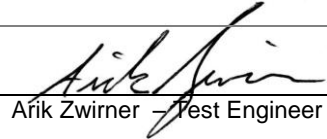
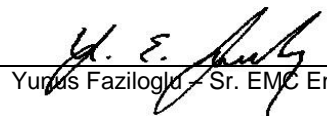




Test Report

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

Report No	ES2970-1
Client	Slingmax Technologies, LLC
Address	205 Bridgewater Rd. Aston, PA 19014
Phone	610-485-8500
Items tested	SOS1
FCC ID	2APZM-SOS1
IC	23959-SOS1
FRN	0027571686
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	Nov 7 to 17, 2018
Results	As detailed within this report
Prepared by	 Arik Zwirner – Test Engineer
Authorized by	 Yunus Faziloglu – Sr. EMC Engineer
Issue Date	3/28/19
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 39 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

Check Fast Node is a frequency hopping transmitter that operates in the frequency range 902.175 – 927.775MHz. It is battery powered.

Following antenna and cable configuration was supplied for testing,
Following antenna was supplied for testing,

Manufacturer	Model	Type	Gain (dBi)
Anaren	66089-0906	Internal whip	3dBi

We found that the product met the above requirements with modification. The output power was reduced to 9dBm. No other modifications were necessary. The test sample was received in good condition.

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	March 29, 2019



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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 5 and ANSI C63.10-2013.

Radiated emissions were maximized by rotating the device around three orthogonal planes as well as varying the test antenna's height and polarity. Worst case orientation was found to be in flat (X) position and all radiated emissions tests were performed in this orientation unless otherwise specified in the data tables.

EUT antenna is internal and therefore cannot be maximized separately.

Conducted emissions testing at the antenna port was performed.
Fresh batteries are used during all testing.

3 channels were tested as follows:

Low channel = 902.175 MHz

Middle channel = 914.975 MHz

High channel = 927.775 MHz

AC line conducted emissions testing wasn't applicable, since EUT is battery powered.

Following bandwidths were used during radiated spurious emissions tests.

Frequency	RBW	VBW
30MHz – 1GHz	120kHz	1MHz
1GHz – 10GHz	1MHz	3MHz



Product Tested - Configuration Documentation

EUT Configuration			
Work Order:	S2970		
Company:	Slingmax Technologies, LLC		
Company Address:	205 Bridgewater Rd. P.O. Box 2423		
	Aston, PA, 19014		
Contact:	Gregory D'Elia		
	MN	PN	SN
EUT:	Check Fast Node		Test Sample 1
EUT Description:	902-928MHz band radio		
EUT Max Frequency:	928 MHz		
Software Operating Mode Description:			
Frequency hopping transmitter in the 902-928MHz band. Battery powered. Client supplied software to change channels and enable-disable hopping.			

Clock Frequencies	
frequencies (MHz)	928

Modifications Required for Compliance

The output power was reduced to 9dBm. No other modifications were necessary.



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 internal whip with 3dBi 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
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
6.7				Occupied Bandwidth measurements were made.



Test Results

20dB Bandwidth and 99% Occupied 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.

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 6.7]

