
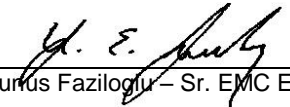




Test Report

CURTIS-STRAUS Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

Report No	ER3165-1
Client	JADAK, a business unit of Novanta Corporation
Address	125 Middlesex Turnpike Bedford, MA 01730
Phone	617-499-4090
Items tested	IZAR RFID Reader
FCC ID	QV5IZAR
IC	5407A-IZAR
FRN	0008403743
Equipment Type	Part 15 Spread Spectrum Transmitter
Equipment Code	DSS
FCC/IC Rule Parts	CFR Title 47 FCC 15.247, ISED Canada RSS-247 Issue 2
Test Dates	January 10 th to , 2017
Results	As detailed within this report
Prepared by	 Zachary Johnson – EMC Engineer
Authorized by	 Yurkus Faziloglu – Sr. EMC Engineer
Issue Date	5/3/2018
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 25 of this report.

Curtis-Straus LLC is accredited to ISO/IEC 17025 by A2LA for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation. See our scope of accreditation at the end of this test report. Any opinions or interpretations expressed in this report are outside the scope of our A2LA accreditation as A2LA only accredits testing.

Testing Cert. No. 1627-01



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Form Final Report REV 7-20-07 (DW)



Summary

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

The IZAR RFID Reader is a frequency hopping transmitter that operates in the frequency range of 902.75 - 927.25MHz. It has four external antennas which are active one at a time during transmission. It is powered by 48V POE or 24V external DC supply.

List of antennas tested:

Antenna	Reader	Cable Length	Nominal Gain
MT-242043 12" x 12" circular	Izar 31.5 dBm NA	12 ft	6 dBil
Laird FG9026 Dipole long	Izar 31.5 dBm NA	12 ft	6 dBil

Note: Output power measurements were performed at the end of the antenna cables and compared to applicable the limit.

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

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	May 3, 2018



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Test Methodology

All the testing was performed according to the following rules/procedures/documents;
CFR Title 47 FCC 15.247, ISED Canada RSS-247 Issue 2, RSS-Gen Issue 4 and ANSI C63.10-2013.

For radiated emissions, MT-242043 12" x 12" circular antenna was maximized around 3 orthogonal planes. Laird FG9026 Dipole long antenna was tested only in vertical orientation as it would only be installed as such.

Conducted measurements at the antenna port were performed as well.

3 channels were tested as follows:

Low channel = 902.75 MHz

Middle channel = 915.25 MHz

High channel = 927.25 MHz

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

Frequency	RBW	VBW
150kHz-30MHz	9kHz	30kHz
30MHz-1GHz	120kHz	1MHz
1GHz-10GHz	1MHz	3MHz



Product Tested - Configuration Documentation

EUT Configuration										
Work Order:	R3165									
Company:	Novanta (Formerly Thing Magic)									
Company Address:	125 Middlesex Turnpike									
	Bedford, MA, 01730									
Contact:	Harinath Reddy									
	MN			PN			SN			
EUT:	IZAR north america			NONE			AC 10			
EUT Description:	4 port network RFID reader									
EUT Max Frequency:	928 MHz									
EUT Min Frequency:	0.5 MHz									
EUT Components	MN			SN						
Adapter Tech 24Vdc power supply	ATS050T-P240			none						
Globtek 24Vdc power supply	GT-41132-6024-T3			none						
Support Equipment	MN			SN						
Dell Laptop	Precision 5510			none						
Phihong AC power Adapter (for POE)	POE125U-4-AT-N-R			P35000002B1						
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
9-30VDC Power	Power DC	1	1	Power DC	No	Yes	1.5	in	yes	Required if POE is not being used
Coaxial Antenna	other	4	4	Coaxial	Yes	No	2	in	yes	EUT to antenna cable
Ethernet (POE)	Ethernet	1	1	Ethernet	No	No	50	in	yes	
GPIO	other	1	0					in	yes	12 pin I/O, 4 pins in and 4 pins out, port not populated
HDMI (mini)	other	1	0					in	yes	not populated during testing.
micro SD Card Slot	other	1	0					in	yes	SD card reader port
USB console	USB	1	0					in	yes	not normally used in operation, used for debug and setup
USB host	USB	1	0					in	yes	not populated
Software Operating Mode Description:										
RFID tag reading on 4 ports, cycling through the 4 ports, adhering to the FCC frequency hopping requirements. using web interface, Reader OS version 5.3.0.46.										
Performance Criteria:										
no immunity testing										

Clock Frequencies	
frequencies (MHz)	928, 902, 300, 0.5



Statement of Conformity

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	External antennas as listed on Pg 3 of this report.
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	The unit complies with the requirements of 15.207
			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.



Test Results

20dB Bandwidth

REQUIREMENT

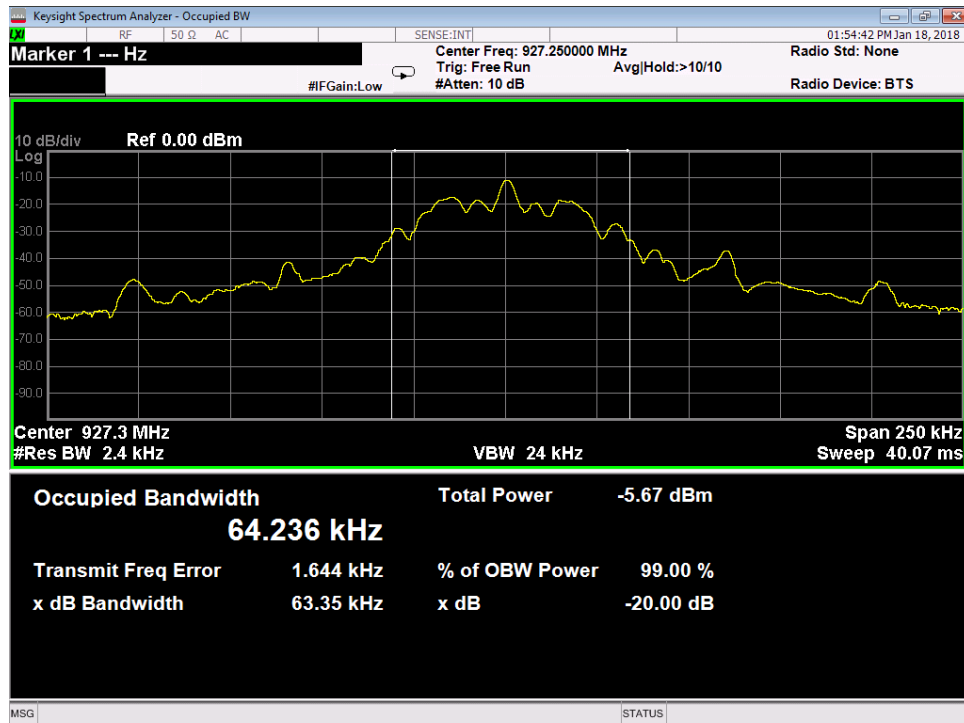
15.247(a)(1)(i): The maximum allowed 20dB bandwidth of the hopping channel is 500kHz

