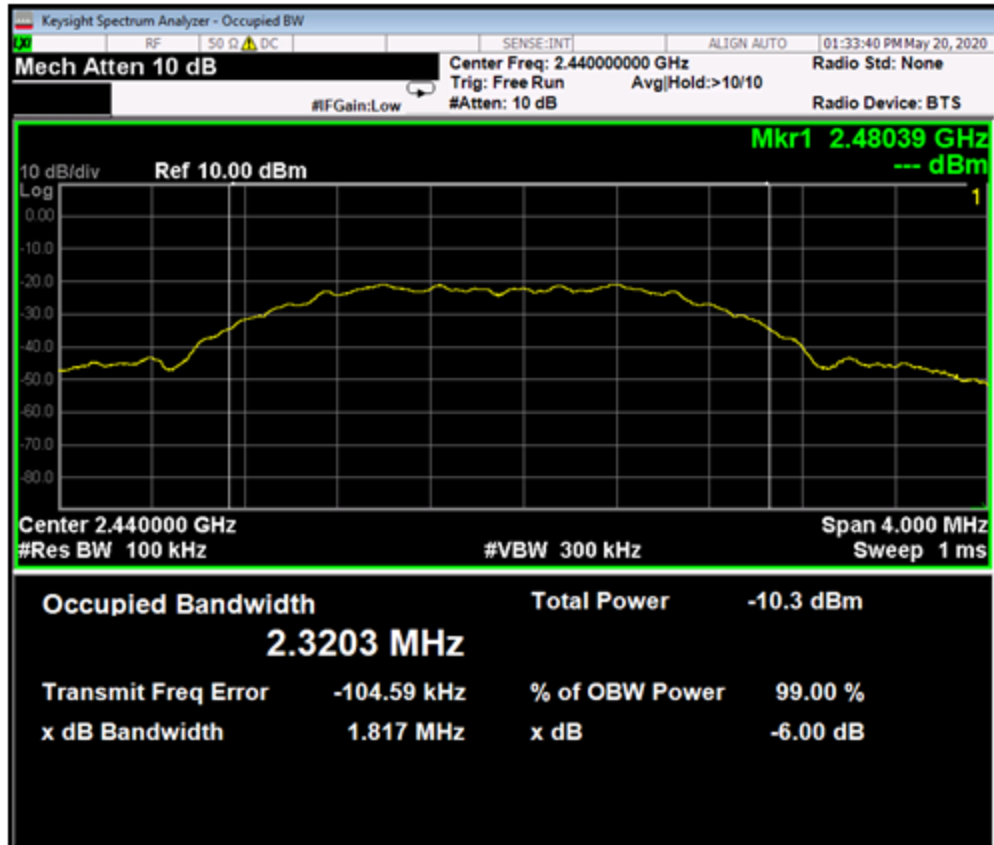
[RSS-GEN Issue 5 Section 6.7]

MEASUREMENTS / RESULTS

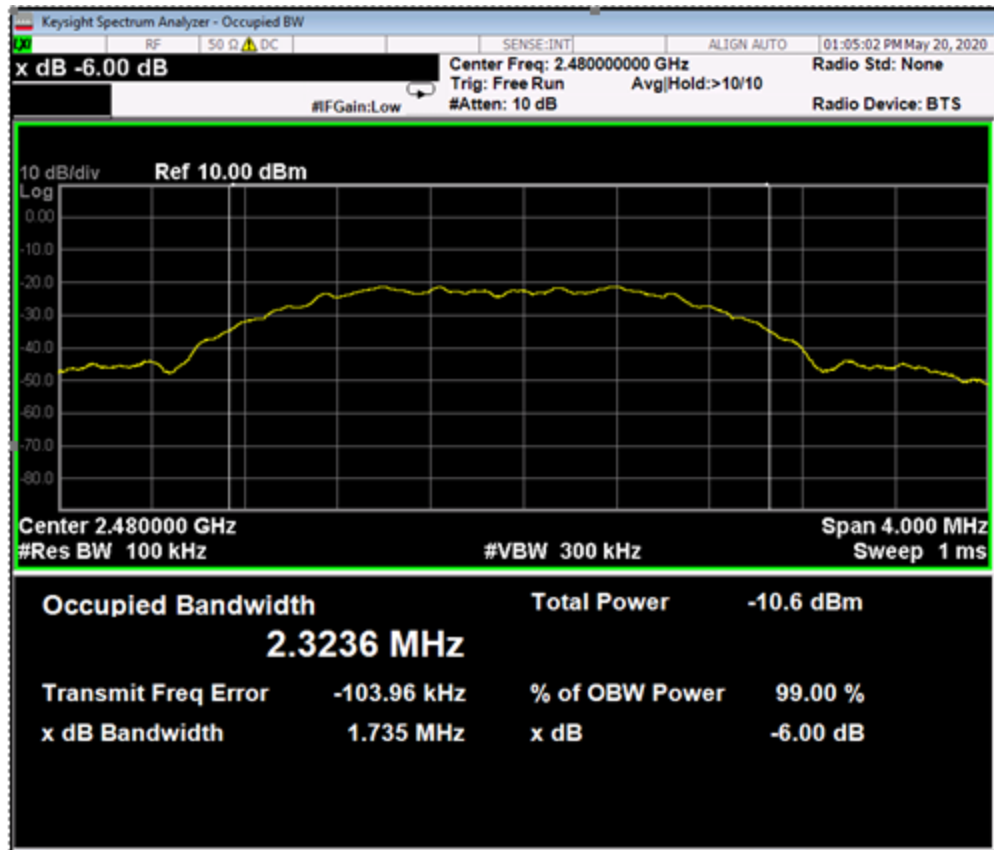
99% Occupied Bandwidth			
Date: 5/19/2020		Company: Osram	
Engineer: AV		Work Order: U0436	
Temp: 23.5°C		Operating Voltage/Frequency: Battery	
Humidity: 32.8%		Pressure: 1018mBar	
Frequency Range: 2400-2480MHz		Measurement Type: Conducted	
Measurement Method: RSS-Gen Issue 5 Section 6.7			
Notes:			
Frequency (MHz)	99% OBW (MHz)		
2405	2.3181		
2440	2.3203		
2480	2.3236		
Test Site: CEMI-2		Cable: none	
Analyzer: 1118473		Attenuator: Asset # 2121	
Copyright Curtis-Straus LLC 2000			



