Test Report

Report No	ER3437-1
Client	OSRAM SYLVANIA INC Sivakumar Thangavelu
Address	200 Ballardvale Street Wilmington, MA 01887
Phone	978-750-3865
Items tested	iQ ZigBee RF Controller
FCC ID	DZO-OSREFRMG13W
IC ID	23566 -OSREFRMG13W
FRN	0021513163
Equipment Type	Digital Transmission System
Equipment Code	DTS
FCC/IC Rule Parts	47 CFR 15.247, RSS-247 Issue 2
Test Dates	November 17th and December 1st, 2017
Results	As detailed within this report
Prepared by	Zachary Johnson – EMC Engineer
Authorized by	Chris Reynolds – EMC Supervisor
Issue Date	2/16/2018
Conditions of Issue	This Test Report is issued subject to the conditions stated in the '*Conditions of Testing*' section on page 32 of this report.

Contents

Form Final Report REV 12-07-15

Summary

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 15.247 and RSS-247. The product is the iQ ZigBee RF Controller. It is a transmitter that operates in the range 2405-2480MHz.

We found that the product met the above requirements without modifications. The test sample was received in good condition on November 17th, 2017.

Test Methodology

All testing was performed according to the following rules/procedures/documents;
CFR 47 Part 15.247, RSS-247 Issue 2, RSS-Gen Issue 4, FCC KDB 558074 D01 DTS Measurement Guidance v04 and ANSI C63.10-2013.
Radiated emissions were maximized by rotating the device around three orthogonal axes as well as varying the test antenna's height and polarity. AC line conducted emissions testing was performed with a 50Ω/50µH LISN. The EUT operating voltage was 120VAC at 60Hz.
RF measurements were performed at the antenna port.

The environmental conditions were as shown below.

Date	Temperature	Humidity
November 17, 2017	25°C	21%RH
December 1, 2017	22°C	29%RH

The following bandwidths were used during radiated spurious and line conducted emissions.

Frequency	RBW	VBW
0.15-30MHz	9kHz	30kHz
30-1000MHz	120kHz	1MHz
1-25GHz	1MHz	3MHz

Product Tested - Configuration Documentation

EUT Configuration			
Work Order:	R3437		
Company:	OSRAM SYLVANIA INC		
Company Address:	200 Ballardvale Street		
	Wilmington, MA, 01887		
Contact:	Sivakumar Thangavelu (3)		
	MN	**PN**	**SN**
EUT:	ZigBee 2.5 GHz RF Module	--	Sample 1
EUT Description:	ZigBee 2.5 GHz RF Module for Lighting		
EUT Max Frequency:	2488 MHz		

Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
DC/Battery	Power DC	1	1	Power DC	No	No	0.05	in	yes	
I/O	3 Wire	1	1	Twisted Pair	No	No	0.05	in	yes	

Software Operating Mode Description:

Constantly transmitting. Channels tested 11, 18, 26 (2405, 2440, and 2480MHz respectively)

Statement of Conformity

The iQ ZigBee RF Controller has been found to conform to the following parts of 47 CFR and RSS 247 as detailed below:

RSS-GEN	RSP-100	RSS 247	Part 15	Comments
6.3			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.
	4		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3, 6.1			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
8.1			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.
8.3			15.203	The antenna for this device is integrated hardwired to the PCB with a gain of -0.5dBi.
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
8.8			15.207	EUT meets the AC Line conducted emissions requirements of this section.
			15.247	The unit complies with the requirements of 15.247
		RSS 247		The unit complies with the requirements of RSS-247
6.6				Occupied Bandwidth measurements were made.

Modifications Required for Compliance

No modifications required for Compliance

Test Results

Bandwidth

LIMIT

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

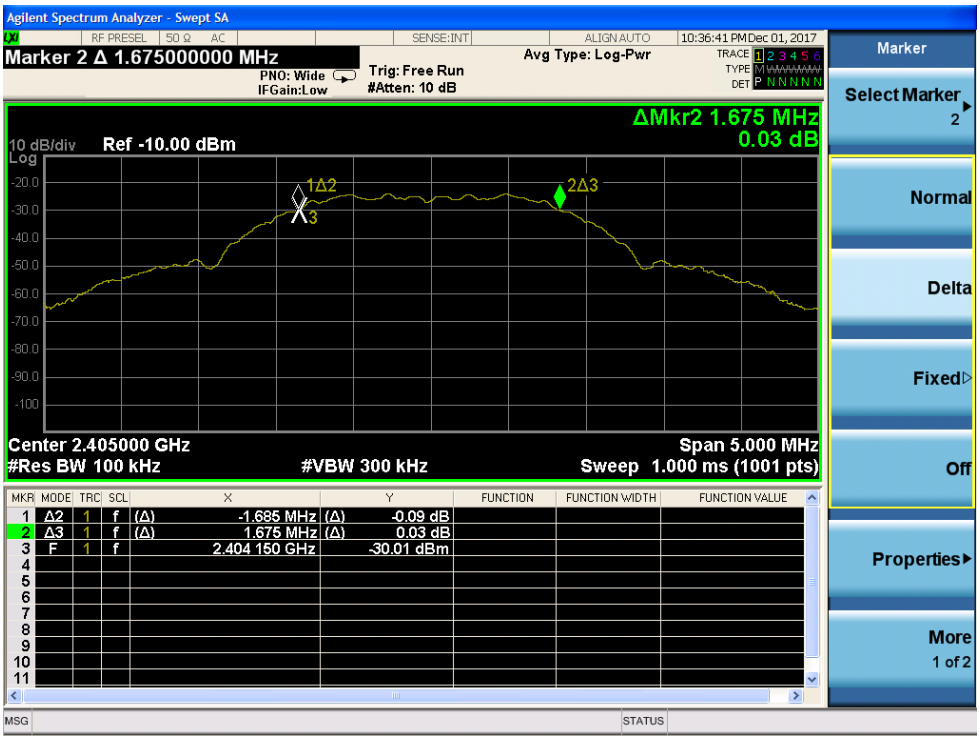
MEASUREMENTS / RESULTS

6dB Bandwidth					
Date: 12/1/2017	**Company:** OSRAM SYLVANIA INC			**Work Order:** R3437	
Engineer: Arik Zwirmer	**EUT:** ZigBee 2.5 GHz RF Module			**Operating Voltage/Frequency:** 120V / 60Hz	
Temp: 22°C	**Humidity:** 29%	**Pressure:** 1010mBar			
Frequency Range: 2402-2480 MHz	**Measurement Type:** Conducted				
	Measurement Method: FCC KDB 558074 D01 DTS Meas Guidance V04				
Notes:					

Frequency (MHz)	Reading (kHz)	6dB Bandwidth Limit (kHz)	Margin (kHz)	Result (Pass/Fail)
2405	1675	≥500	1175	Pass
2440	1660	≥500	1160	Pass
2480	1635	≥500	1135	Pass

Test Site: CEMI 6 **Cable:** None **Attenuator:** 2121 30dB Pad
Analyzer: 2093 SA

PLOTS



DTS Bandwidth, Low Channel

DTS Bandwidth, Mid Channel

DTS Bandwidth, High Channel

Rev. 2/12/2018

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017
Preamps /Couplers Attenuators / Filters	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