RSS-247 Issue 2 Section 5.1: The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

MEASUREMENTS / RESULTS

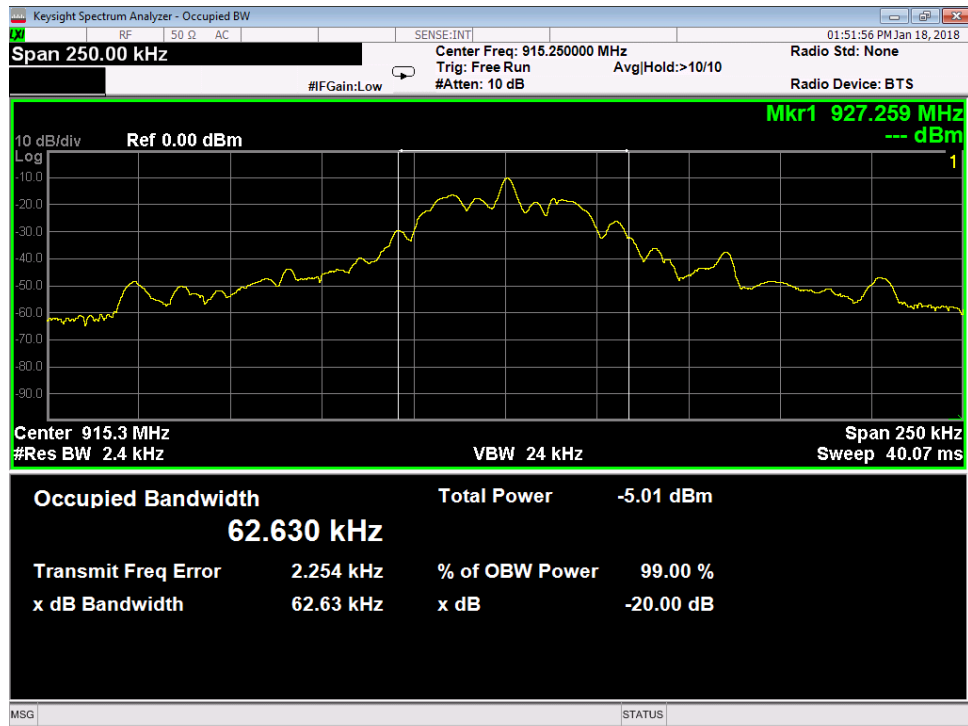
20dB Bandwidth			
Date: 1-17-2018		Company: Novanta	
Engineer: Zac Johnson		EUT: Izar Reader	
Temp: 19.8°C		Humidity: 32%	
		Pressure: 1017mBar	
Frequency Range: 902.75-927.25 MHz		Measurement Type: Conducted	
		Measurement Method: ANSI C63.10-2013	
Notes:			
Frequency Reading (MHz)	Reading (kHz)	20dB Bandwidth	
		Limit (kHz)	Result (Pass/Fail)
902.75	62.56	<500	Pass
915.25	62.63	<500	Pass
927.25	63.35	<500	Pass
Test Site: CEMI 5		Attenuator: 2107 Pad	
Analyzer: 1118473 SA		Copyright Curtis-Straus LLC 2000	