Occupied Bandwidth – Low Channel



Occupied Bandwidth – Middle Channel



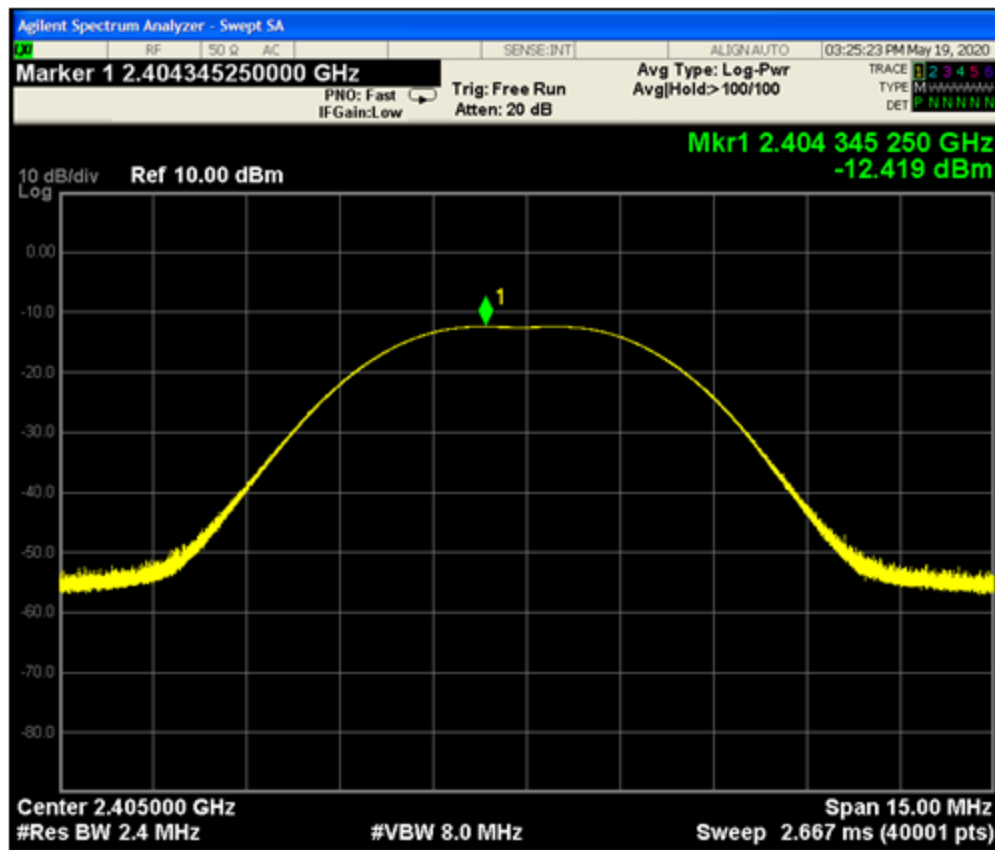
Occupied Bandwidth – High Channel

Peak Output Power**LIMIT**

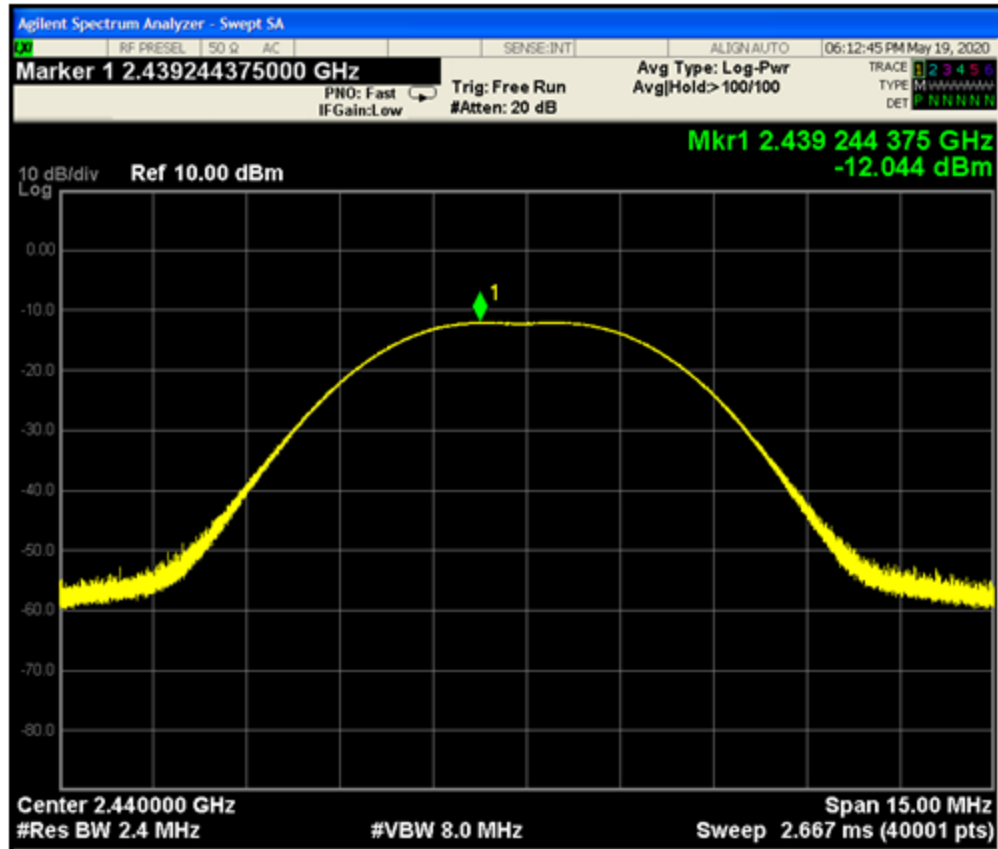
Conducted Output Power: 1 Watt per [15.247(b) (3)]

MEASUREMENTS / RESULTS

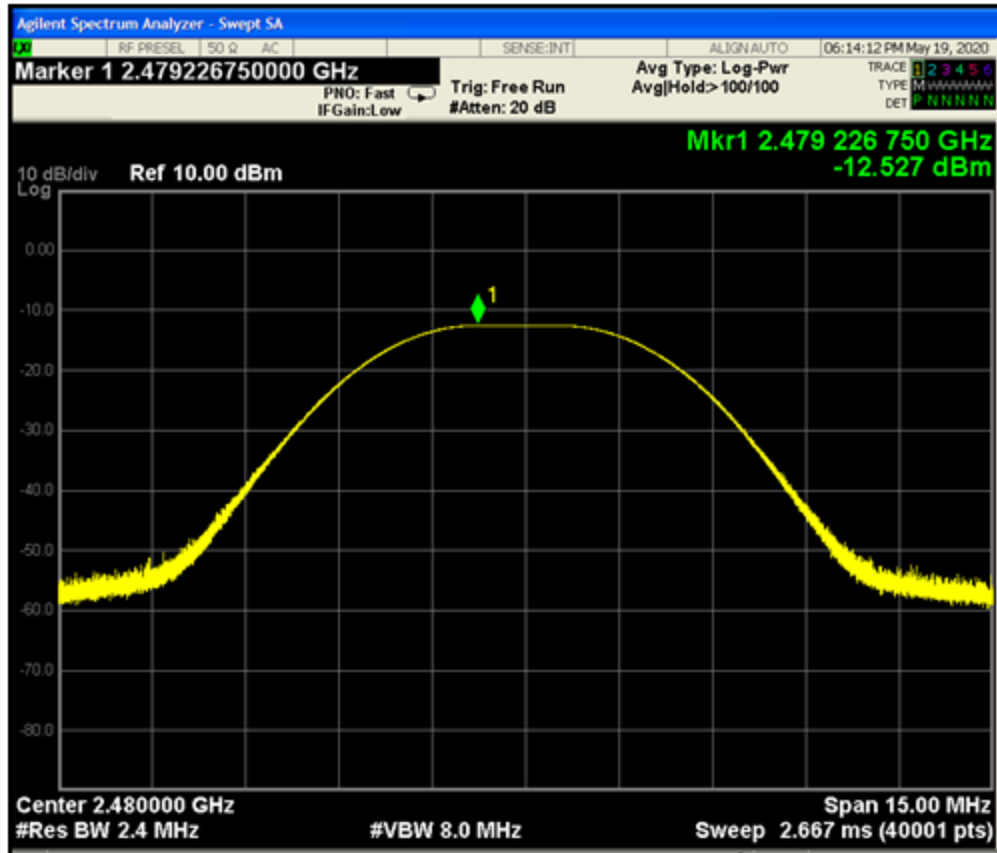
Peak Output Power							
Date: 5/19/2020		Company: Osram			Work Order: U0436		
Engineer: AV					Operating Voltage/Frequency: Battery		
Temp: 23.5°C		Humidity: 32.8%		Pressure: 1018mBar			
Frequency Range: 2400-2480MHz				Measurement Type: Conducted			
				Measurement Method: FCC KDB 558074 D01 15.247 Meas Guidance v05r02			
Notes:							
Frequency	Peak Reading	Cable Loss	Attenuator Loss	Peak Output Power	Limit	Margin	Result
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	(Pass/Fail)
2405	-12.419	0.37	29.50	17.45	30.0	-12.55	Pass
2440	-12.044	0.37	29.50	17.83	30.0	-12.17	Pass
2480	-12.527	0.37	29.50	17.34	30.0	-12.66	Pass
Test Site: CEMI-2		Cable: none		Attenuator: Asset # 2121			
Analyzer: 1168255							
Peak Output Power (dBm)= Peak Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dB)							