Peak Power

LIMIT

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

MEASUREMENTS / RESULTS

Peak Output Power

Date: 12/1/2017 **Company:** OSRAM SYLVANIA INC **Work Order:** R3437
Engineer: Arik Zwirmer **EUT:** ZigBee 2.5 GHz RF Module **Operating Voltage/Frequency:** 120V / 60Hz
Temp: 22°C **Humidity:** 29% **Pressure:** 1010mBar
Frequency Range: 2405-2480 MHz **Measurement Type:** Conducted

Notes:

Frequency (MHz)	Adjusted Peak Reading (dBm)	Correction Factor Added to Spectrum Analyzer (Attenuator + Dongle) (dB)	---	---	Limit (dBm)	Margin (dB)	Result (Pass/Fail)
2405	9.744	30.00	---	---	30.0	-20.26	Pass
2440	9.435	30.00	---	---	30.0	-20.57	Pass
2480	8.664	30.00	---	---	30.0	-21.34	Pass

Test Site: CEMI 6 **Cable:** None **Attenuator:** 2121 30dB Pad
Analyzer: 2093 SA
Peak Output Power (dBm)= Peak Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dB)

PLOTS

Peak Output Power, Low Channel

Peak Output Power, Mid Channel

Peak Output Power, High Channel

Rev. 2/12/2018

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

Radiated Spurious Emissions

LIMITS

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

Testing has been performed on 3 channels (low, middle and high) when a harmonic of the transmitter was seen, otherwise center channel was tested. Worst case results are shown in the following data tables.

MEASUREMENTS / RESULTS

Curtis Straus - a Bureau Veritas Company					Work Order - R3437				
Radiated Emissions Electric Field 3m Distance					EUT Power Input - 3V Battery Powered				
Top Peaks Vertical 30-1000MHz					Test Site - CH-2				
Operator: ZJ					Conditions - 22.2°C; 27%RH; 996mBar				
Center Channel									
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Lim1: FCC_pt15_109_Class_B	Lim1 Margin	Lim1 Test Results	Worst Margin Lim1	Antenna Height	Turntable Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
30	31.8	-7.7	24.1	40	-15.9	PASS	-15.9	100	225
120.137	33.6	-14.9	18.7	43.5	-24.8	PASS		150	225
196.355	35.3	-16.5	18.8	43.5	-24.7	PASS		200	0
466.33	35.7	-10	25.7	46	-20.3	PASS		200	135
825.473	33.4	-3.9	29.4	46	-16.6	PASS		100	135
983.413	31.8	-2.1	29.7	54	-24.3	PASS		200	315

Curtis Straus - a Bureau Veritas Company					Work Order - R3437				
Radiated Emissions Electric Field 3m Distance					EUT Power Input - 3V Battery Powered				
Top Peaks Horizontal 30-1000MHz					Test Site - CH-2				
Operator: ZJ					Conditions - 22.2°C; 27%RH; 996mBar				
Center Channel									

Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Lim1: FCC_pt15_109_Class_B	Lim1 Margin	Lim1 Test Results	Worst Margin Lim1	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
30	31.4	-7.7	23.7	40	-16.3	PASS		250	135
122.756	35.2	-14.8	20.4	43.5	-23.1	PASS		250	270
184.06	37.5	-17.5	20	43.5	-23.5	PASS		150	180
466.379	37.2	-10	27.2	46	-18.8	PASS		100	45
910.784	32.5	-2.7	29.8	46	-16.2	PASS	-16.2	100	315
994.447	32.2	-1.9	30.3	54	-23.7	PASS		250	90

30-1000MHz

Curtis Straus - a Bureau Veritas Company	Work Order - R3437
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3V (battery powered)
1-6GHz Horizontal Data	Test Site - CH-1
Operator: AKZ	Conditions - 23°C; 23%RH; 1005mBar
Notes:	
E-ETH Channel 28 10dBm	EUT Maximum Frequency - 2480MHz

Data Taken at 01:14:14 PM, Friday, November 17, 2017

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
1288.9	47.6	38.3	-8.4	39.2	74	-34.7	PASS		29.9	54	-24.1	PASS		185	20
2201.9	45.9	37.2	-106.5	-60.6	74	-134.5	PASS		-69.3	54	-123.3	PASS		275	25
2487.8	48.1	40.3	-105.8	-57.7	74	-131.7	PASS		-65.5	54	-119.5	PASS		275	9
2810.3	48.1	39	-0.4	47.6	74	-26.3	PASS	-26.3	38.6	54	-15.4	PASS	-15.4	186	281
3606.8	44.3	36.4	-3.7	40.6	74	-33.4	PASS		32.7	54	-21.3	PASS		220	188
5800	43.5	34.7	0.7	44.2	74	-29.8	PASS		35.4	54	-18.6	PASS		203	227

Curtis Straus - a Bureau Veritas Company	Work Order - R3366
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3V (battery powered)
Top Peaks Vertical 1-6GHz	Test Site - Chamber 1
Operator: Chris Bramley	Conditions - 25.2°C; 21%RH; 1006mBar
Notes:	Witnessed by - Siv Thangavelu
	EUT Maximum Frequency - 2480MHz
2440MHz	

Data Taken at 05:52:55 PM, Friday, November 17, 2017

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Margin to Average Limit (dB)	Average Limit Test Result (Pass/Fail)	Average Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2191.25	49.5	-3.7	45.8	74	-28.2	PASS		54	-8.2	PASS		100	128
2808.75	48.8	-0.4	48.5	74	-25.5	PASS		54	-5.5	PASS		300	240
5851.88	49.7	0.7	50.4	74	-23.6	PASS	-23.6	54	-3.6	PASS	-3.6	300	134

1-6GHz Mid Channel

Curtis Straus - a Bureau Veritas Company	Work Order - R3366
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3V (battery powered)
Top Peaks Horizontal 6-18GHz	Test Site - CH
Operator: AKZ	Conditions - 23°C; 23%RH; 1005mBar
Notes:	
	EUT Maximum Frequency - 2480MHz

Data Taken at 01:28:38 PM, Friday, November 17, 2017

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Margin to Avg Limit (dB)	Avg Limit Test Results (Pass/Fail)	Avg Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
12694.5	44.7	10.6	55.4	83.5	-28.1	PASS		63.5	-8.1	PASS		175	73
13299	44.9	11.2	56.1	83.5	-27.4	PASS		63.5	-7.4	PASS		100	209
14579.1	46.8	10	56.8	83.5	-26.7	PASS		63.5	-6.7	PASS		150	172
15107.1	45.8	10.8	56.6	83.5	-26.9	PASS		63.5	-6.9	PASS		200	29
17013.6	45.8	16.2	62.1	83.5	-21.4	PASS	-21.4	63.5	-1.4	PASS	-1.4	200	208
17970.9	43.7	17.5	61.2	83.5	-22.3	PASS		63.5	-2.3	PASS		200	243

Curtis Straus - a Bureau Veritas Company	Work Order - R3366
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3V (battery powered)
6-18GHz Vertical Data	Test Site - Chamber 1
Operator: Chris Bramley	Conditions - 25.2°C; 21%RH; 1006mBar
Notes:	Witnessed by - Siv Thangavelu
	EUT Maximum Frequency - 2480MHz
2440MHz	