PLOTS

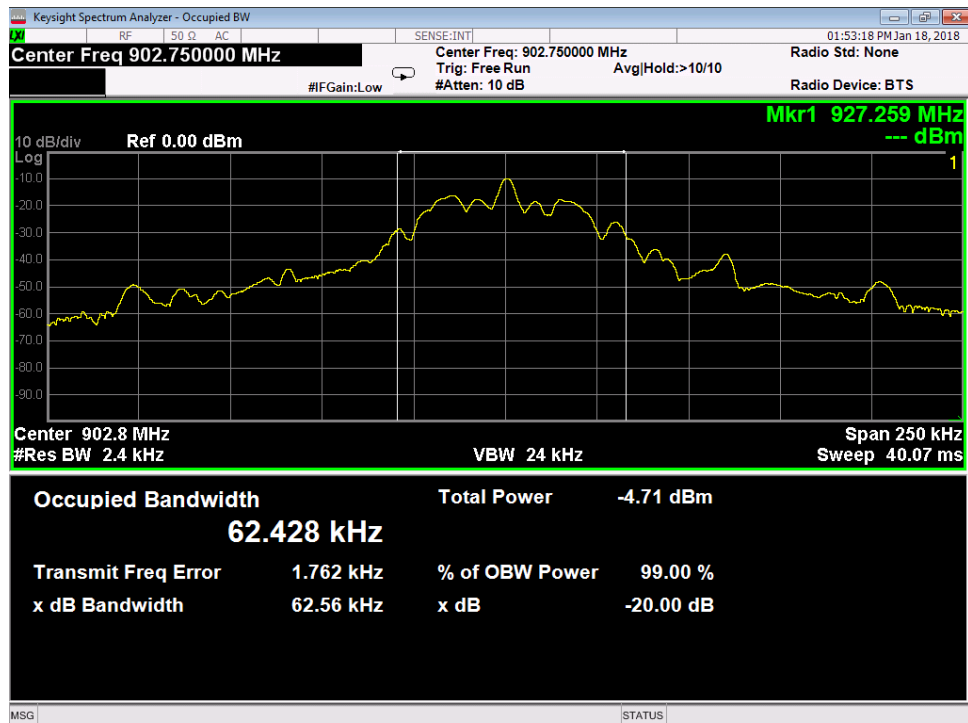


927.25MHz High Channel





915.25MHz Mid Channel



902.75MHz Low Channel



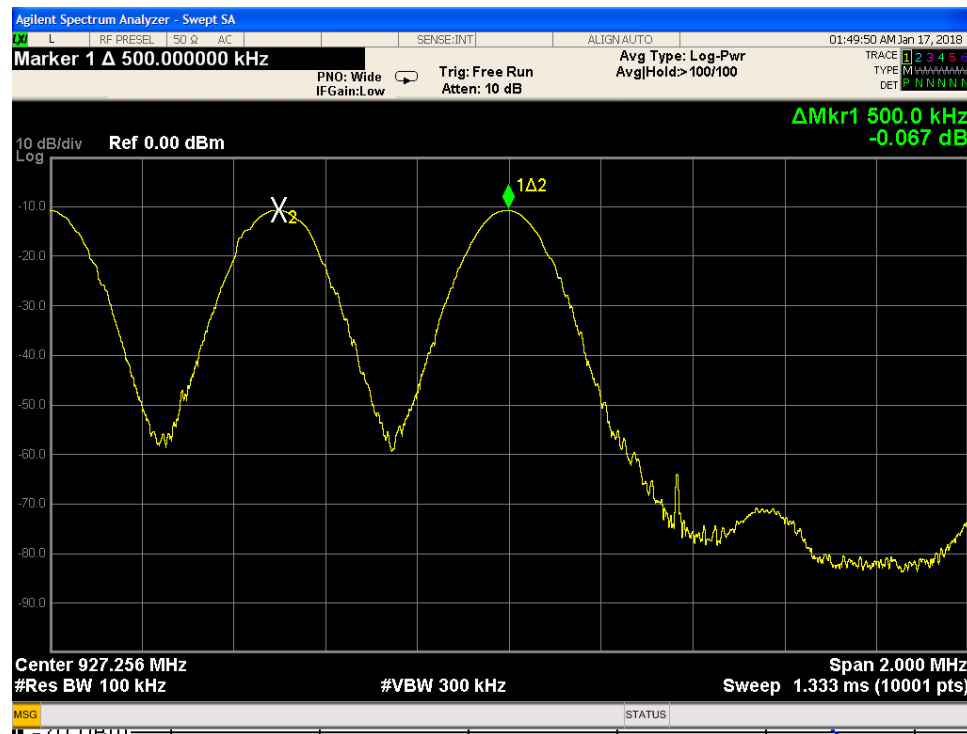
Channel Separation

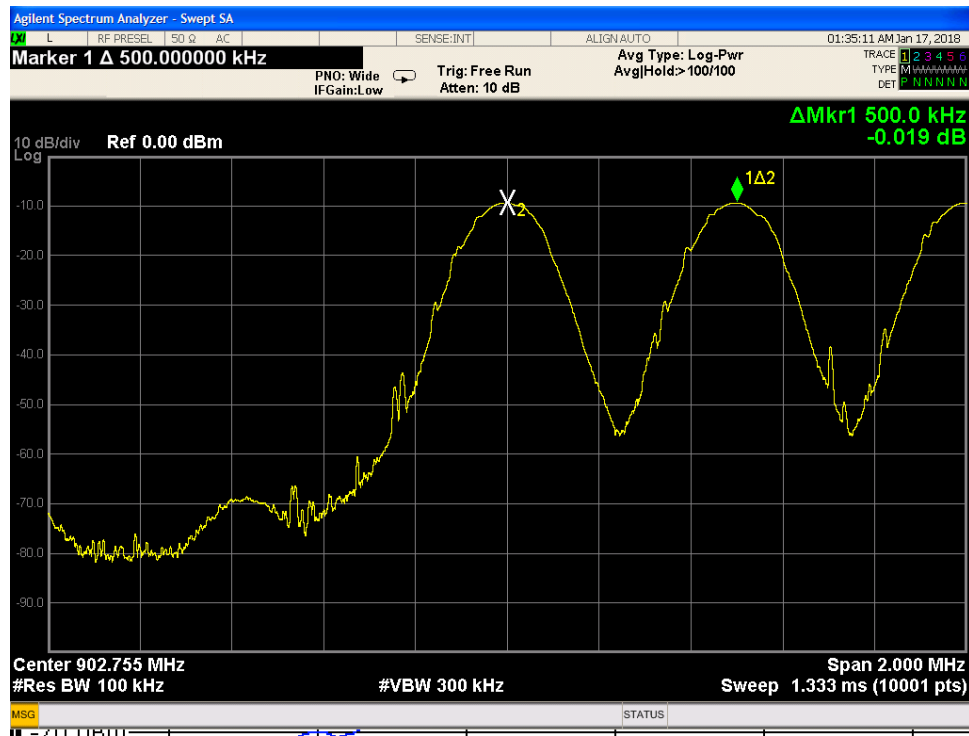
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.
[15.247 (a) (1)]

MEASUREMENTS / RESULTS

Channels are spaced by 500kHz as seen in the following plots. This is higher than both 25kHz and the 20dB bandwidth of the product.

Plots





Low Separation

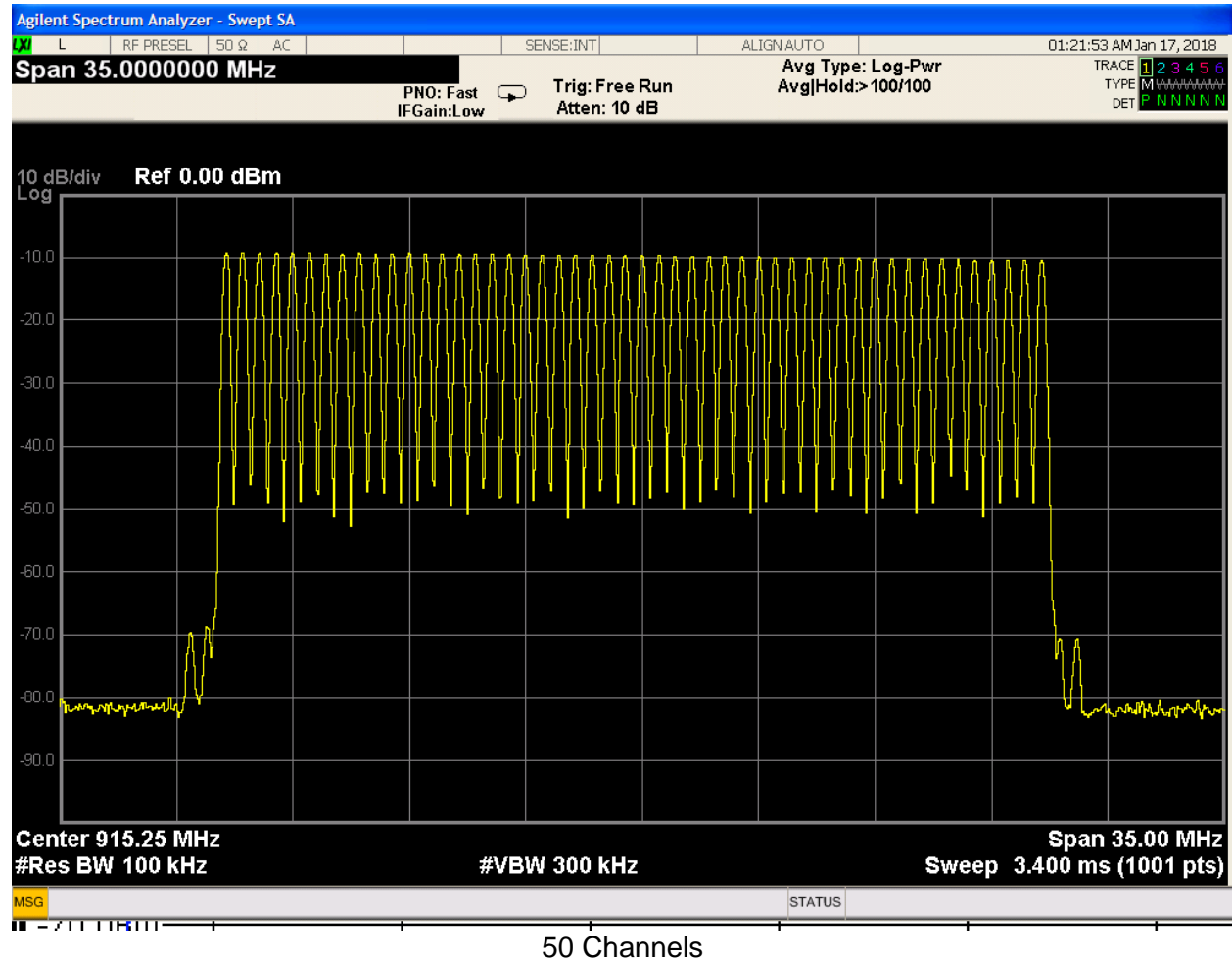


Number of Channels

For frequency hopping systems operating in the 902-928MHz band: if the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping frequencies [15.247 (a) (1) (i)]