Peak Output Power – Low Channel



Peak Output Power – Mid Channel



Peak Output Power – High Channel

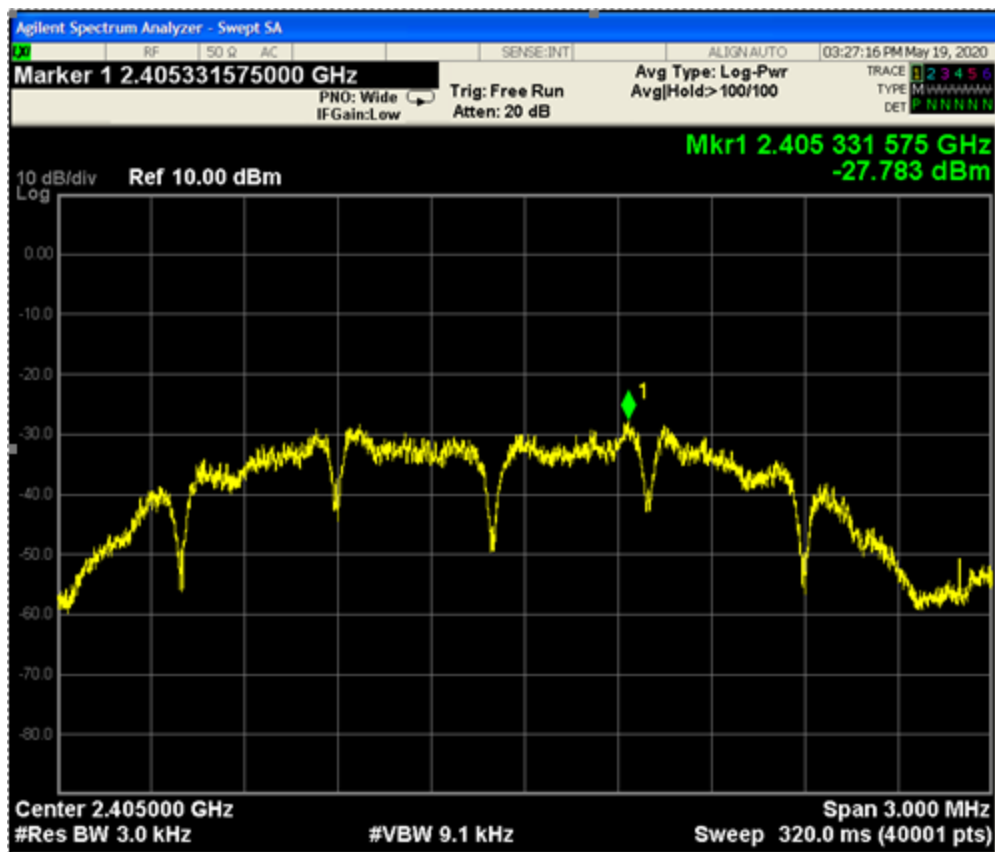
Peak Power Spectral Density

LIMIT

...the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.
[15.247(e)]

MEASUREMENTS / RESULTS

Peak Power Spectral Density							
Date: 5/19/2020		Company: Osram			Work Order: U0436		
Engineer: AV		Operating Voltage/Frequency: Battery					
Temp: 23.5°C		Humidity: 32.8%		Pressure: 1018mBar			
Frequency Range: 2400-2480MHz			Measurement Type: Conducted				
Measurement Method: FCC KDB 558074 D01 15.247 Meas Guidance v05r02							
Notes:							
Frequency	Peak Reading	Cable Loss	Attenuator Loss	Peak PSD	Limit	Margin	Result
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	
2405	-27.783	0.37	29.5	2.09	8.0	-5.91	Pass
2440	-32.284	0.37	29.5	-2.41	8.0	-10.41	Pass
2480	-32.477	0.37	29.5	-2.61	8.0	-10.61	Pass
Test Site: CEMI-2		Cable: none		Attenuator: Asset # 2121			
Analyzer: 1118473							
PSD(dBm) = Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dBm)							