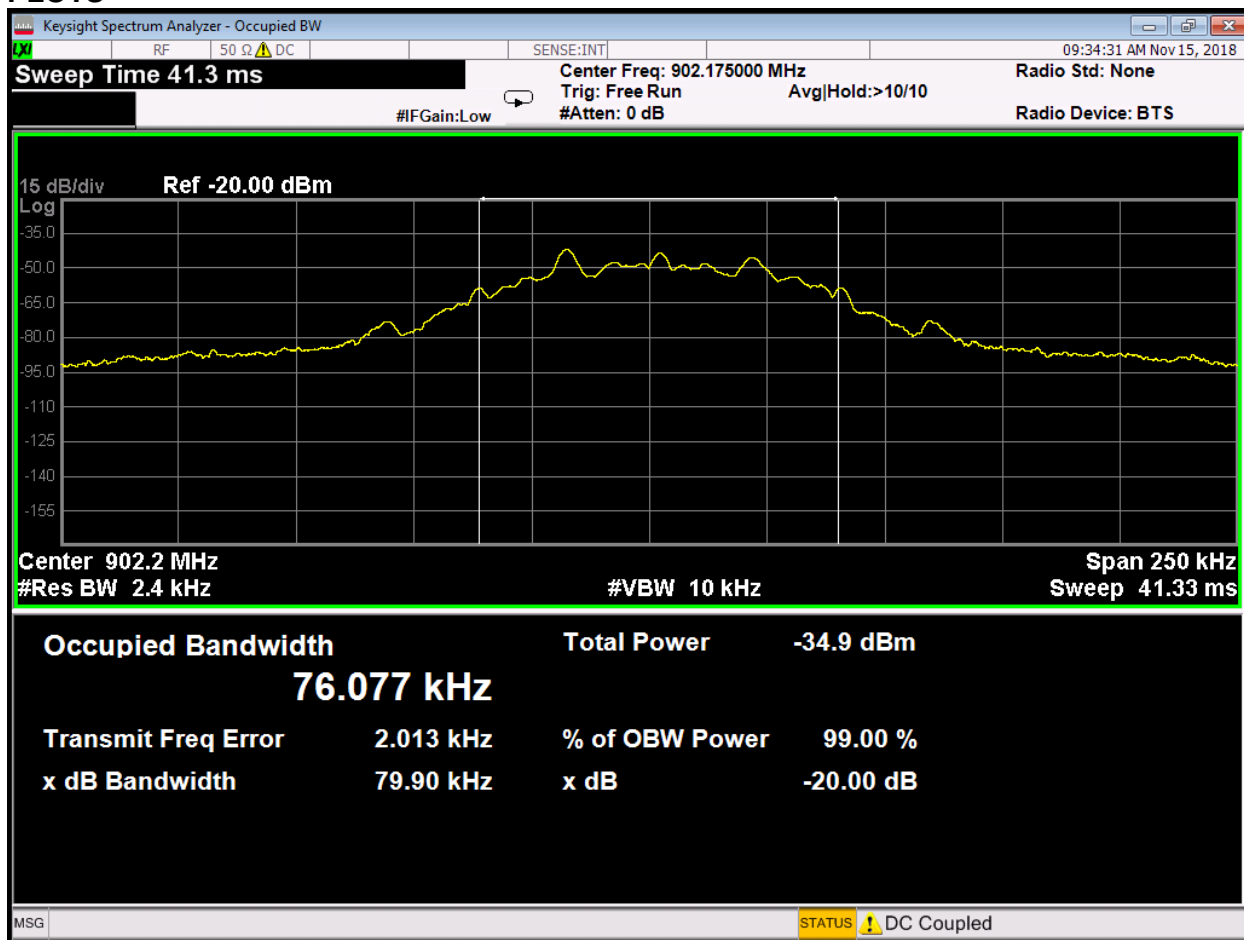
MEASUREMENTS / RESULTS

99% Occupied Bandwidth				
Date: 11/14/2018		Company: Slingmax Technologies, LLC		Work Order: S2970
Engineer: Arik Zwirner		EUT: SlingMax Checkfast Node		Operating Voltage/Frequency: 3.6V DC
Temp: 22.1°C		Humidity: 33%	Pressure: 1005mBar	
Frequency Range: 902-928MHz		Measurement Type: Conducted		
Measurement Method: RSS-Gen Issue 5 Section 6.7				
Notes:				
Frequency (MHz)	99% OBW (KHz)			
902.175	76.077			
914.975	75.905			
927.775	76.002			
Test Site: EMC-5		Cable: 2289 Cbl	Attenuator: 2121 Pad	
Analyzer: 118472 SA		Copyright Curtis-Straus LLC 2000		

20dB Bandwidth				
Date: 11/14/2018		Company: Slingmax Technologies, LLC		Work Order: S2970
Engineer: Arik Zwirner		EUT: SlingMax Checkfast Node		Operating Voltage/Frequency: 3.6V DC
Temp: 22.1°C		Humidity: 33%	Pressure: 1005mBar	
Frequency Range: 902-928 MHz		Measurement Type: Conducted		
Measurement Method: ANSI C63.10-2013				
Notes:				
Frequency (MHz)	Reading (kHz)	6dB Bandwidth		
		Limit (kHz)	Margin (kHz)	Result (Pass/Fail)
902.175	79.90	≤500	-420	Pass
914.975	79.84	≤500	-420	Pass
927.775	80.06	≤500	-420	Pass
Test Site: EMC-5		Cable: 2289 Cbl		Attenuator: 2121 Pad
Analyzer: 118472 SA		Copyright Curtis-Straus LLC 2000		