MEASUREMENTS / RESULTS

PLOTS



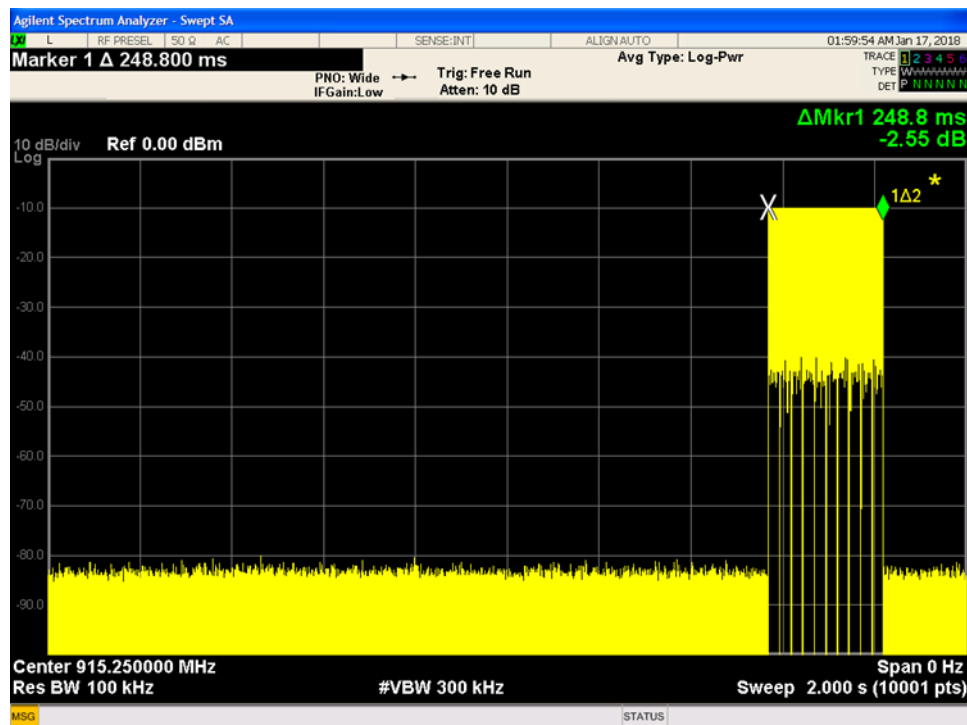
Dwell Time

For frequency hopping systems operating in the 902-928MHz band: if the 20dB bandwidth of the hopping channel is less than 250 kHz ...the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;

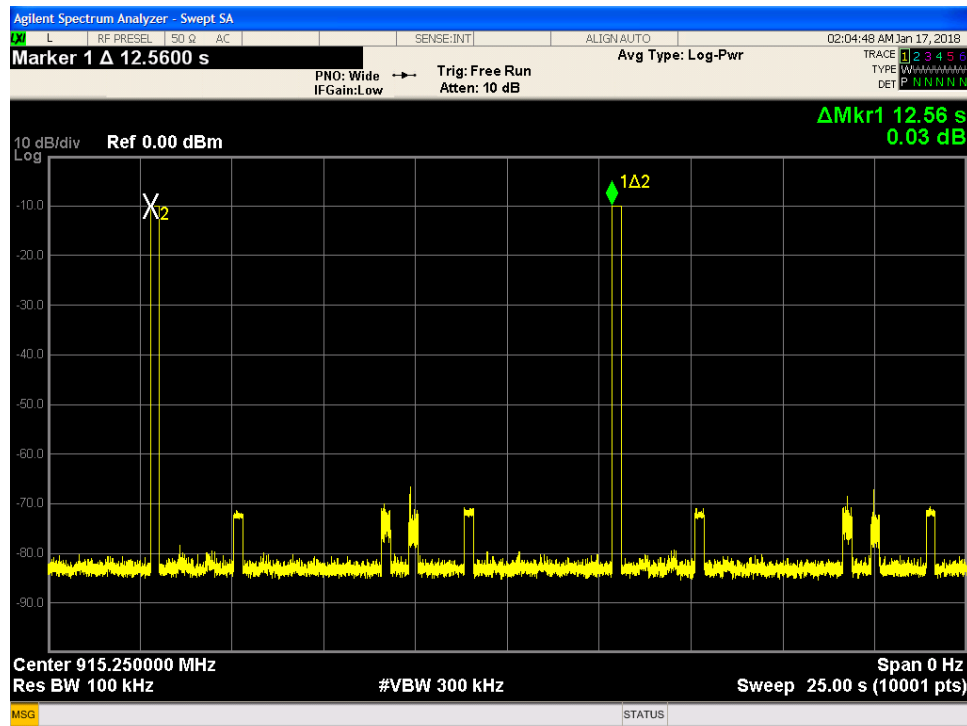
[15.247 (a) (1) (i)]

MEASUREMENTS / RESULTS

Plots



Single Hop = 248.8ms



Pulse Separation, 12.56 Seconds

Average time of occupancy: $248.8\text{ms}/12560\text{ms} = 0.0198 * 20\text{s period} = 0.396\text{s}$

This is less than the 0.4s requirement and therefore compliant.