Peak PSD – Low Channel



Peak PSD – Mid Channel



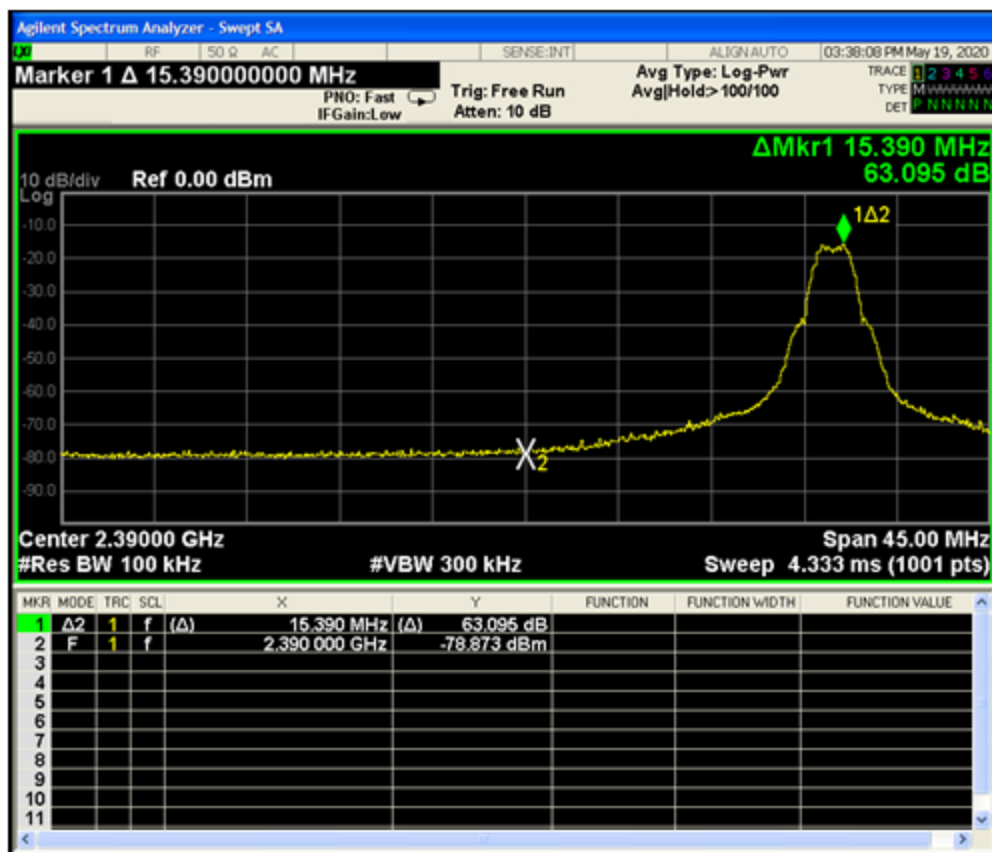
Peak PSD – High Channel

Conducted Bandedges

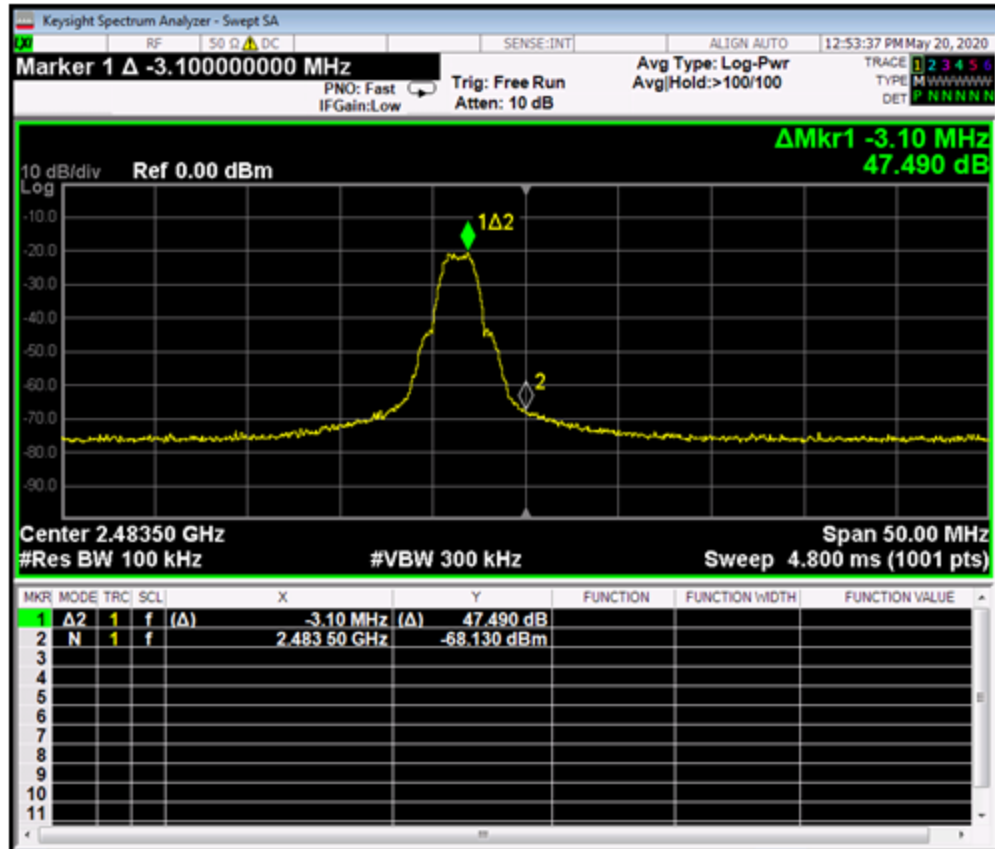
Band edges must be more than 20dB below fundamental.

MEASUREMENTS / RESULTS

Conducted Bandedge						
Date: 5/19/2020		Company: Osram		Work Order: U0436		
Engineer: AV		Operating Voltage/Frequency: Battery				
Temp: 23.5°C		Humidity: 33%		Pressure: 1018mBar		
Frequency Range: 2400-2480MHz		Measurement Type: Conducted				
Measurement Method: FCC KDB 558074 D01 15.247 Meas Guidance v05r02						
Notes:						
Bandage Frequency (GHz) (GHz)		Adjusted Bandedge (dBm)	Adjusted Fundamental (dBm)	Delta to Peak (dB)	Limit	
					(dB)	(Pass/Fail)
Low Bandedge	2.390	-78.88	-15.78	63.10	≥ 20	Pass
High Bandedge	2.483	-68.13	-20.64	47.49	≥ 20	Pass
Test Site: CEMI-2		Cable: none		Attenuator: Asset # 2121		
Analyzer: 1118473		Copyright Curtis-Straus LLC 2000				