PLOTS



Low Channel





Mid Channel





High Channel

Note: Plots above show both 20dB Bandwidth and 99% OBW measurement data



Channel Separation

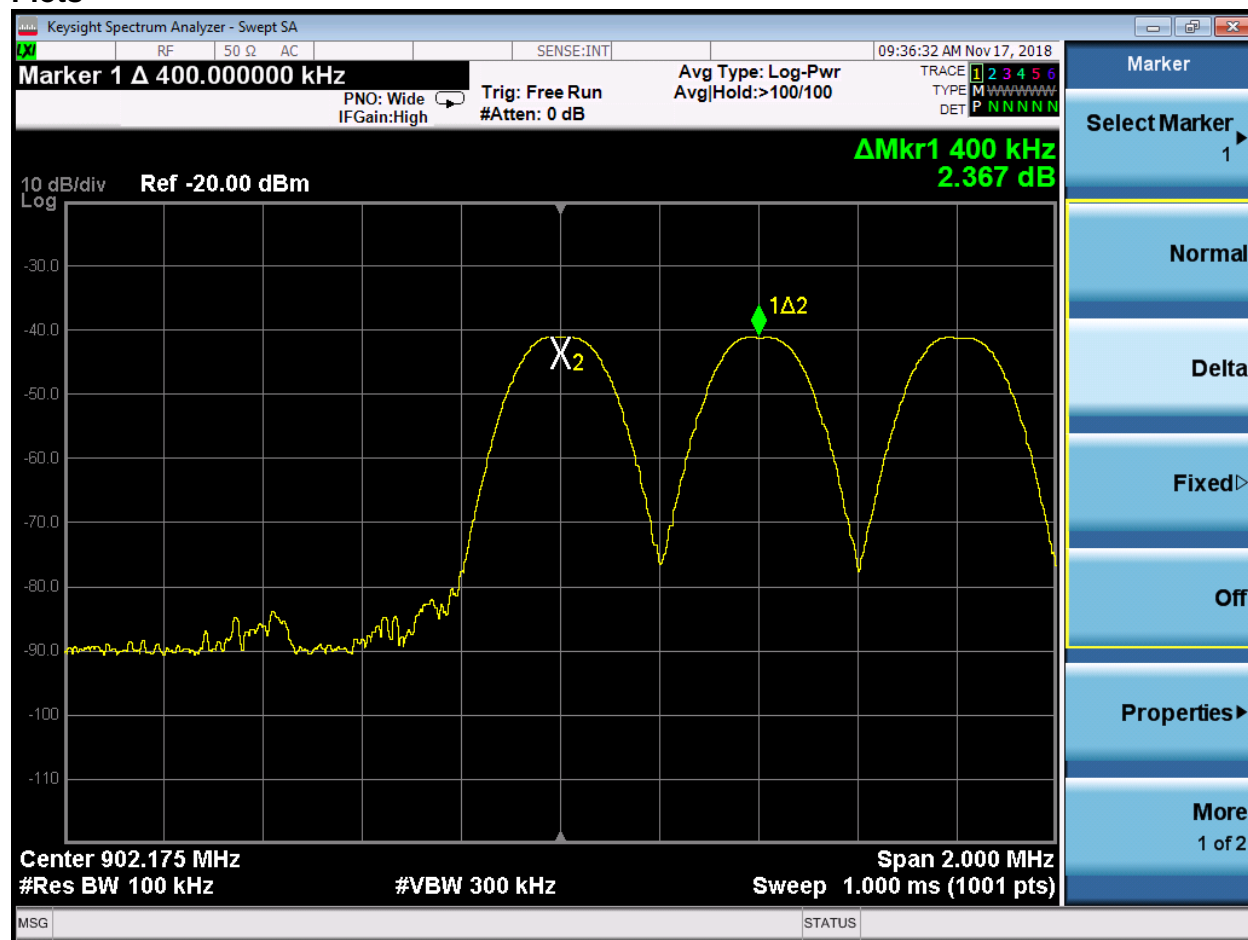
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

[15.247 (a) (1)]

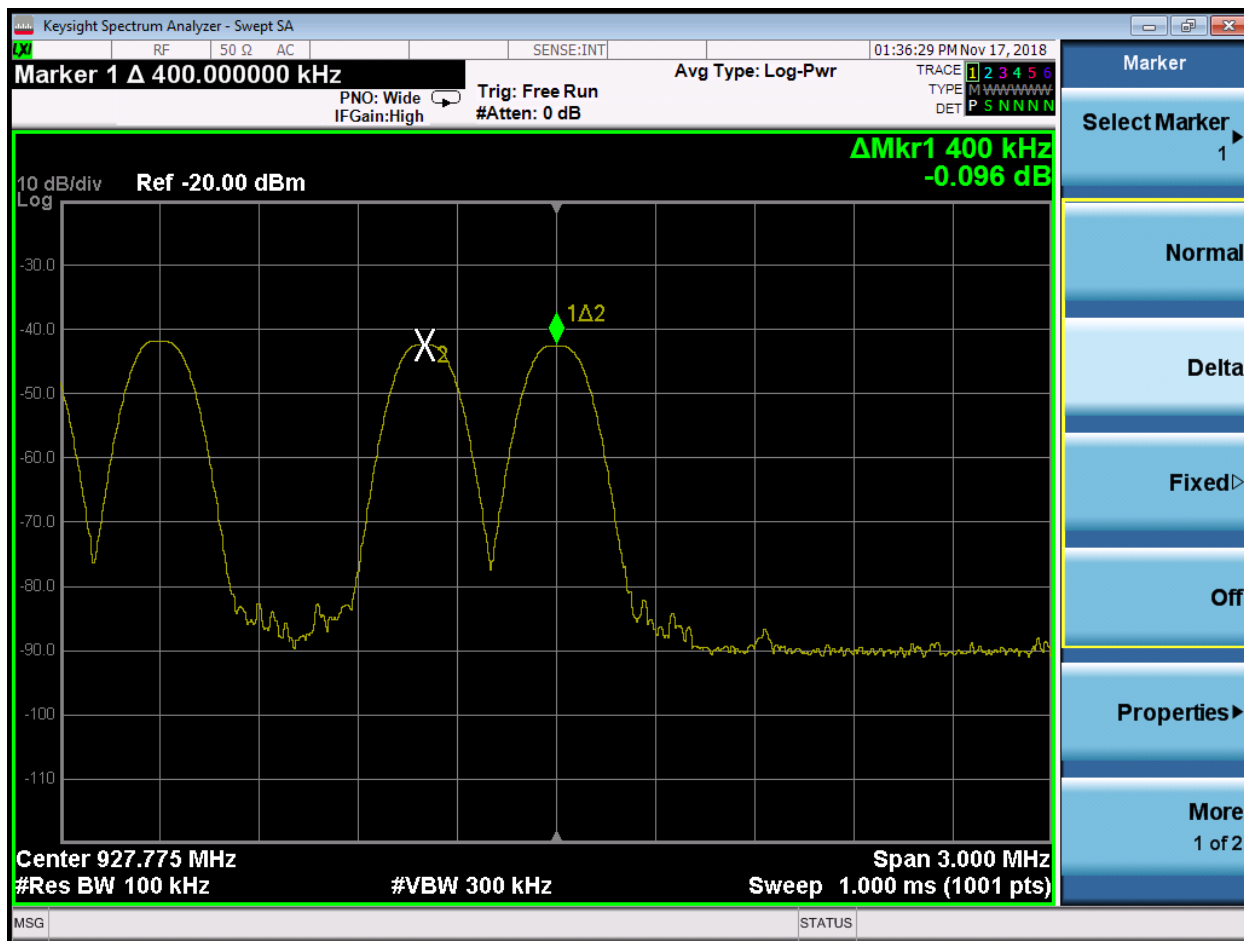
MEASUREMENTS / RESULTS

Channels are spaced by 400kHz as seen in the following plots. This is higher than both 25kHz and the 20dB bandwidth of the product.