Peak Output Power

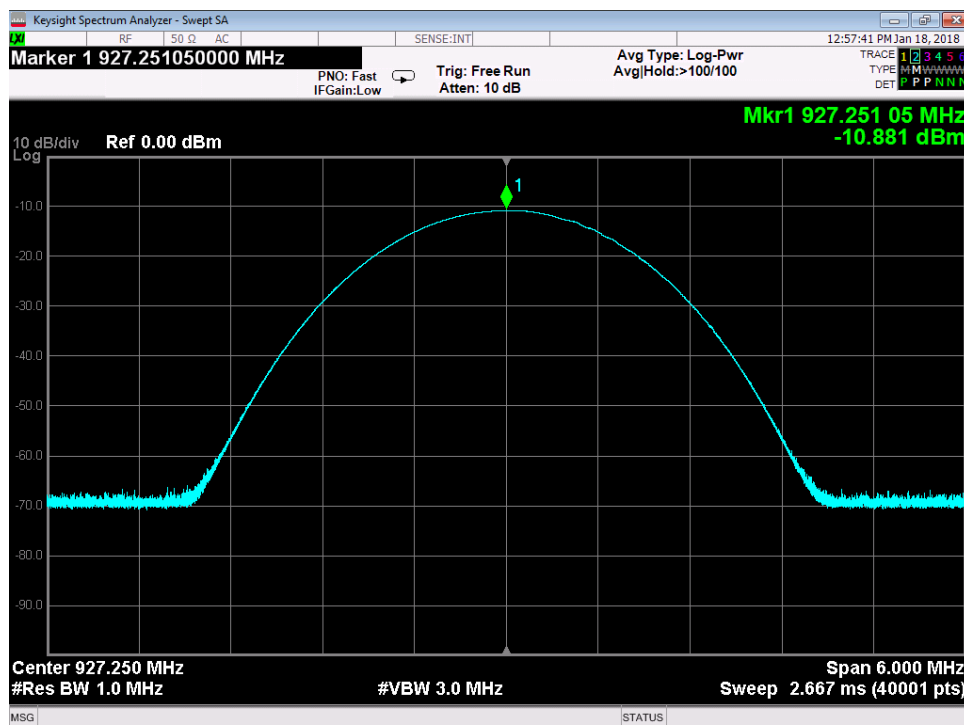
LIMIT

Conducted Output Power: 1 Watt [15.247(b) (2)]

MEASUREMENTS / RESULTS

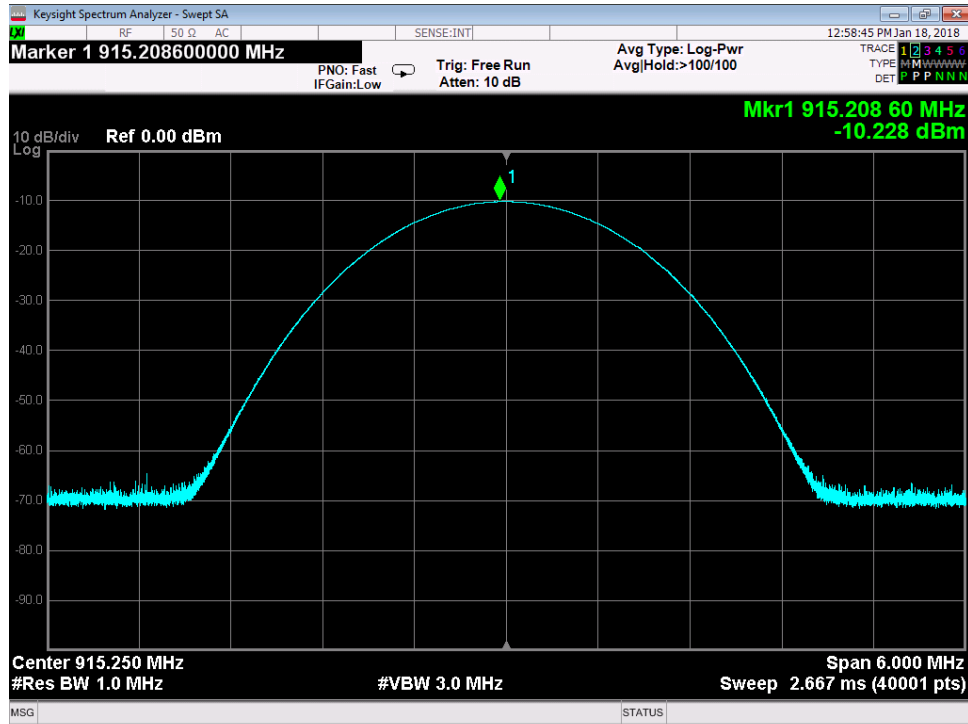
Peak Output Power								
Date: 1-17-2018			Company: Novanta			Work Order: R3165		
Engineer: Zac Johnson			EUT: Izar Reader			Operating Voltage/Frequency: POE		
Temp: 19.8°C			Humidity: 32%			Pressure: 1017mBar		
Frequency Range: 902.75-927.25 MHz					Measurement Type: Conducted			
EUT Power Setting: 31dBm								
Notes: Measurements taken at end of cable								
Power Setting	Cable Length	Frequency	Peak Reading	Attenuator Loss	Peak Output Power	Limit	Margin	Result
(dBm)	(feet)	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)	(Pass/Fail)
31.5	12	902.75	-10.16	40.0	29.84	30.0	-0.16	Pass
31.5	12	915.25	-10.23	40.0	29.77	30.0	-0.23	Pass
31.5	12	927.25	-10.88	40.0	29.12	30.0	-0.88	Pass
Test Site: CEMI 5			Cable: '---			Attenuator: 2107 Pad		
Analyzer: 1118473 SA								
Peak Output Power (dBm)= Peak Reading (dBm) + Attenuator Loss (dB)								