Low Band Edge



High Band Edge

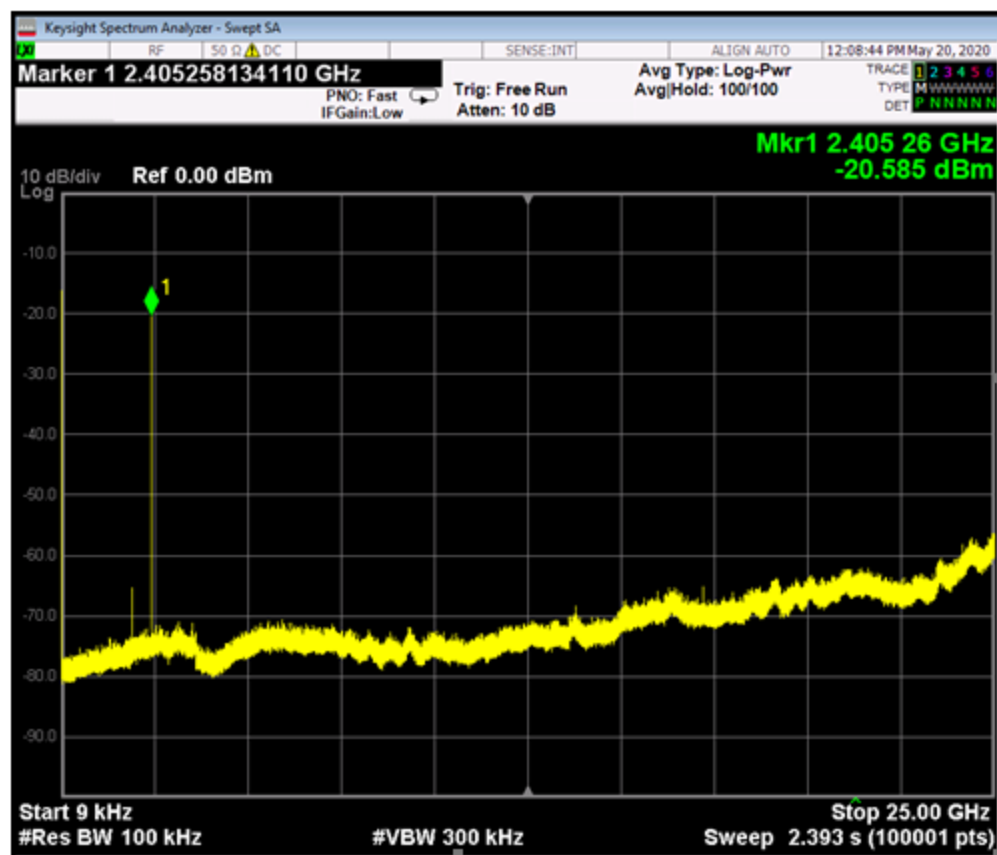
Conducted Spurious Emissions

LIMITS

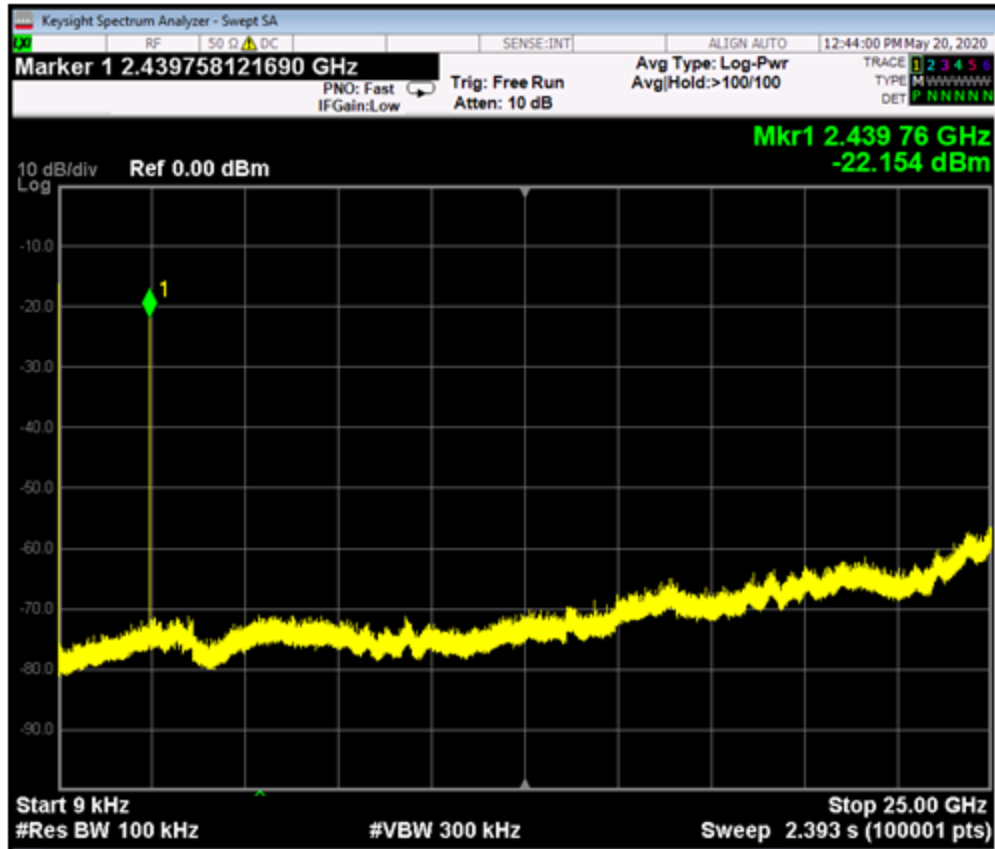
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth that contains the highest level of desired power based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.
[15.247(d)]

Conducted spurious emissions at the antenna port were measured in accordance with ANSI C63.10-2013 Section 11.11.

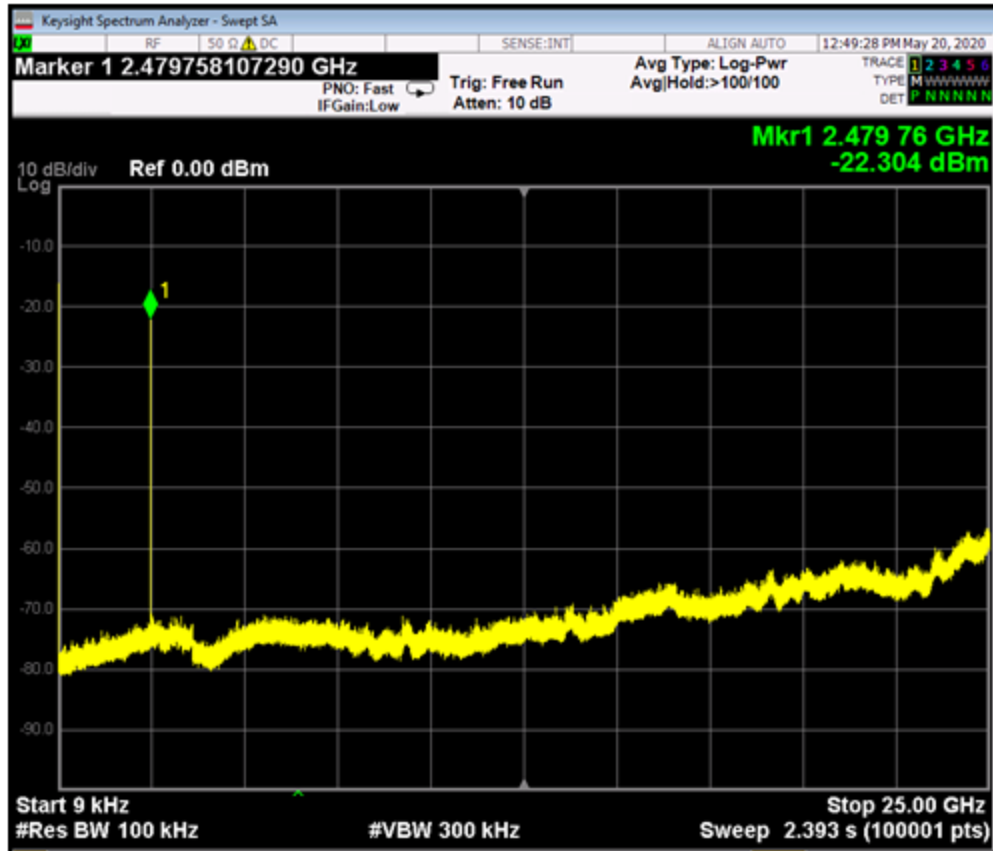
Frequency range up to 25GHz was investigated for all 3 channels (low, middle and high) at the EUT antenna port. No emissions within 20dB of their corresponding fundamental were found.



Low Channel



Mid Channel



High Channel

Test equipment used for all antenna port measurements:

Rev. 5/16/2020							
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental MXE EMI Receiver(1168255)	20Hz-8.4GHz	N9038A	Agilent	MY53290009	1168255	I	9/25/2020
Rental EXA Signal Analyzer(1118473)	9KHz-26.5GHz	N9010A-526;N	AT	MY51170076	1118473	I	7/22/2020
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	5/3/2021
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	11/15/2020
Asset #2655		1235C97	Control Company	181683829	2655	I	10/3/2020
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.							