Plots



Low End of the Band



High End of the Band



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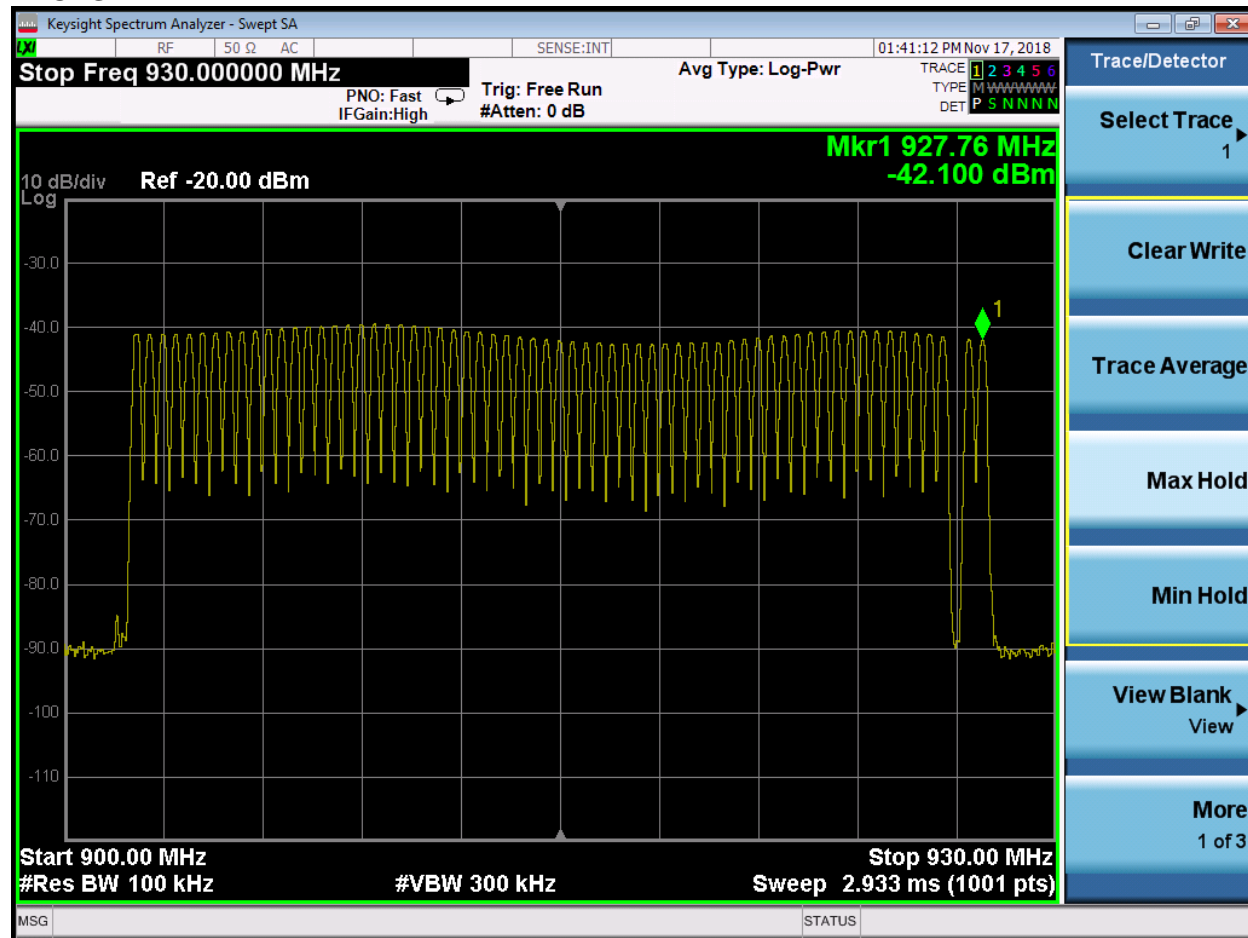