PLOTS

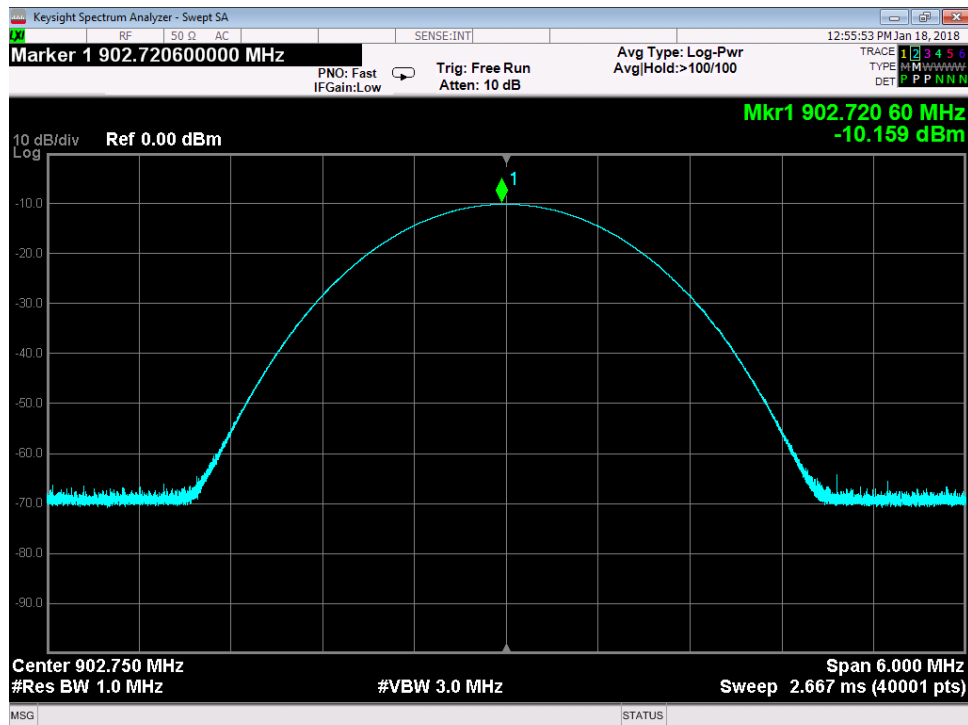


927.25MHz High Channel





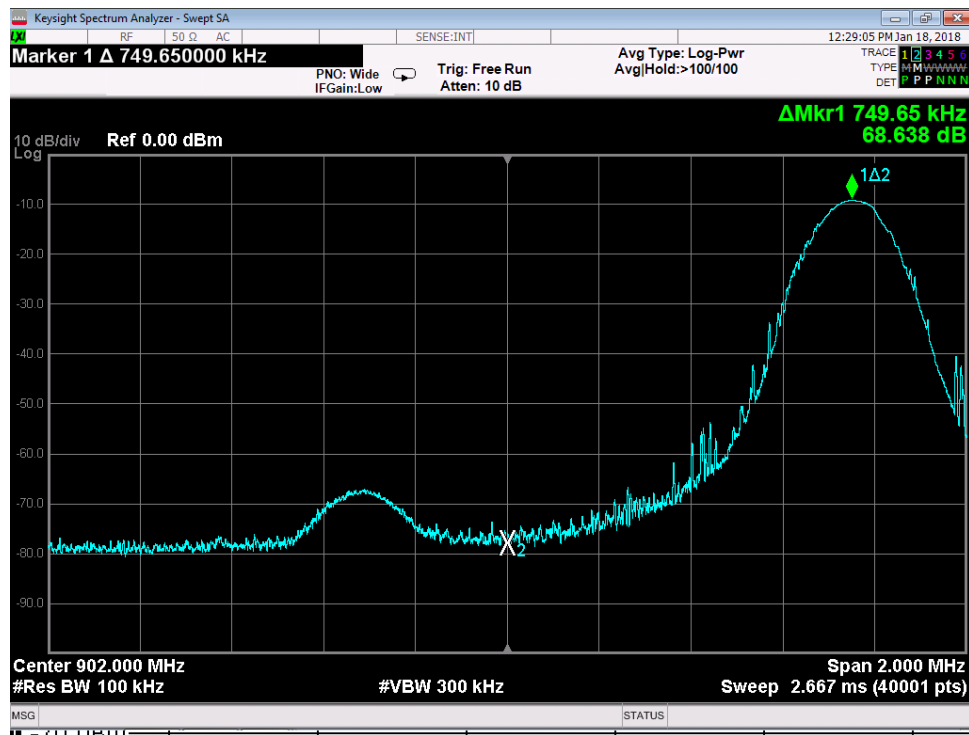
915.25MHz Mid Channel



902.75MHz Low Channel

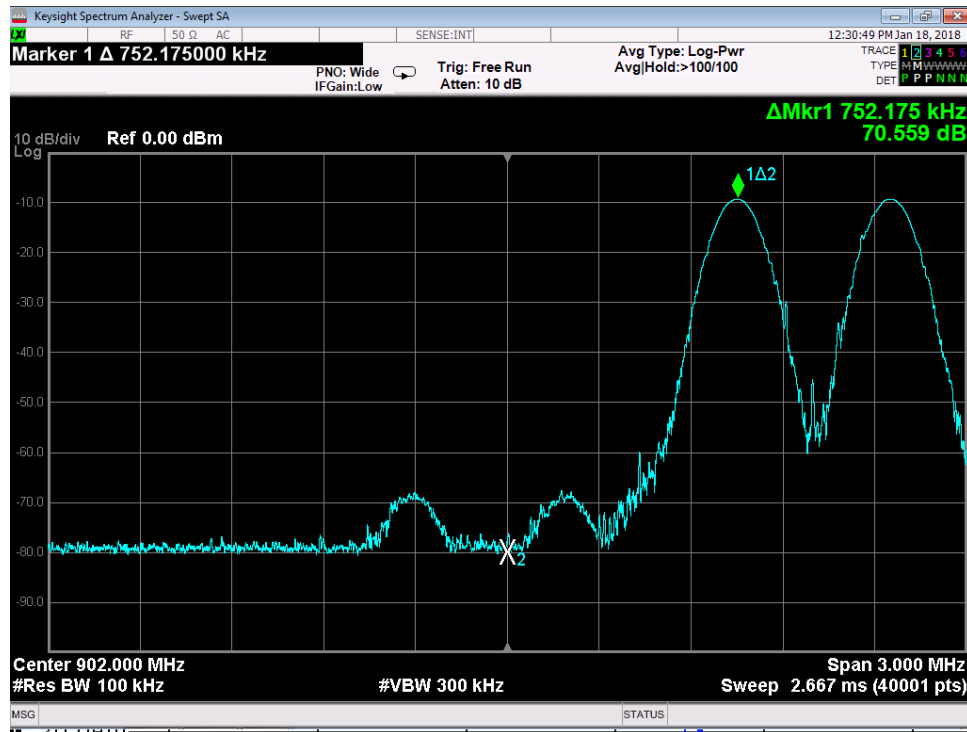
Conducted Bandedges

All band edges over 20dB from peak

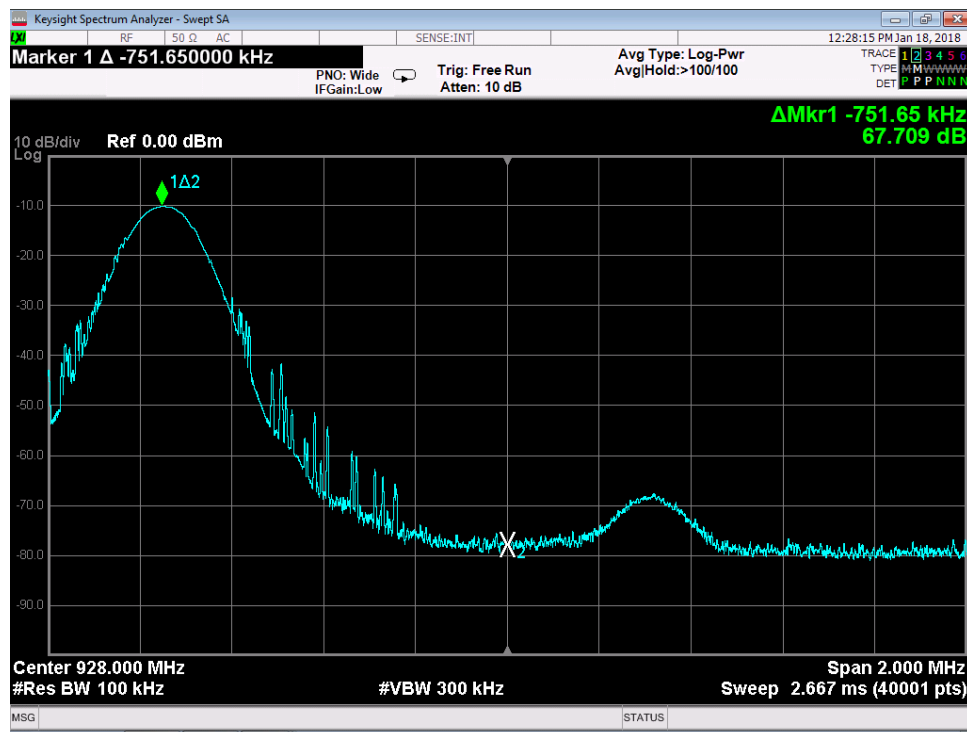


Low Bandedge Non-hopping

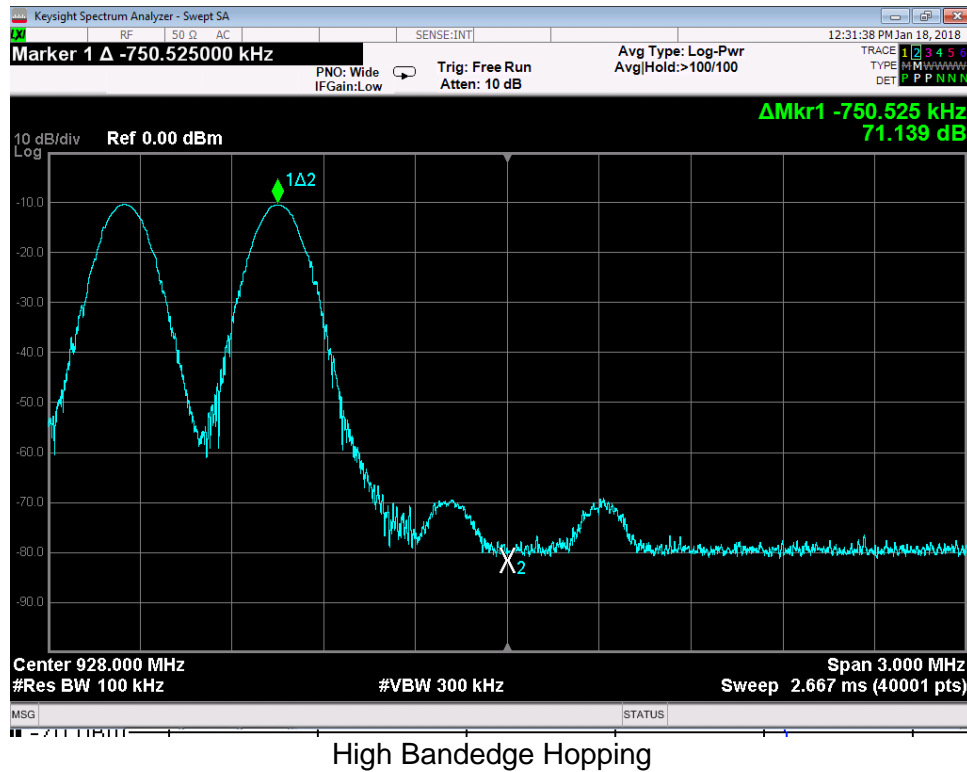




Low Bandedge Hopping



High Bandedge Non-hopping



Rev. 1/9/2018

Spectrum Analyzers / Receivers / Preselctors

Rental EXA Signal Analyzer(1118473)

Range

9KHz-26.5GHz N9010A-526;N

MN

N9010A-526;N

Mfr

AT

SN

MY51170076 1118473

Asset

1118473

Cat

I

Calibration Due

5/19/2018

Calibrated on

5/19/2017

Meteorological Meters/Chambers

Weather Clock (Pressure Only)

TH A#2083

MN

BA928

Mfr

Oregon Scientific

SN

C3166-1

Asset

831

Cat

I

Calibration Due

4/28/2018

Calibrated on

4/28/2016

Preamps/Couplers Attenuators / Filters

API - 40dB 100W Attenuator

Range

0.009-18GHz

MN

48-40-34

Mfr

API Weinschel

SN

CG7990

Asset

2107

Cat

II

Calibration Due

10/4/2018

Calibrated on

10/4/2017

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

Equipment used for the following tests:*20dB Bandwidth**Channel Separation**Number of Hopping Channels**Dwell Time**Peak Output Power**Conducted Bandedges*

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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)]

*Data shown for worst case center channel

**Two antenna setups were used for radiated emissions; a square antenna with a circular pattern and a dipole antenna with a linear pattern. Data is presented for each antenna.

MEASUREMENTS / RESULTS

Circular Antenna:

Curtis Straus - a Bureau Veritas Company				Work Order - R3165					
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE					
Top Peaks Vertical 30-1000MHz				Test Site - CH-1					
Operator: ZJ				Conditions - 22.5°C; 27%RH; 1013mBar					