Radiated Bandedges

LIMITS

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
[15.247(d)]

Radiated Bandedges														
Date: 16-Mar-20										Work Order: U0436				
Engineer: LN										EUT Operating Voltage/Frequency: Battery				
Temp: 23.4°C					Humidity: 30%					Pressure: 991mbar				
Note: Zigbee, 19dB output power										Measurement Distance: 3 m				
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
High Channel														
H	2483.5	47.0	47.0	38.9	32.4	3.1	43.6	43.6	74.0	-30.4	Pass	54.0	-10.4	Pass
V	2483.5	49.6	49.6	38.9	32.4	3.1	46.2	46.2	74.0	-27.8	Pass	54.0	-7.8	Pass
Low Channel														
H	2390.0	43.1	43.1	38.9	32.4	3.1	39.7	39.7	74.0	-34.3	Pass	54.0	-14.3	Pass
V	2390.0	43.5	43.5	38.9	32.4	3.1	40.1	40.1	74.0	-33.9	Pass	54.0	-13.9	Pass
Table Result:				Pass by -7.8 dB					Worst Freq:				2483.5 MHz	
Test Site: CH2				Cable 1: Asset #2455					Cable 2: Asset #2467				Cable 3:2681 ---	
Analyzer: 2093				Preamp: 8449B					Antenna: Blue Horn				Preselector: ---	
CSsoft Radiated Emissions Calculator v 1.017.215														
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														
Copyright Curtis-Straus LLC 2000														

Radiated Spurious Emissions

LIMITS

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
[15.247(d)]

MEASUREMENTS / RESULTS

30MHz – 1GHz

Bureau Veritas Consumer Product Services Inc.	Work Order - U0436
Radiated Emissions Electric Field 3m Distance	EUT Power Input - Battery
Top Peaks Vertical 30-1000MHz	Test Site - CH-2
Notes:	Conditions - 24.1°C; 37.3%RH; 1014mBar
Zigbee Channel 11 at 19dBm Y axis	Test Engineer - BP
	EUT Maximum Frequency - 2480

Data Taken at 11:17:54 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
30.8	30.4	1.6	32	40	-8	PASS	-8	200	315
130.201	29.1	-4.4	24.7	43.5	-18.8	PASS		150	45
947.984	28.5	7.9	36.3	46	-9.7	PASS		150	0
998.642	28.9	8.6	37.6	54	-16.4	PASS		150	180

Bureau Veritas Consumer Product Services Inc.	Work Order - U0436
Radiated Emissions Electric Field 3m Distance	EUT Power Input - Battery
Top Peaks Horizontal 30-1000MHz	Test Site - CH-2
Notes:	Conditions - 24.1°C; 37.3%RH; 1014mBar
Zigbee Channel 11 at 19dBm Y axis	Test Engineer - BP
	EUT Maximum Frequency - 2480

Data Taken at 11:17:54 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.388	30.8	1.8	32.7	40	-7.3	PASS	-7.3	100	225
125.763	29.2	-4.3	24.8	43.5	-18.7	PASS		100	90
199.095	29.9	-5.2	24.6	43.5	-18.9	PASS		100	90
930.111	29.5	7.4	36.9	46	-9.1	PASS		100	180
986.371	29.1	8.3	37.3	54	-16.7	PASS		100	270



Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz

Notes:

Zigbee Channel 18 at 19dBm Y axis

Work Order - U0436

EUT Power Input - Battery

Test Site - CH-2

Conditions - 24.1°C; 37.3%RH; 1014mBar

Test Engineer - BP

EUT Maximum Frequency - 2480

Data Taken at 11:37:34 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
30.024	30.4	2.1	32.5	40	-7.5	PASS	-7.5	100	90
124.357	29.1	-4.4	24.7	43.5	-18.8	PASS		150	225
198.149	29.4	-5.5	23.9	43.5	-19.6	PASS		100	45
949.899	28.4	7.9	36.3	46	-9.7	PASS		200	135
983.146	28.4	8.2	36.6	54	-17.4	PASS		200	0

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz

Notes:

Zigbee Channel 18 at 19dBm Y axis

Work Order - U0436

EUT Power Input - Battery

Test Site - CH-2

Conditions - 24.1°C; 37.3%RH; 1014mBar

Test Engineer - BP

EUT Maximum Frequency - 2480

Data Taken at 11:37:34 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.727	31	1.6	32.7	40	-7.3	PASS	-7.3	100	45
118.876	29.6	-4.8	24.8	43.5	-18.7	PASS		150	45
201.666	29.4	-5.1	24.3	43.5	-19.2	PASS		200	135
957.247	28.2	8	36.2	46	-9.8	PASS		200	180
995.756	28	8.5	36.6	54	-17.4	PASS		100	90

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz

Notes:

Zigbee Channel 26 at 19dBm Y axis

Work Order - U0436

EUT Power Input - Battery

Test Site - CH-2

Conditions - 24.1°C; 37.3%RH; 1014mBar

Test Engineer - BP

EUT Maximum Frequency - 2480

Data Taken at 11:56:57 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
30	31	2.1	33.1	40	-6.9	PASS	-6.9	200	270
123.217	29.5	-4.5	25.1	43.5	-18.4	PASS		150	135
907.583	29	6.9	35.9	46	-10.1	PASS		150	270
989.791	28.6	8.4	36.9	54	-17.1	PASS		150	90

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz

Notes:

Zigbee Channel 26 at 19dBm Y axis

Work Order - U0436

EUT Power Input - Battery

Test Site - CH-2

Conditions - 24.1°C; 37.3%RH; 1014mBar

Test Engineer - BP

EUT Maximum Frequency - 2480

Data Taken at 11:56:58 AM, Monday, May 18, 2020

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.024	30.4	2.1	32.5	40	-7.5	PASS	-7.5	150	180
122.975	30.1	-4.5	25.7	43.5	-17.8	PASS		150	0
934.598	29.1	7.5	36.6	46	-9.4	PASS		150	270
985.304	28.6	8.3	36.9	54	-17.1	PASS		100	225

1GHz - 6GHz

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Notes:
Zigbee Channel 11 (2405MHz)

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 11:05:47 AM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
1005.3	45.8	35.8	-6.6	39.2	74	-34.8	PASS		29.2	54	-24.8	PASS		225	283
2050.7	42.4	34.7	2.4	44.8	74	-29.2	PASS		37.1	54	-16.9	PASS		187	237
3198.6	43.7	34.7	4.5	48.2	74	-25.8	PASS		39.2	54	-14.8	PASS		125	22
4654.8	42.6	33.5	6.6	49.2	74	-24.8	PASS		40	54	-14	PASS		107	179
5328.8	40.9	32.7	8.1	49	74	-25	PASS		40.8	54	-13.2	PASS		275	55
5966.1	40.8	33.1	9.7	50.6	74	-23.4	PASS	-23.4	42.8	54	-11.2	PASS	-11.2	284	63

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Notes:
Zigbee Channel 11 (2405MHz)

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 11:12:05 AM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5874.9	41.6	32.9	9.5	51.1	74	-22.9	PASS	-22.9	42.4	54	-11.6	PASS	-11.6	182	262

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Notes:
Zigbee Channel 18 2440MHz

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 11:29:59 AM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5990.5	42.4	33.2	9.8	52.2	74	-21.8	PASS	-21.8	43	54	-11	PASS	-11	276	7

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Notes:
Zigbee Channel 18 2440MHz

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 11:40:11 AM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5873.9	41.5	32.9	9.5	51	74	-23	PASS	-23	42.4	54	-11.6	PASS	-11.6	112	78



Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Notes:
Zigbee Channel 18 2440MHz

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 11:53:17 AM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5879.2	41.3	32.9	9.5	50.8	74	-23.2	PASS	-23.2	42.4	54	-11.6	PASS	-11.6	291	175

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Notes:
Zigbee Channel 18 2440MHz

Work Order - Verification
EUT Power Input - DC
Test Site - CH 2,
Conditions - 23.4°C; 29.7%RH; 1030mBar
Test Engineer - LN
0

Data Taken at 12:03:09 PM, Monday, March 16, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5919.4	42.6	33	9.6	52.3	74	-21.7	PASS	-21.7	42.6	54	-11.4	PASS	-11.4	100	243

6GHz-18GHz

Bureau Veritas Consumer Product Services Inc.	Work Order - U0436
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.0 VDC
6-18GHz Vertical Data	Test Site - CH 2
Notes:	Conditions - 23.7°C; 31.2%RH;1014 mBar
ZigBee	Test Engineer - LN
Channel 11 (2405 MHz)	EUT Maximum Frequency - 2480 MHz