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
17920.5	46.9	46.9	13.6	60.5	83.5	-23	PASS	-23	60.5	63.5	-3	PASS	-3	125	290

6-18GHz Center Channel

Radiated Emissions Table

Date: 17-Nov-17 **Company:** OSRAM **Work Order:** R3437
Engineer: Chris Bramley **EUT Desc:** E-ETH **EUT Operating Voltage/Frequency:** 3Vdc Battery
Temp: 25.2°C **Humidity:** 21% **Pressure:** 1006mBar
Frequency Range: 18-25GHz **Measurement Distance:** 0.1 m
Notes: Channel 11(2405MHz), Channel 18(2440MHz), Channel 26(2480MHz) Power 10dBm **EUT Max Freq:** 2480MHz

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)
No emissions found within 25dB of the limit														

Table Result: --- by --- dB ***Worst Freq:*** --- MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #2328
Analyzer: Gold **Preamp:** 18-26.5GHz **Antenna:** 18-26.5GHz Horn
CSsoft Radiated Emissions Calculator v 1.017.197

Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

18-25GHz

Radiated Emissions Table

Date: 17-Nov-17 **Company:** Osram **Work Order:** R3437
Engineer: Arik Zwirner **EUT Desc:** E-ETH **EUT Operating Voltage/Frequency:** 3V (battery)
Temp: 23°C **Humidity:** 23% **Pressure:** 1005mbar
Frequency Range: 2390MHz and 2483.5MHz **Measurement Distance:** 1 m
Notes: High and Low Band Edge Readings **EUT Max Freq:** 2480MHz

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)
H	2390.0	52.5	52.5	37.5	32.6	3.1	50.7	50.7	83.5	-32.8	Pass	63.5	-12.8	Pass
V	2483.5	62.4	62.4	37.5	32.8	3.2	60.9	60.9	83.5	-22.6	Pass	63.5	-2.6	Pass

Table Result: Pass by -2.6 dB ***Worst Freq:*** 2483.5 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #2457 **Cable 2:** Asset #2456 **Cable 3:** ---
Analyzer: --- **Preamp:** Asset #2111 **Antenna:** Blue Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.197

Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

Radiated Bandedges

Rev. 11/9/2017

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental EXA Signal Analyzer(1118472)	9KHz-26.5GHz	N9010A-526;K	AT	MY51170010	1118472	I	7/25/2018	7/25/2017
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	2/28/2018	2/28/2017
Radiated Emissions Sites	**FCC Code**	**IC Code**	**VCCI Code**	**Range**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz	1685	I	12/21/2018	12/21/2016
EMI Chamber 1	719150	2762A-6	A-0015	1-18GHz	1685	I	12/21/2018	12/21/2016
Preamps /Couplers Attenuators / Filters	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
2311 PA	1-1000MHz	PAM-103	COM-POWER	441174	2311	II	10/29/2018	10/29/2017
2111 HF Preamp	0.5-18GHz	PAM-118A	COM-POWER	551063	2111	II	10/29/2018	10/29/2017
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/16/2018	10/16/2017
Antennas	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Red-Black Bilog	30-2000MHz	JB1	Sunol	A091604-2	1106	I	2/28/2019	2/28/2017
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use	date of test
Blue Horn	1-18Ghz	3117	ETS	157647	1861	I	2/14/2019	2/14/2017
Meteorological Meters/Chambers		**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	4/28/2016
TH A#2084		HTC-1	HDE		2084	II	3/23/2018	3/23/2017
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #2456	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2457	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2466	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2328	1 - 26.5GHz	PE350-72	Pasternack	1539		II	2/12/2019	2/12/2018
Attenuators	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
2489(6dB)	9KHz-18GHz					II	11/27/2018	11/27/2017

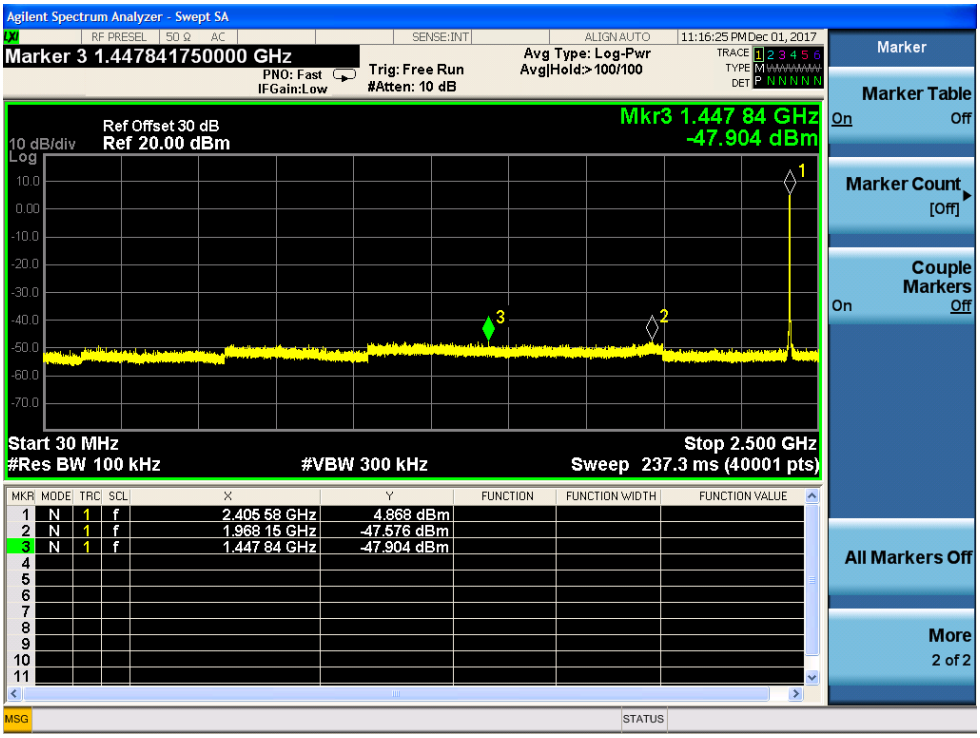
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