Number of Channels

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



64 Channels



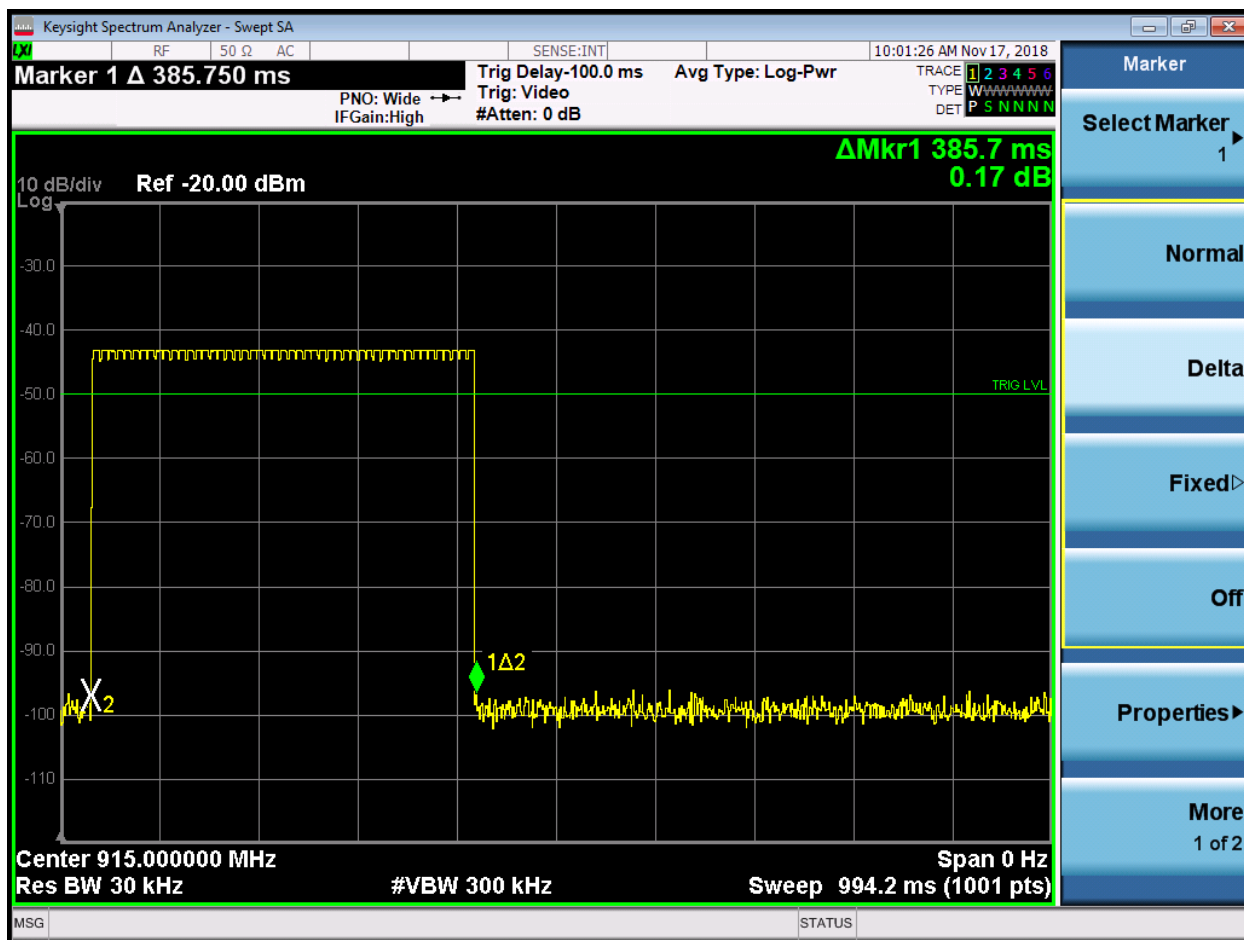
Dwell Time

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;

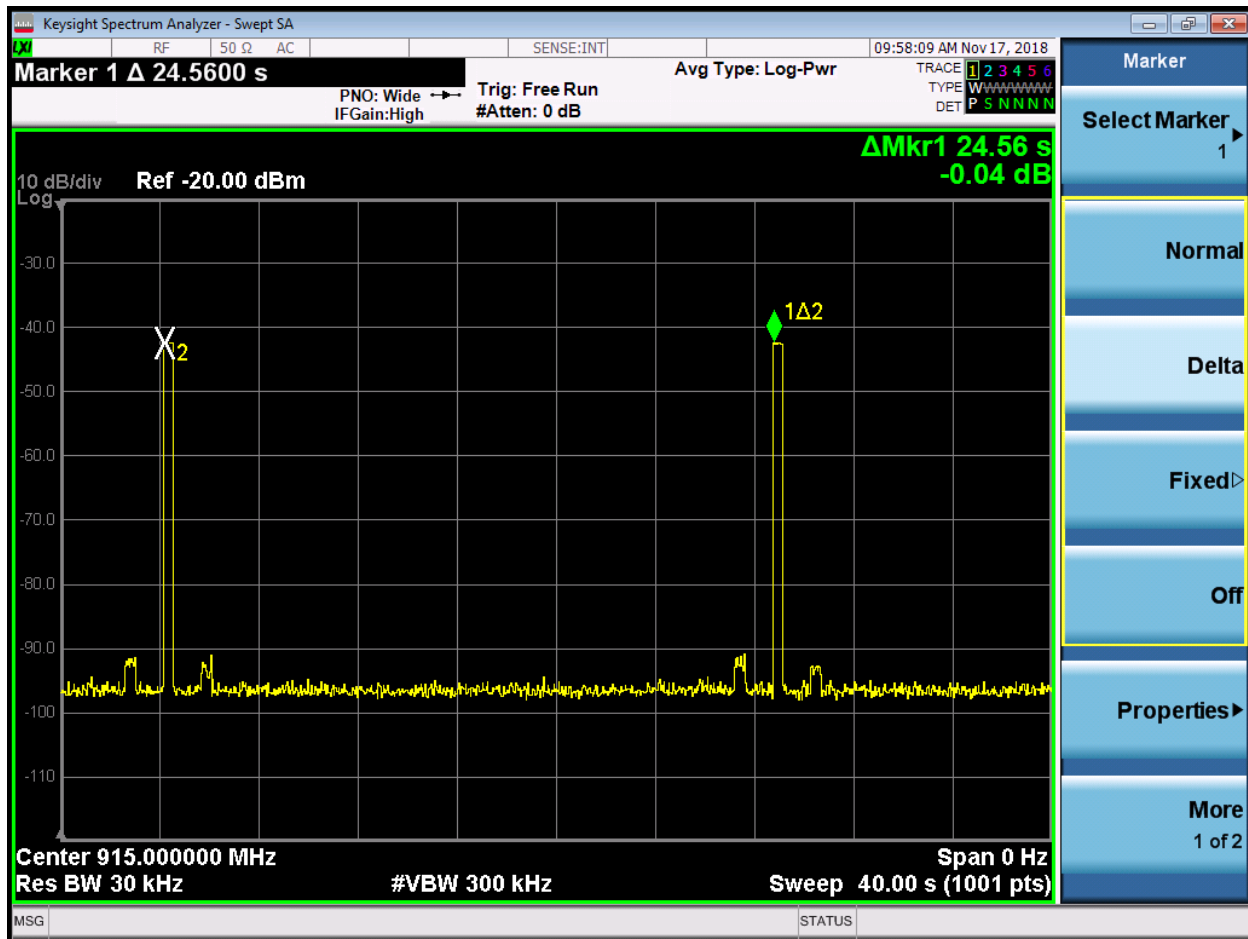
[15.247 (a) (1) (i)]