Data Taken at 10:16:16 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
10534.7	43.7	34.9	12.9	56.7	83.5	-26.8	PASS		47.8	63.5	-15.7	PASS		191	191
12911.4	46.4	34.5	17.6	64	83.5	-19.5	PASS		52.1	63.5	-11.4	PASS		200	262
14788	41.5	34.1	20.7	62.3	83.5	-21.2	PASS		54.8	63.5	-8.7	PASS		200	265
16720.9	41.8	33.4	24.4	66.2	83.5	-17.3	PASS		57.8	63.5	-5.7	PASS		200	209
17411.3	42.2	32	24.6	66.8	83.5	-16.7	PASS		56.6	63.5	-6.9	PASS		126	161
17853.2	44.2	33.6	25.4	69.6	83.5	-13.9	PASS	-13.9	59	63.5	-4.5	PASS	-4.5	200	222

Bureau Veritas Consumer Product Services Inc.	Work Order - U0436
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.0 VDC
6-18GHz Horizontal Data	Test Site - CH 2
Notes:	Conditions - 23.7°C; 31.2%RH;1014 mBar
ZigBee	Test Engineer - LN
Channel 11 (2405 MHz)	EUT Maximum Frequency - 2480 MHz

Data Taken at 10:35:34 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
7213	56.2	47.9	7.2	63.4	83.5	-20.1	PASS		55.1	63.5	-8.4	PASS		160	0
8582.1	43.6	33.8	10.1	53.8	83.5	-29.7	PASS		44	63.5	-19.5	PASS		175	223
10184.2	45.6	36.6	12.4	58	83.5	-25.5	PASS		49	63.5	-14.5	PASS		175	106
12650	43	35.1	17.4	60.4	83.5	-23.1	PASS		52.5	63.5	-11	PASS		183	139
17851.3	42.8	33.5	25.4	68.2	83.5	-15.3	PASS	-15.3	58.9	63.5	-4.6	PASS	-4.6	141	91

Bureau Veritas Consumer Product Services Inc.	Work Order - U0436
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.0 VDC
6-18GHz Vertical Data	Test Site - CH 2
Notes:	Conditions - 23.7°C; 31.2%RH;1014 mBar
ZigBee	Test Engineer - LN
Channel 18 (2440 MHz)	EUT Maximum Frequency - 2480 MHz

Data Taken at 10:59:15 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
12990	44.4	34.8	17.7	62.1	83.5	-21.4	PASS		52.4	63.5	-11.1	PASS		100	0
13569.1	42.1	34.6	18.6	60.7	83.5	-22.8	PASS		53.2	63.5	-10.3	PASS		103	77
15878	44.2	34.1	21.7	65.9	83.5	-17.6	PASS		55.8	63.5	-7.7	PASS		100	13
17847.9	42.2	33.4	25.4	67.6	83.5	-15.9	PASS	-15.9	58.8	63.5	-4.7	PASS	-4.7	100	0

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Notes:
ZigBee
Channel 18 (2440 MHz)

Work Order - U0436
EUT Power Input - 3.0 VDC
Test Site - CH 2
Conditions - 23.7°C; 31.2%RH;1014 mBar
Test Engineer - LN
EUT Maximum Frequency - 2480 MHz

Data Taken at 11:18:48 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
12965.9	41.6	34.3	17.6	59.2	83.5	-24.3	PASS		51.9	63.5	-11.6	PASS		135	95
13506.2	44.2	34	18.4	62.6	83.5	-20.9	PASS		52.5	63.5	-11	PASS		100	208
17288.3	43.8	33	24.4	68.2	83.5	-15.3	PASS		57.4	63.5	-6.1	PASS		186	301
17856.1	43.6	33.6	25.4	69.1	83.5	-14.4	PASS	-14.4	59.1	63.5	-4.4	PASS	-4.4	150	237

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Notes:
ZigBee
Channel 26 (2480 MHz)

Work Order - U0436
EUT Power Input - 3.0 VDC
Test Site - CH 2
Conditions - 23.7°C; 31.2%RH;1014 mBar
Test Engineer - LN
EUT Maximum Frequency - 2480 MHz

Data Taken at 11:54:15 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
11438.4	44.8	35.1	14.9	59.7	83.5	-23.8	PASS		50	63.5	-13.5	PASS		100	42
12799.6	43.2	34.5	17.4	60.6	83.5	-22.9	PASS		51.9	63.5	-11.6	PASS		100	40
17904.1	40.3	32.6	25.7	66	83.5	-17.5	PASS	-17.5	58.3	63.5	-5.2	PASS	-5.2	110	119

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Notes:
ZigBee
Channel 26 (2480 MHz)

Work Order - U0436
EUT Power Input - 3.0 VDC
Test Site - CH 2
Conditions - 23.7°C; 31.2%RH;1014 mBar
Test Engineer - LN
EUT Maximum Frequency - 2480 MHz

Data Taken at 11:54:15 AM, Tuesday, March 17, 2020

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
12880.8	43	34.7	17.6	60.6	83.5	-22.9	PASS		52.3	63.5	-11.2	PASS		147	181
17400.5	41.1	32.3	24.6	65.7	83.5	-17.8	PASS		56.9	63.5	-6.6	PASS		116	290
17826	42.3	33.1	25.4	67.7	83.5	-15.8	PASS	-15.8	58.5	63.5	-5	PASS	-5	138	239

No emissions found in the 18-25GHz frequency range.

Rev. 5/16/2020

Spectrum Analyzers / Receivers /Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
2093 MXE EMI Receiver		20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	12/31/2020
Radiated Emissions Sites		FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due
EMI Chamber 2		719150	2762A-7	A-0015	30-1000MHz	1686	I	12/7/2020
Preamps /Couplers Attenuators / Filters		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
8449B HF Preamp		1-18GHz	8449B	Agilent	1149055		II	11/24/2020
8447F Rental PA		9KHz-1.3GHz	84477F	HP	3113A05395		II	6/18/2020
2116 BRF		0.009-18000MHz	BRM50702	Micro-Tronics	G226	2116	II	11/11/2020
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red-Brown Bilog		30-2000MHz	JB1	Sunol	A0032406	1218	I	3/11/2021
Blue Horn		1-18Ghz	3117	ETS	157647	1861	I	3/9/2021
Meteorological Meters/Chambers			MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)			BA928	Oregon Scientific	C3166-1	831	I	11/15/2020
Asset #2656			1235C97	Control Company	181683818	2656	I	10/3/2020
Cables		Range		Mfr			Cat	Calibration Due
Asset #2455		9KHz-18GHz		MegaPhase			II	11/2/2020
Asset #2467		9KHz-18GHz		MegaPhase			II	11/2/2020
Asset #2582		9KHz-18GHz		Pasternack			II	7/10/2020

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Test Equipment Used



AC Line Conducted Emissions LIMITS

Frequency of emission (MHz)	Quasi-peak limit (dBμV)	Average limit (dBμV)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

MEASUREMENTS / RESULTS

Bureau Veritas Consumer Product Services Inc.
Conducted Emissions per CISPR 16-2-1
Peak Detector Data
Notes:
Line
Power Supply

Work Order # - U0463
EUT Power Input - 120VAC 60Hz
Test Site - CEMI-2
Conditions: - 23.5°C; 32.7%RH; 1006mBar
Test Engineer - BPZ
0