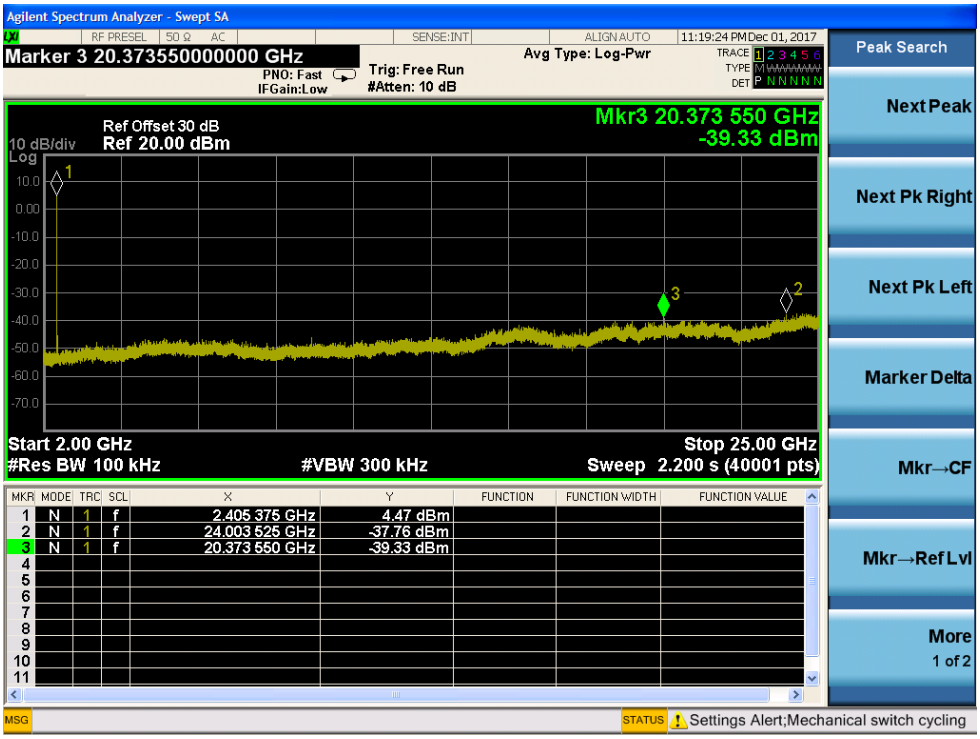
Conducted Spurious Emissions

LIMITS

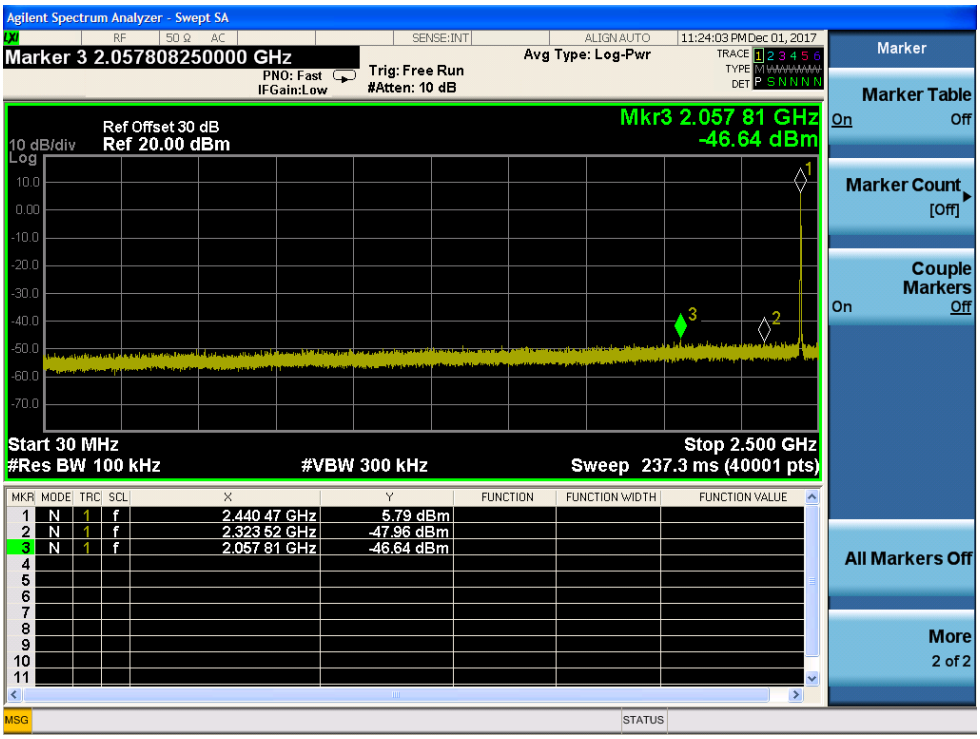
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth that contains the highest level of 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)]