MEASUREMENTS / RESULTS

Plots



Single Hop = 385.7ms



Average Dwell time in a 20sec period = $(20s / 24.56s) * 385.7ms = 314.1ms$.
 Limit (maximum) = 400ms
 Result: Pass



Peak Output Power**LIMIT**

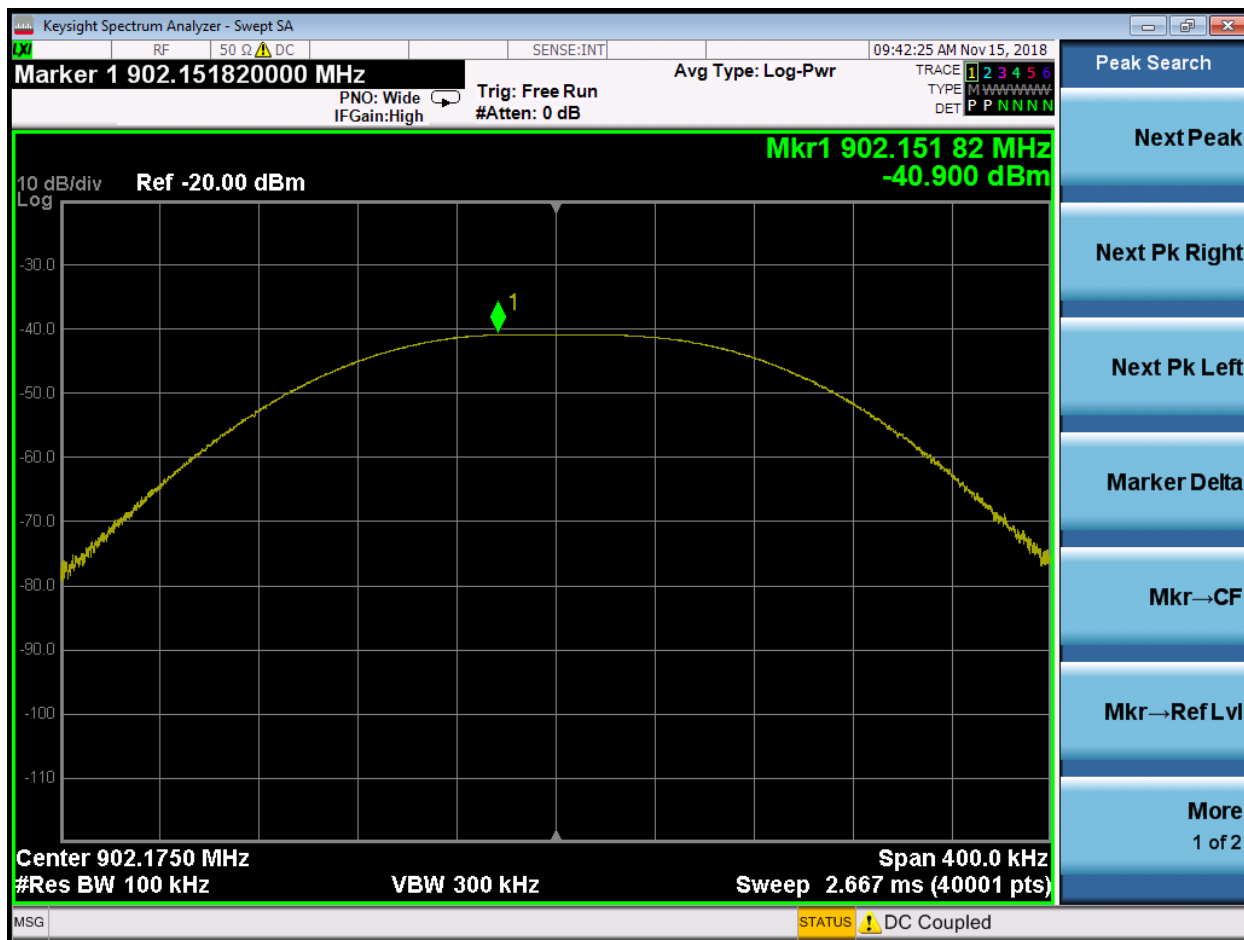
Conducted Output Power: 1 Watt [15.247(b) (2)]