Data Taken at 10:57:19 AM, Tuesday, May 19, 2020

Frequency (MHz)	Raw Pk Reading (dBμV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBμV)	QP Lim: Mains_FCC&CISPR_QP_Class_A (dBμV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)	Av Lim: Mains_FCC&CISPR_Avg_Class_A (dBμV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.15	33.1	19.4	52.5	79	-26.5	PASS	-26.5	66	-13.5	PASS	-13.5
0.19	31.4	19.4	50.8	79	-28.2	PASS		66	-15.2	PASS	
0.254	28.9	19.4	48.3	79	-30.7	PASS		66	-17.7	PASS	
0.296	28.2	19.4	47.7	79	-31.3	PASS		66	-18.3	PASS	
0.325	25.8	19.4	45.2	79	-33.8	PASS		66	-20.8	PASS	
0.506	19.1	19.4	38.6	73	-34.4	PASS		60	-21.4	PASS	

Bureau Veritas Consumer Product Services Inc.
Conducted Emissions per CISPR 16-2-1
Peak Detector Data
Notes:
Neutral
Power Supply

Work Order # - U0463
EUT Power Input - 120VAC 60Hz
Test Site - CEMI-2
Conditions: - 23.5°C; 32.7%RH; 1006mBar
Test Engineer - BPZ
0

Data Taken at 11:03:11 AM, Tuesday, May 19, 2020

Frequency (MHz)	Raw Pk Reading (dBμV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBμV)	QP Lim: Mains_FCC&CISPR_QP_Class_A (dBμV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)	Av Lim: Mains_FCC&CISPR_Avg_Class_A (dBμV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.159	33.3	19.4	52.7	79	-26.3	PASS	-26.3	66	-13.3	PASS	-13.3
0.207	31.9	19.4	51.4	79	-27.6	PASS		66	-14.6	PASS	
0.251	29.3	19.4	48.7	79	-30.3	PASS		66	-17.3	PASS	
0.292	28.5	19.4	47.9	79	-31.1	PASS		66	-18.1	PASS	
0.527	20	19.4	39.5	73	-33.5	PASS		60	-20.5	PASS	
0.701	20.2	19.5	39.6	73	-33.4	PASS		60	-20.4	PASS	

Bureau Veritas Consumer Product Services Inc.
Conducted Emissions per CISPR 16-2-1
Peak Detector Data
Notes:
Line
Zigbee Channel 18

Work Order # - U0463
EUT Power Input - 120VAC 60Hz
Test Site - CEMI-2
Conditions: - 23.5°C; 32.7%RH; 1006mBar
Test Engineer - BPZ
0

Data Taken at 11:38:58 AM, Tuesday, May 19, 2020

Frequency (MHz)	Raw Pk Reading (dBµV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBµV)	QP Lim: Mains_FCC&CISPR_QP_Class_A (dBµV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)	Av Lim: Mains_FCC&CISPR_Avg_Class_A (dBµV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.156	33.1	19.4	52.6	79	-26.4	PASS	-26.4	66	-13.4	PASS	-13.4
0.273	28.6	19.4	48	79	-31	PASS		66	-18	PASS	
0.307	24.8	19.4	44.2	79	-34.8	PASS		66	-21.8	PASS	
0.353	24.8	19.4	44.2	79	-34.8	PASS		66	-21.8	PASS	
0.567	18.8	19.4	38.3	73	-34.7	PASS		60	-21.7	PASS	
0.724	18.8	19.5	38.3	73	-34.7	PASS		60	-21.7	PASS	

Bureau Veritas Consumer Product Services Inc. Conducted Emissions per CISPR 16-2-1 Peak Detector Data Notes: Neutral Zigbee Channel 18					Work Order # - U0463 EUT Power Input - 120VAC 60Hz Test Site - CEMI-2 Conditions: - 23.5°C; 32.7%RH; 1006mBar Test Engineer - BPZ 0						
Data Taken at 11:45:54 AM, Tuesday, May 19, 2020											
Frequency (MHz)	Raw Pk Reading (dBµV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBµV)	QP Lim: Mains_FCC&CISPR_QP_Class_A (dBµV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)	Av Lim: Mains_FCC&CISPR_Avg_Class_A (dBµV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.151	33.5	19.4	53	79	-26	PASS	-26	66	-13	PASS	-13
0.188	30	19.4	49.5	79	-29.5	PASS		66	-16.5	PASS	
0.25	29	19.4	48.4	79	-30.6	PASS		66	-17.6	PASS	
0.276	28.6	19.4	48.1	79	-30.9	PASS		66	-17.9	PASS	
0.302	26.7	19.4	46.1	79	-32.9	PASS		66	-19.9	PASS	
0.533	20.2	19.4	39.7	73	-33.3	PASS		60	-20.3	PASS	

Rev. 5/16/2020

Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental MXE EMI Receiver(1168255)	20Hz-8.4GHz	N9038A	Agilent	MY53290009	1168255	I	9/25/2020

LISNs/Measurement Probes	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
LISN Asset 2092	9KHz-30MHz	NNLK 8121	Schwarzbeck	NNLK 8121-662	2092	I	9/4/2020

Conducted Test Sites (Mains / Telco)	FCC Code	VCCI Code	Cat	Calibration Due
CEMI 2	719150	A-0015	III	NA

Meteorological Meters/Chambers	MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	11/15/2020
Asset #2655	1235C97	Control Company	181683829	2655	I	10/3/2020

Cables	Range	Mfr	Cat	Calibration Due
CEMI-13	9kHz - 2GHz	C-S	II	4/8/2021

Attenuators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
20dB20W Attenuator(A#2499)	9KHz-4GHz	766-20	Narda	8710	2499	II	12/5/2020

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Test Equipment Used



Bureau Veritas Consumer Products Services Inc.
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



Measurement Uncertainty

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radiated Emissions (30-1000MHz)	5.6dB	N/A
NIST	4.6dB	5.2dB (Ucisprr)
CISPR		
Radiated Emissions (1-26.5GHz)	4.6dB	N/A
Radiated Emissions (above 26.5GHz)	4.9dB	N/A
Magnetic Radiated Emissions	5.6dB	N/A
Conducted Emissions		
NIST	3.9dB	N/A
CISPR	3.6dB	3.6dB (Ucisprr)
Telco Conducted Emissions (Current)	2.9dB	N/A
Telco Conducted Emissions (Voltage)	4.4dB	N/A
Electrostatic Discharge	11.5%	N/A
Radiated RF Immunity (Uniform Field)	1.6dB	N/A
Electrical Fast Transients	23.1%	N/A
Surge	23.1%	N/A
Conducted RF Immunity	3dB	N/A
Magnetic Immunity	12.8%	N/A
Dips and Interrupts	2.3V	N/A
Harmonics	3.5%	N/A
Flicker	3.5%	N/A
Radio frequency (@ 2.4GHz)	3.23×10^{-8}	1×10^{-7}
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation:		
• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		

Conditions of Testing

[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("Client"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "Conditions"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "BUREAU VERITAS," "BUREAU VERITAS CONSUMER PRODUCTS SERVICES," "BVCPS," "MTL," "ACTS," "MTL-ACTS" and CURTIS-STRAUS (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only where such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or



different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.

13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.

14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts.

Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

The complete list of the Approved Subcontractors Bureau Veritas Consumer Products Services Inc. may use to delegate the performance of work can be provided upon request.