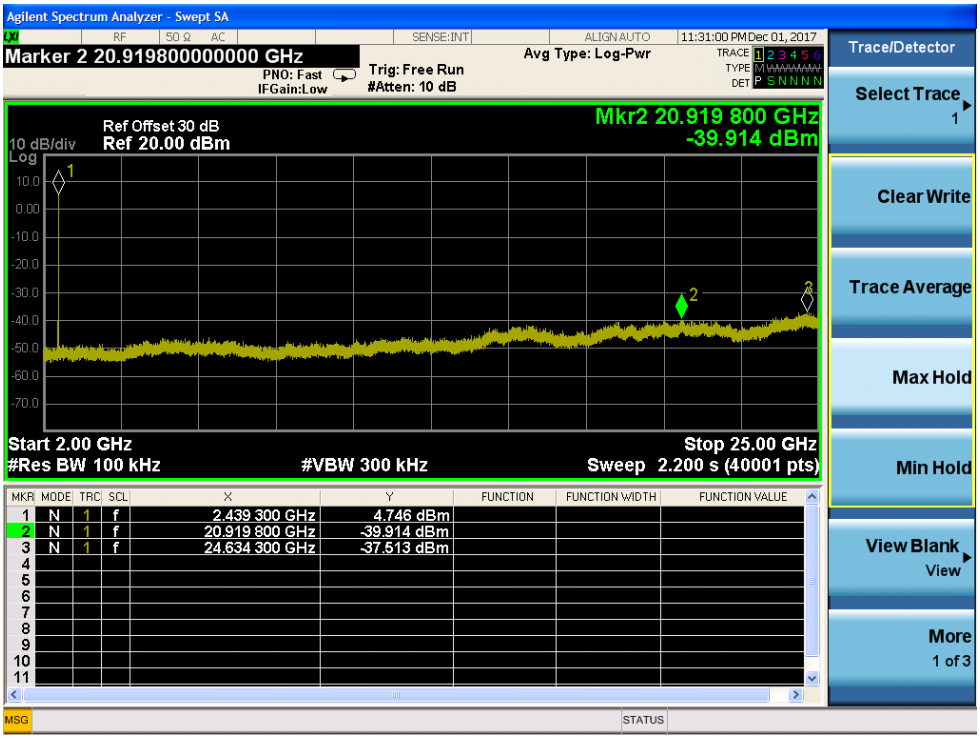
MEASUREMENTS / RESULTS



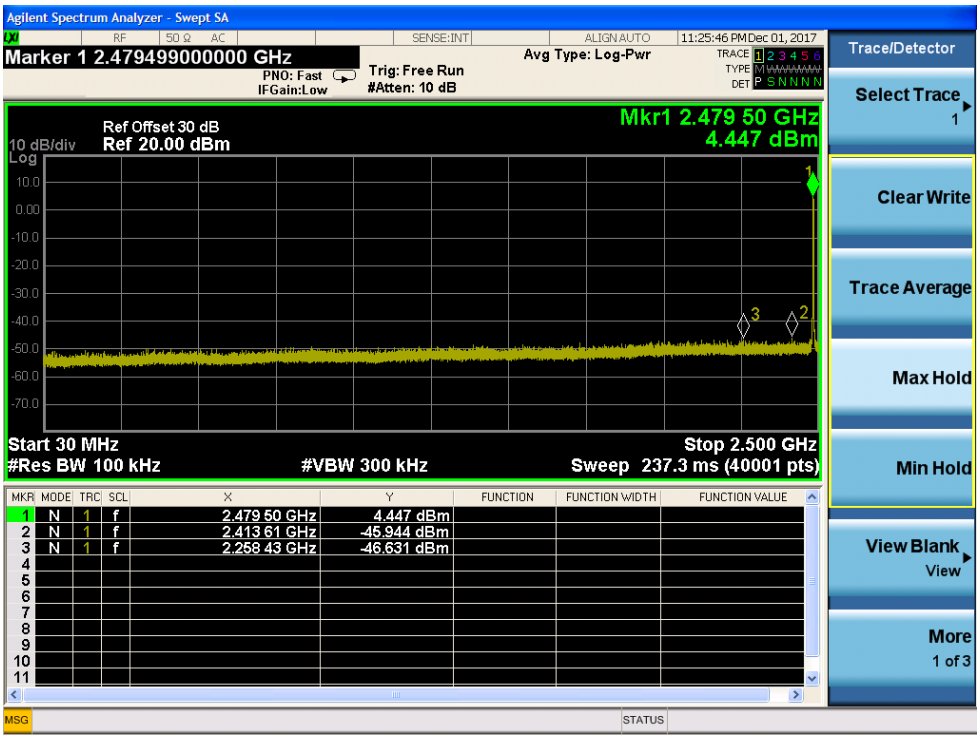

Agilent Spectrum Analyzer - Swept SA
RF PRESEL 50 Ω AC
SENSE:INT
ALIGN AUTO
11:19:24 PM Dec 01, 2017
Marker 3 20.373550000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 30 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr3 20.373 550 GHz
-39.33 dBm
Start 2.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.200 s (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.405 375 GHz 4.47 dBm
2 N 1 f 24.003 525 GHz -37.76 dBm
3 N 1 f 20.373 550 GHz -39.33 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS
Settings Alert;Mechanical switch cycling

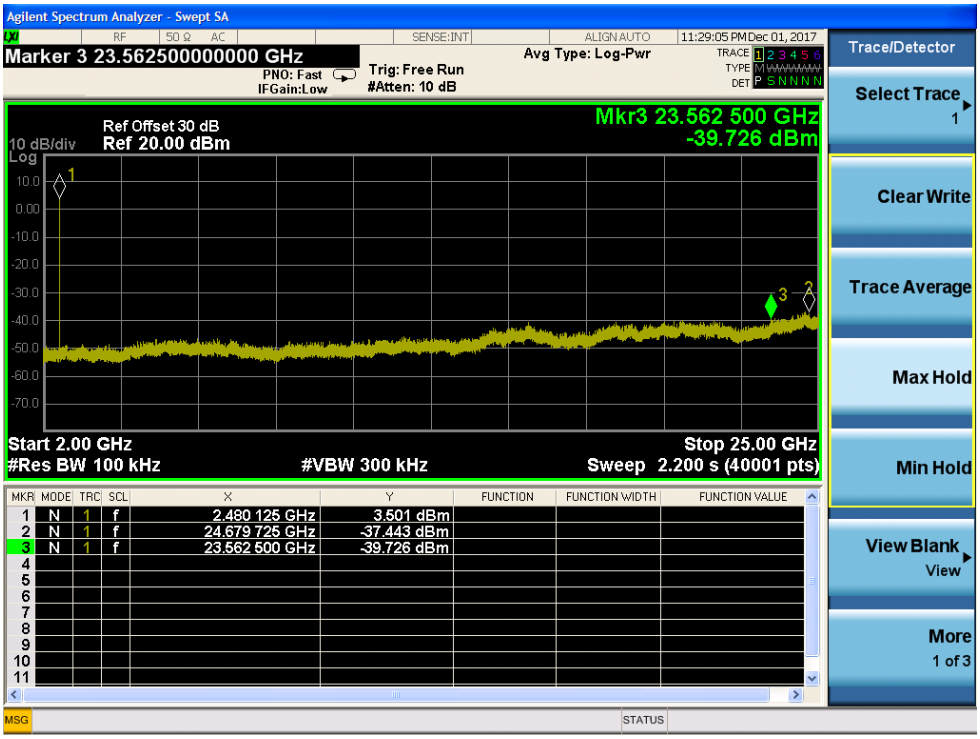
Channel 11


Agilent Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
11:24:03 PM Dec 01, 2017
Marker 3 2.057808250000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M
DET P S N N N N
Ref Offset 30 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr3 2.057 81 GHz
-46.64 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.500 GHz
Sweep 237.3 ms (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.440 47 GHz 5.79 dBm
2 N 1 f 2.323 52 GHz -47.96 dBm
3 N 1 f 2.057 81 GHz -46.64 dBm
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Marker 2 20.919800000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
11:31:00 PM Dec 01, 2017
Ref Offset 30 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr2 20.919 800 GHz
-39.914 dBm
Start 2.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.200 s (40001 pts)
1 N 1 f 2.439 300 GHz 4.746 dBm
2 N 1 f 20.919 800 GHz -39.914 dBm
3 N 1 f 24.634 300 GHz -37.513 dBm
Trace/Detector
Select Trace 1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank View
More 1 of 3

Channel 18


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.479499000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
11:25:46 PM Dec 01, 2017
Ref Offset 30 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.479 50 GHz
4.447 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.500 GHz
Sweep 237.3 ms (40001 pts)
1 N 1 f 2.479 50 GHz 4.447 dBm
2 N 1 f 2.413 61 GHz -45.944 dBm
3 N 1 f 2.258 43 GHz -46.631 dBm
Trace/Detector
Select Trace 1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank View
More 1 of 3



Channel 26

Rev. 2/12/2018

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

Band Edge Measurements

Conducted Bandedge

Date: 12/1/2017 **Company:** OSRAM SYLVANIA INC **Work Order:** R3437

Engineer: Arik Zwirmer **EUT:** ZigBee 2.5 GHz RF Module **Operating Voltage/Frequency:** 120V / 60Hz

Temp: 22°C **Humidity:** 29% **Pressure:** 1010mBar

Frequency Range: 2405-2480 MHz **Measurement Type:** Conducted

Measurement Method: FCC KDB 558074 D01 DTS Meas Guidance V04

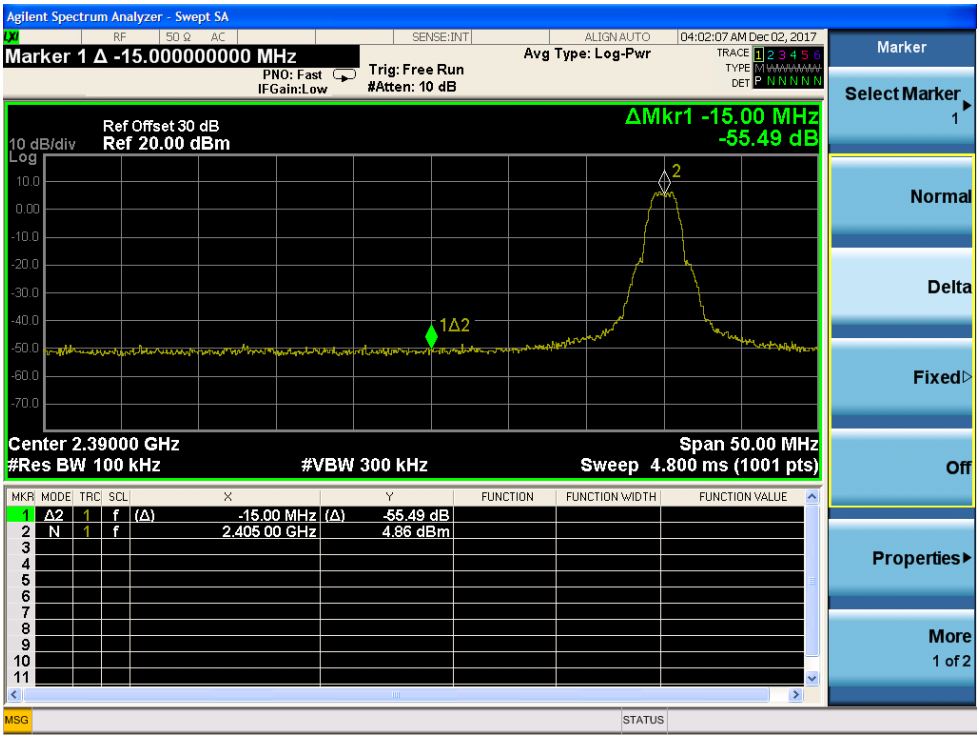
Notes:

	Adjusted Bandedge (dBm)	Delta to Peak (dB)	Limit (dB)	Limit (Pass/Fail)
Low Bandedge	2390	55.49	≥ 20	Pass
High Bandedge	2483.5	46.4	≥ 20	Pass

Test Site: CEMI 6 **Cable:** None **Attenuator:** 2121 30dB Pad

Analyzer: 2093 SA

PLOTS



Band Edge, Lower Channel

Band Edge, Upper Channel

Rev. 2/12/2018

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

Power Spectral Density

LIMIT

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

MEASUREMENTS / RESULTS

Peak Power Spectral Density

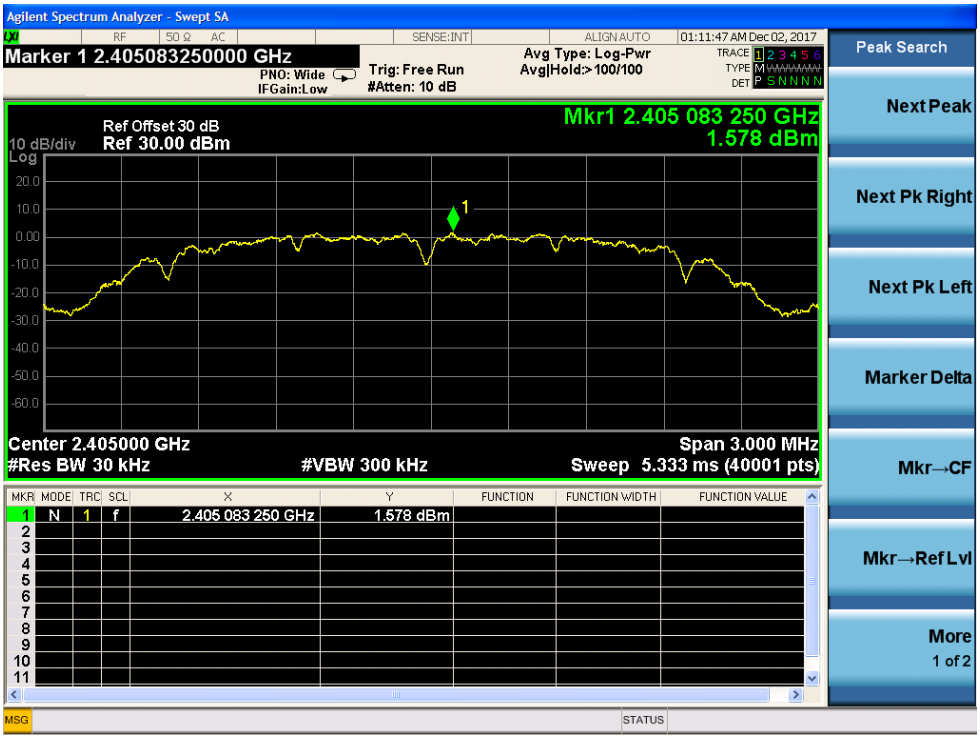
Date: 12/1/2017 **Company:** OSRAM SYLVANIA INC **Work Order:** R3437
Engineer: Arik Zwirmer **EUT:** ZigBee 2.5 GHz RF Module **Operating Voltage/Frequency:** 120V / 60Hz
Temp: 22°C **Humidity:** 29% **Pressure:** 1010mBar
Frequency Range: 2405-2480 MHz **Measurement Type:** Conducted

Notes:

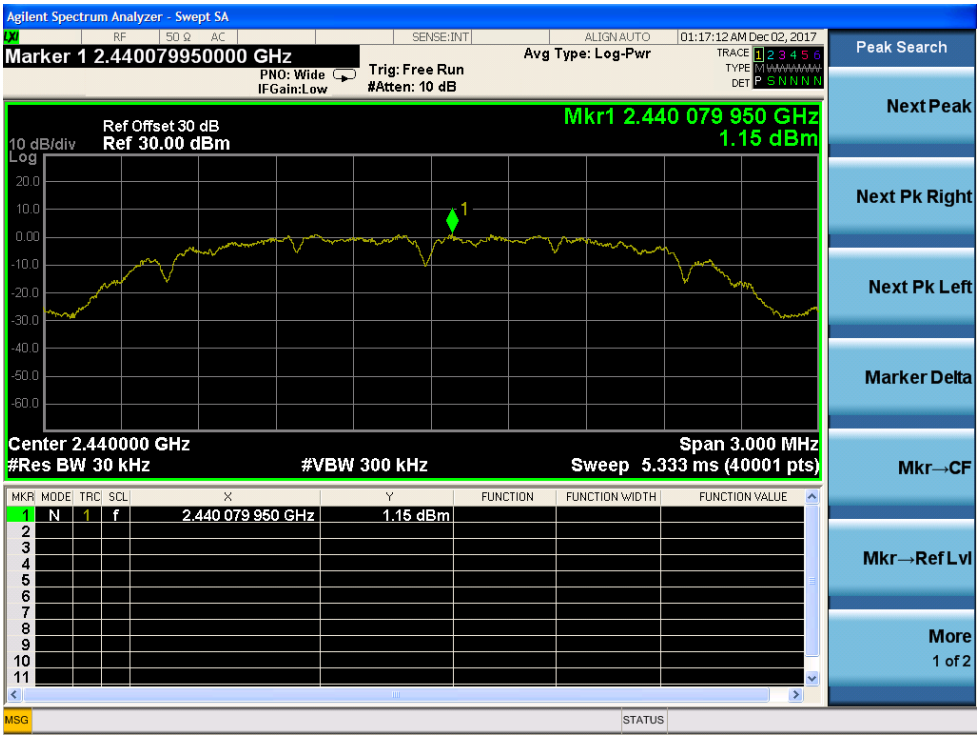
Frequency	Adjusted Peak Reading	Correction Factor Added to Spectrum Analyzer (Attenuator + Dongle)	---	---	Limit	Margin	Result
(MHz)	(dBm)	(dB)	---	---	(dBm)	(dB)	
2405	1.58	30.00	---	---	8.0	-6.42	Pass
2440	1.15	30.00	---	---	8.0	-6.85	Pass
2480	0.51	30.00	---	---	8.0	-7.49	Pass