MEASUREMENTS / RESULTS

Peak Output Power							
Date: 11/14/2018		Company: Slingmax Technologies, LLC			Work Order: S2970		
Engineer: Arik Zwirner		EUT: SlingMax Checkfast Node			Operating Voltage/Frequency: 3.6V DC		
Temp: 22.1°C		Humidity: 33%		Pressure: 1005mBar			
Frequency Range: 902-928 MHz				Measurement Type: Conducted			
Measurement Method: ANSI C63.10-2013							
Notes:							
Frequency	Peak Reading	Cable Loss	Attenuator Loss	Peak Output Power	Limit	Margin	Result
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	(Pass/Fail)
902.175	-40.90	0.50	40.03	-0.37	30.0	-30.37	Pass
914.975	-41.84	0.50	40.03	-1.31	30.0	-31.31	Pass
927.775	-41.74	0.50	40.03	-1.21	30.0	-31.21	Pass
Test Site: EMC-5		Cable: 2289 Cbl			Attenuator: 2121 Pad		
Analyzer: 118472 SA							
Peak Output Power (dBm)= Peak Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dB)							



PLOTS



POP Low





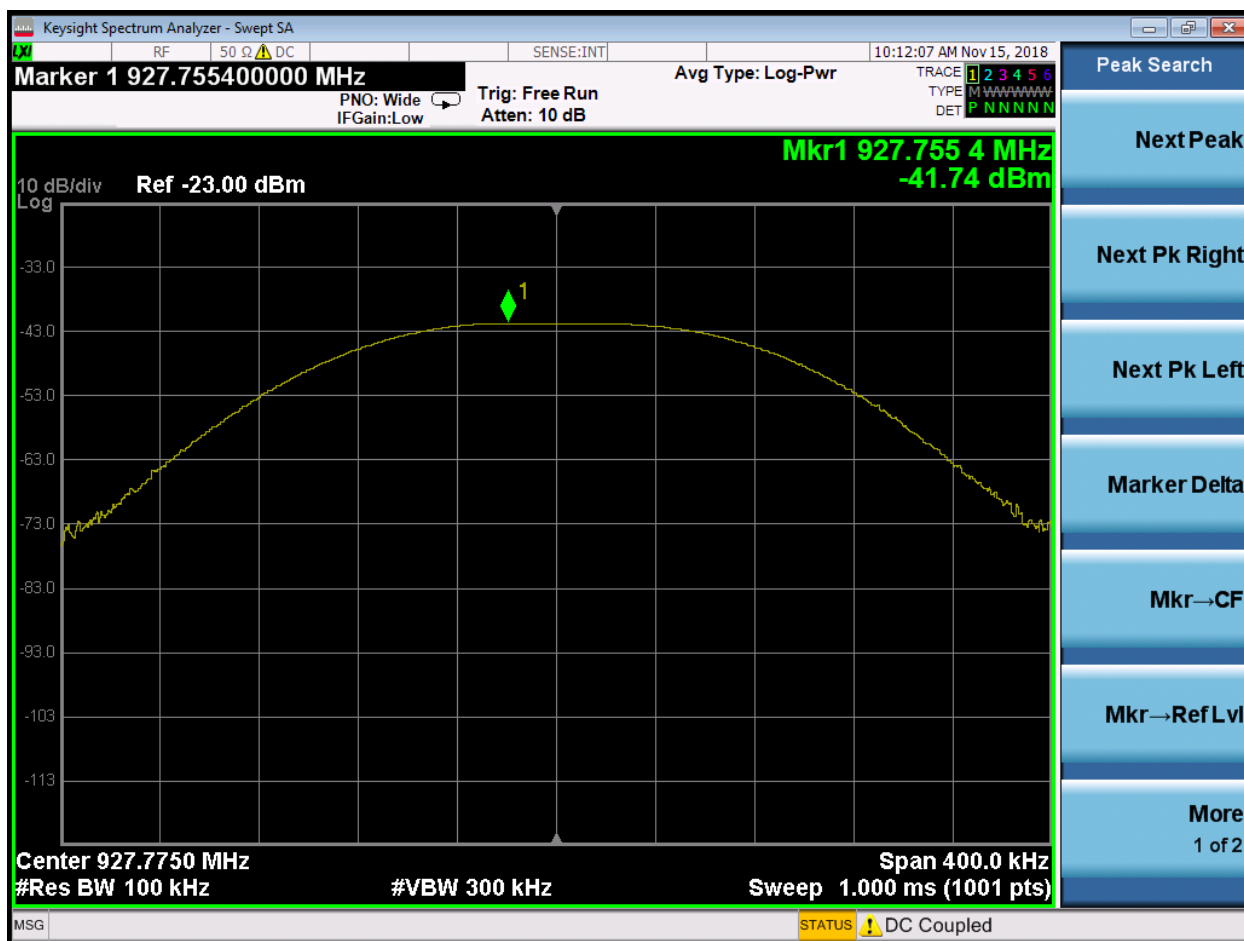