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Lim1: FCC_pt15_10 9_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)
85.484	57.8	-21.4	36.4	40	-3.6	PASS		100	90
86.842	58.4	-21.2	37.2	40	-2.8	PASS	-2.8	100	90
88.249	57.3	-21.2	36.1	43.5	-7.4	PASS		100	90
93.365	56.9	-20.3	36.5	43.5	-7	PASS		150	45
576.037	44.4	-7.9	36.5	46	-9.5	PASS		100	45

Curtis Straus - a Bureau Veritas Company				Work Order - R3165					
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE					
30-1000MHz Horizontal Data				Test Site - CH-1					
Operator: ZJ				Conditions - 22.5°C; 27%RH; 1013mBar					
Frequency	Raw QP Reading	Correction Factor	Adjusted QP Amplitude	Lim1: FCC_pt15_109_Class_B	Margin to Lim1	Test Results Lim1	Worst Margin Lim1	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
33.245	28.3	-11.1	17.3	40	-22.7	PASS		148	13
165.808	50.9	-16.8	34.1	43.5	-9.4	PASS	-9.4	156	128
660.037	40.3	-5.6	33.9	46	-12.1	PASS		254	322
684.032	42.4	-5.7	36.1	46	-9.9	PASS		100	299
708.036	40	-5.7	34	46	-12	PASS		102	290

30-1000MHz



Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 24V DC									
Top Peaks Vertical 1-6GHz				Test Site - CH-1									
Operator: ZJ				Conditions - 22.5°C; 27%RH; 1013mBar									
4:27:34 PM Monday January 15 2018													

Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 24V DC									
Top Peaks Horizontal 1-6GHz				Test Site - CH-1									
Operator: ZJ				Conditions - 22.5°C; 27%RH; 1013mBar									
4:27:34 PM	Monday	January 15	2018										
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Margin to Peak Limit	Peak Limit Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_109_ClassB_AVG	Margin to Avg Limit	Avg Limit Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
1247.88	49.4	-8.7	40.7	74	-33.3	PASS		54	-13.3	PASS		300	30
2745.75	50.1	-5	45.1	74	-28.9	PASS		54	-8.9	PASS		200	43
3307.63	49	-3.7	45.3	74	-28.6	PASS		54	-8.6	PASS		100	235
4113	48.2	-2.9	45.4	74	-28.6	PASS		54	-8.6	PASS		100	0
5708.25	46.2	1	47.2	74	-26.8	PASS	-26.8	54	-6.8	PASS	-6.8	200	315