Test Site: CEMI 6 **Cable:** None **Attenuator:** 2121 30dB Pad
Analyzer: 2093 SA
PSD(dBm) = Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dBm)

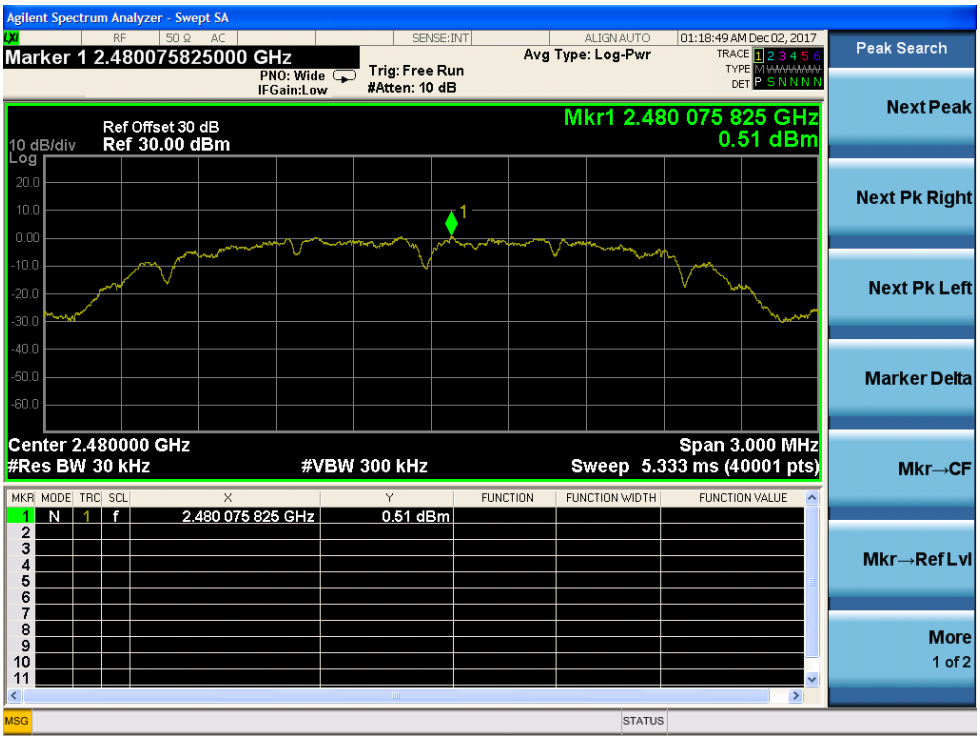
PLOTS



Power Spectral Density, Low Channel



Power Spectral Density, Mid Channel



Power Spectral Density, High Channel

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

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

Curtis Straus - a Bureau Veritas Company
Conducted Emissions per CISPR 16-2-1
Peak Detector Data
Notes:

Work Order# R3437
EUT Power Input - 120VAC/ 60Hz
Test Site - CEMI-3
Conditions: - 22°C; 29%RH; 1010mBar
Test Engineer - AKZ

Data Taken at 02:32:34 PM, Friday, December 01, 2017

Frequency (MHz)	Raw Pk Reading (dBµV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBµV)	QP Lim: Mains_FCC&CISPR_QP_Class_B (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_B (dBµV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.157	21.2	20.5	41.7	65.6	-23.9	PASS	-23.9	55.6	-13.9	PASS	-13.9
0.19	18.7	20.6	39.3	64.1	-24.8	PASS		54.1	-14.8	PASS	
0.237	15.6	20.6	36.1	62.2	-26.1	PASS		52.2	-16.1	PASS	
3.665	7.5	20.7	28.2	56	-27.8	PASS		46	-17.8	PASS	
21.755	10.8	21	31.8	60	-28.2	PASS		50	-18.2	PASS	
21.782	12.3	21	33.3	60	-26.7	PASS		50	-16.7	PASS	

Hot Lead

Curtis Straus - a Bureau Veritas Company
Conducted Emissions per CISPR 16-2-1
Peak Detector Data
Notes:
Neutral Phase

Work Order# R3437
EUT Power Input - 120VAC/ 60Hz
Test Site - CEMI-3
Conditions: - 22°C; 29%RH; 1010mBar
Test Engineer - AKZ

Data Taken at 02:19:48 PM, Friday, December 01, 2017

Frequency (MHz)	Raw Pk Reading (dBµV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBµV)	QP Lim: Mains_FCC&CISPR_QP_Class_B (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_B (dBµV)	Margin to Avg Limit (dB)	Pk to Avg Limit Results (Pass/Fail)	Worst Margin (Avg Limit) (dB)
0.15	20.1	20.5	40.6	66	-25.4	PASS		56	-15.4	PASS	
0.169	20.4	20.6	41	65	-24	PASS	-24	55	-14	PASS	-14
0.204	16.6	20.6	37.2	63.5	-26.3	PASS		53.5	-16.3	PASS	
0.52	8.3	20.5	28.8	56	-27.2	PASS		46	-17.2	PASS	
1.142	7.9	20.5	28.4	56	-27.6	PASS		46	-17.6	PASS	
21.784	12.4	21	33.4	60	-26.6	PASS		50	-16.6	PASS	

Neutral Lead

Rev. 11/26/2017

Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental EXA Signal Analyzer(1118472)	9KHz-26.5GHz	N9010A-526;K	AT	MY51170010	1118472	I	7/25/2018	7/25/2017

LISNs/Measurement Probes	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
LISN Asset 1732	150kHz-30MHz	LI-150A	Com-Power	201094	1732	I	3/8/2018	3/8/2017
LISN Asset 1733	150kHz-30MHz	LI-150A	Com-Power	201095	1733	I	3/8/2018	3/8/2017

Conducted Test Sites (Mains / Telco)	FCC Code		VCCI Code			Cat	Calibration Due	Calibrated on
CEMI 3	719150		A-0015			III	NA	N/A

Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	4/28/2016
TH A#2078		HTC-1	HDE		2078	II	3/23/2018	3/23/2017

Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
CEMI-02	9kHz - 2GHz		C-S			II	4/13/2018	4/13/2017

Attenuators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
20dB Attenuator-60	9kHz-2GHz			N/A		II	9/23/2018	9/23/2017

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

Occupied Bandwidth

REQUIREMENT

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. [RSS-GEN 6.6]

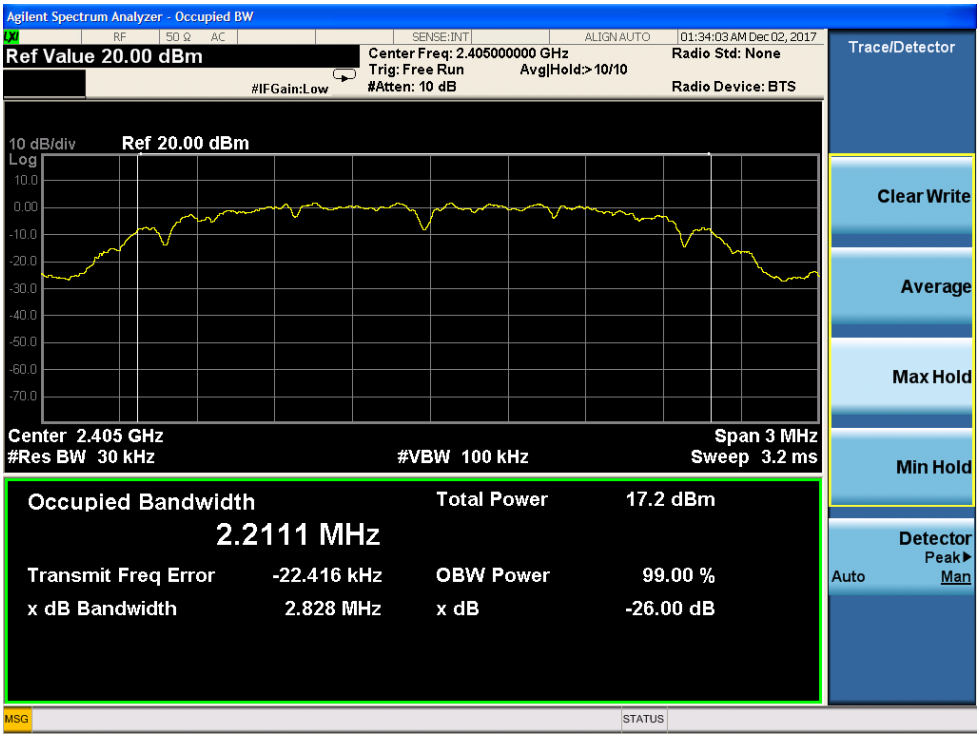
MEASUREMENTS / RESULTS

Occupied Bandwidth Table

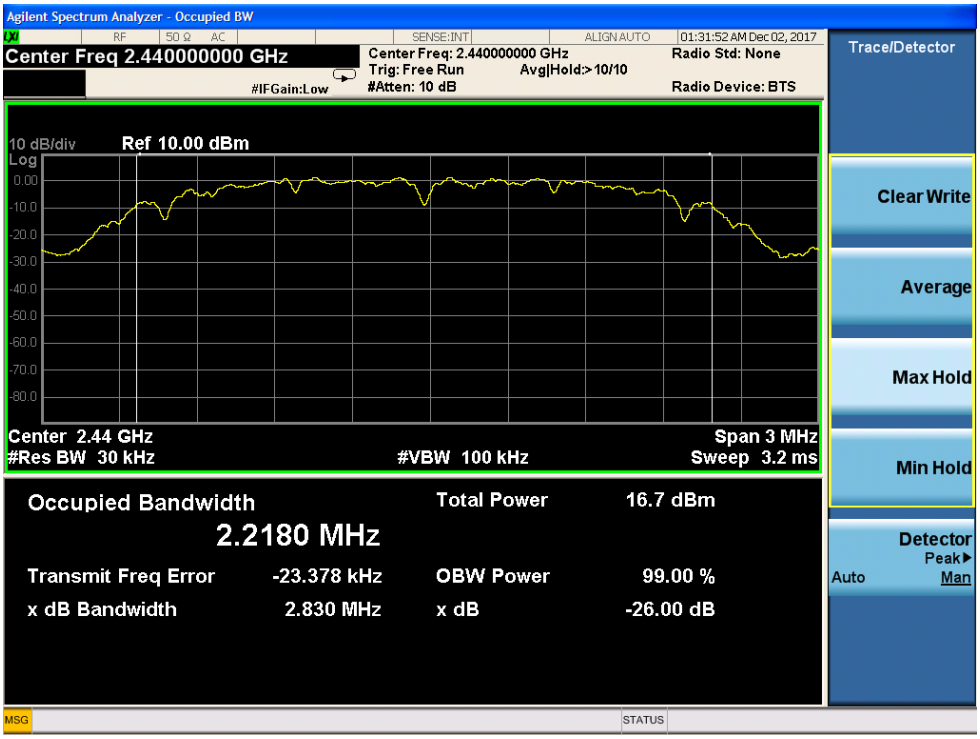
Date: 01-Dec-17	**Company:** Osram	**Work Order:** R3437
Engineer: Arik Zwirner		**EUT Operating Voltage/Frequency:** 120V/60Hz
Temp: 22°C	**Humidity:** 29%	**Pressure:** 1010mBar
Frequency Range: Fundamental		
Notes:		

Channel	Frequency	Occupied Bandwidth
Low	2405.0	2.2111
Middle	2440	2.2180
High	2480.0	2.2170

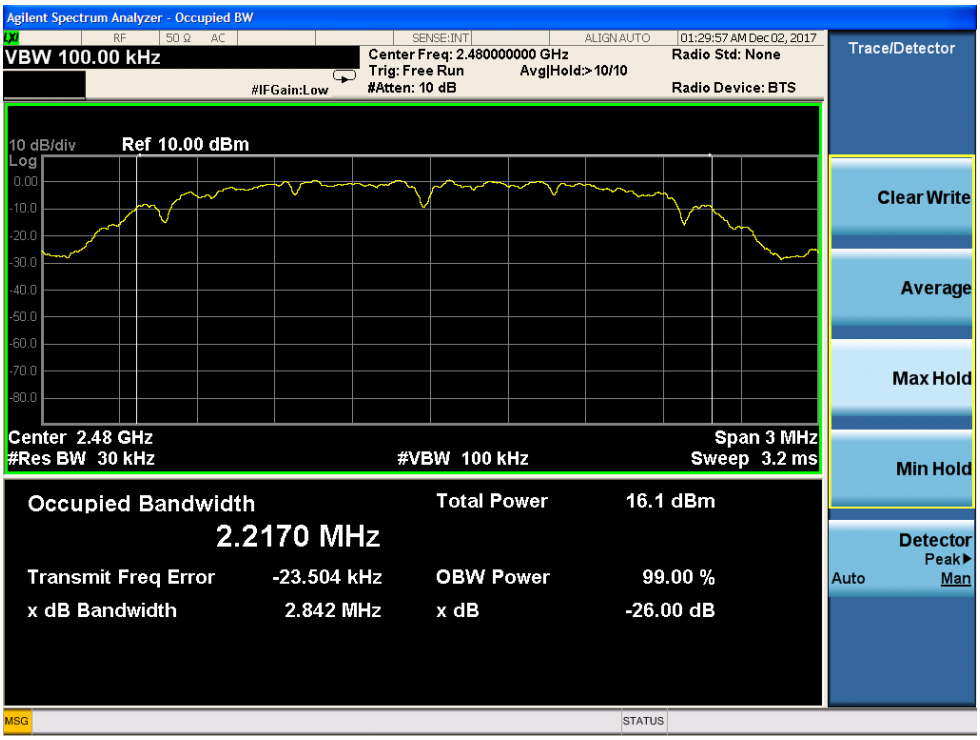
PLOTS



Occupied Bandwidth, Low Channel



Occupied Bandwidth, Mid Channel



Occupied Bandwidth, High Channel

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217

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

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) NIST CISPR	 5.6dB 4.6dB	 N/A 5.2dB (Ucispr)
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 CISPR	 3.9dB 3.6dB	 N/A 3.6dB (Ucispr)
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 were 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.

17. 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 Curtis-Straus may use to delegate the performance of work can be provided upon request.

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