1GHz-6GHz

Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 1m Distance				EUT Power Input - 24V DC									
Top Peaks Vertical 6-18GHz				Test Site - CH-1									
Operator: ZJ				Conditions - 22.5°C; 27%RH; 1013mBar									
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Margin to Peak Limit	Peak Limit Test Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_109_ClassB_AVG	Margin to Avg Limit	Avg Limit Test Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
6683	47.1	7.3	54.4	83.5	-29.1	PASS		63.5	-9.1	PASS		200	132
8114.9	47.1	9.2	56.3	83.5	-27.2	PASS		63.5	-7.2	PASS		100	269
8881.2	47.3	9	56.3	83.5	-27.2	PASS		63.5	-7.2	PASS		100	30
9709.3	46.7	10	56.7	83.5	-26.8	PASS	-26.8	63.5	-6.8	PASS	-6.8	150	236



Curtis Straus - a Bureau Veritas Company						Work Order - R3165									
Radiated Emissions Electric Field 1m Distance						EUT Power Input - 24V DC									
Top Peaks Horizontal 6-18GHz						Test Site - CH-1									
Operator: ZJ						Conditions - 22.5°C; 27%RH; 1013mBar									
5:39:36 PM Monday January 15 2018															

6GHz-10GHz - 915.25MHz

Linear Antenna:

Curtis Straus - a Bureau Veritas Company				Work Order - R3165					
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE 48V					
Top Peaks Vertical 30-1000MHz				Test Site - CH1					
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar					
Power: POE 48V DC									
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz					
	Peak	Correction	Adjusted	Lim1:	Lim1	Lim1 Test	Worst		
Frequency	Reading	Factor	Peak	FCC_pt15_209	Margin	Results	Margin	Antenna	Turntable
			Amplitude				Lim1	Height	Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
52.771	59.2	-21.9	37.3	40	-2.7	PASS	-2.7	100	45
54.153	56.3	-22	34.3	40	-5.7	PASS		100	225
59.755	57.3	-21.9	35.4	40	-4.6	PASS		100	270
61.161	54.3	-21.4	32.9	40	-7.1	PASS		100	0
87.788	55	-21.1	33.9	40	-6.1	PASS		100	45
109.273	52.3	-16	36.3	43.5	-7.2	PASS		100	135

Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE 48V									
Top Peaks Horizontal 30-1000MHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar									
Power: POE 48V DC													
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz									
			Adjusted				Worst				Worst		
Frequency	Peak	Correction	Peak	Lim1:	Lim1	Lim1 Test	Margin	Lim2:	Lim2	Lim2 Test	Margin	Antenna	EUT
	Reading	Factor	Amplitude	FCC_pt15_209	Margin	Results	Lim1	FCC_pt15_209	Margin	Results	Lim2	Height	Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
99.937	48.7	-18.4	30.3	43.5	-13.2	PASS		43.5	-13.2	PASS		200	45
124.648	49	-14.6	34.4	43.5	-9.1	PASS	-9.1	43.5	-9.1	PASS	-9.1	250	0
126.079	46.3	-14.7	31.6	43.5	-11.9	PASS		43.5	-11.9	PASS		200	0
127.461	44.4	-14.5	30	43.5	-13.5	PASS		43.5	-13.5	PASS		200	0
135.851	45.4	-14.7	30.7	43.5	-12.8	PASS		43.5	-12.8	PASS		200	0
749.982	38.5	-4.6	34	46	-12	PASS		46	-12	PASS		100	135

30-1000MHz



Curtis Straus - a Bureau Veritas Company				Work Order - R3165											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE 48V											
1-6GHz Vertical Data				Test Site - CH1											
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar											
Power: POE 48V DC															
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz											
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Peak Margin	Peak Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_209_Average	Avg Margin	Avg Results	Worst Avg Margin	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
3279.3	33.6	24.8	18.7	52.3	74	-21.7	PASS		43.5	54	-10.5	PASS		300	51
5712.7	33.3	24.4	24	57.4	74	-16.6	PASS	-16.6	48.5	54	-5.5	PASS	-5.5	187	324

Curtis Straus - a Bureau Veritas Company				Work Order - R3165											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - POE 48V											
1-6GHz Horizontal Data				Test Site - CH1											
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar											
Power: POE 48V DC															
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz											
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Peak Margin	Peak Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_209_Average	Avg Margin	Avg Results	Worst Avg Margin	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
3297	33	24.8	18.6	51.6	74	-22.4	PASS		43.4	54	-10.6	PASS		125	279
5177.1	33.7	24.1	23.1	56.8	74	-17.2	PASS		47.2	54	-6.8	PASS		300	241
5722.7	35.3	24.4	24	59.3	74	-14.7	PASS	-14.7	48.4	54	-5.6	PASS	-5.6	179	186

1GHz-6GHz - 915.25MHz Mid Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 1m Distance				EUT Power Input - POE 48V									
Top Peaks Vertical 6-18GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar									
Power: POE 48V DC													
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz									
			Adjusted Peak	Pk Lim:			Peak Limit	Av Lim:			Avg Limit		
	Raw Peak	Correction	Amplitude	FCC_pt15_209	Margin to	Peak Limit	Worst	FCC_pt15_209	Margin to	Avg Limit	Worst	Antenna	EUT
Frequency	Reading	Factor		_Peak	Peak Limit	Test Results	Margin	_Average	Avg Limit	Test Results	Margin	Height	Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
6406.8	47.6	-3.1	44.5	83.5	-39	PASS		63.5	-19	PASS		200	150
9705.2	47.2	-1.7	45.5	83.5	-38	PASS	-38	63.5	-18	PASS	-18	125	7

Curtis Straus - a Bureau Veritas Company				Work Order - R3165									
Radiated Emissions Electric Field 1m Distance				EUT Power Input - POE 48V									
Top Peaks Horizontal 6-18GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 24.5°C; 21%RH; 1001mBar									
Power: POE 48V DC													
Port 1: 6dBi Dipole antenna				EUT Maximum Frequency - 928MHz									
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Margin to Peak Limit	Peak Limit Test Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_209_Average	Margin to Avg Limit	Avg Limit Test Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
8920.9	47.9	-2.6	45.4	83.5	-38.1	PASS	-38.1	63.5	-18.1	PASS	-18.1	175	8

6GHz-10GHz - 915.25MHz Mid Channel



Test Equipment Used:

Rev. 1/23/2018								
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
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
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
Brown	1-10GHz	CS	CS	N/A	1523	II	10/18/2018	10/18/2017
2111 HF Preamp	0.5-18GHz	PAM-118A	COM-POWER	551063	2111	II	11/19/2018	11/19/2017
2130 BRP	9KHz-10GHz	BRM18770	Micro-Tronics	1	2130	II	1/10/2019	1/10/2018
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	1/13/2019	1/13/2017
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 #2051	9KHz - 18GHz		Florida RF			II	3/5/2018	3/5/2017
Asset #2456	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2466	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
2487(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.								



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	5.6dB	N/A
CISPR	4.6dB	5.2dB (Ucisprr)
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



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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.

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