POP Mid



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POP High



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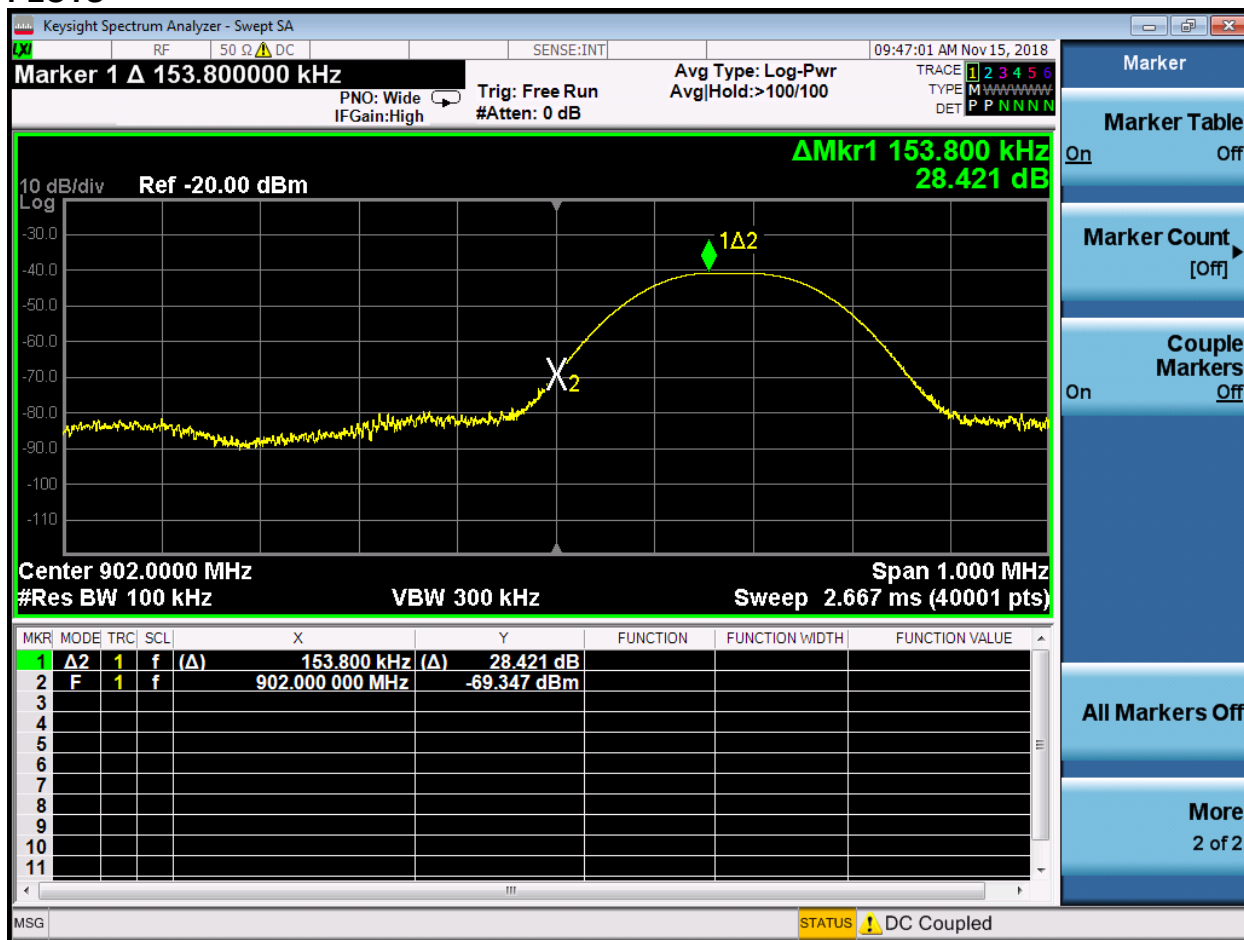
Conducted Bandedges

All band edges must be more than 20dB below the fundamental.

Conducted Bandedge					
Date: 11/14/2018		Company: Slingmax Technologies, LLC			
Engineer: Arik Zwirner		EUT: SlingMax Checkfast Node			
Temp: 22.1°C		Humidity: 33%			
		Pressure: 1005mBar			
Frequency Range: 902-928 MHz		Measurement Type: Conducted			
		Measurement Method: ANSI C63.10-2013			
Notes:					
	Delta to Peak		Limit		
	(dBm)		(dB)	(Pass/Fail)	
	28.421		≥ 20	Pass	
	34.86		≥ 20	Pass	
	31.01		≥ 20	Pass	
Low Bandedge	34.86		≥ 20	Pass	
High Bandedge	31.01		≥ 20	Pass	
Low Bandedge Hopping	43.18		≥ 20	Pass	
High Bandedge Hopping					
Test Site: EMC-5		Cable: 2289 Cbl		Attenuator: 2121 Pad	
Analyzer: 118472 SA					
Copyright Curtis-Straus LLC 2000					

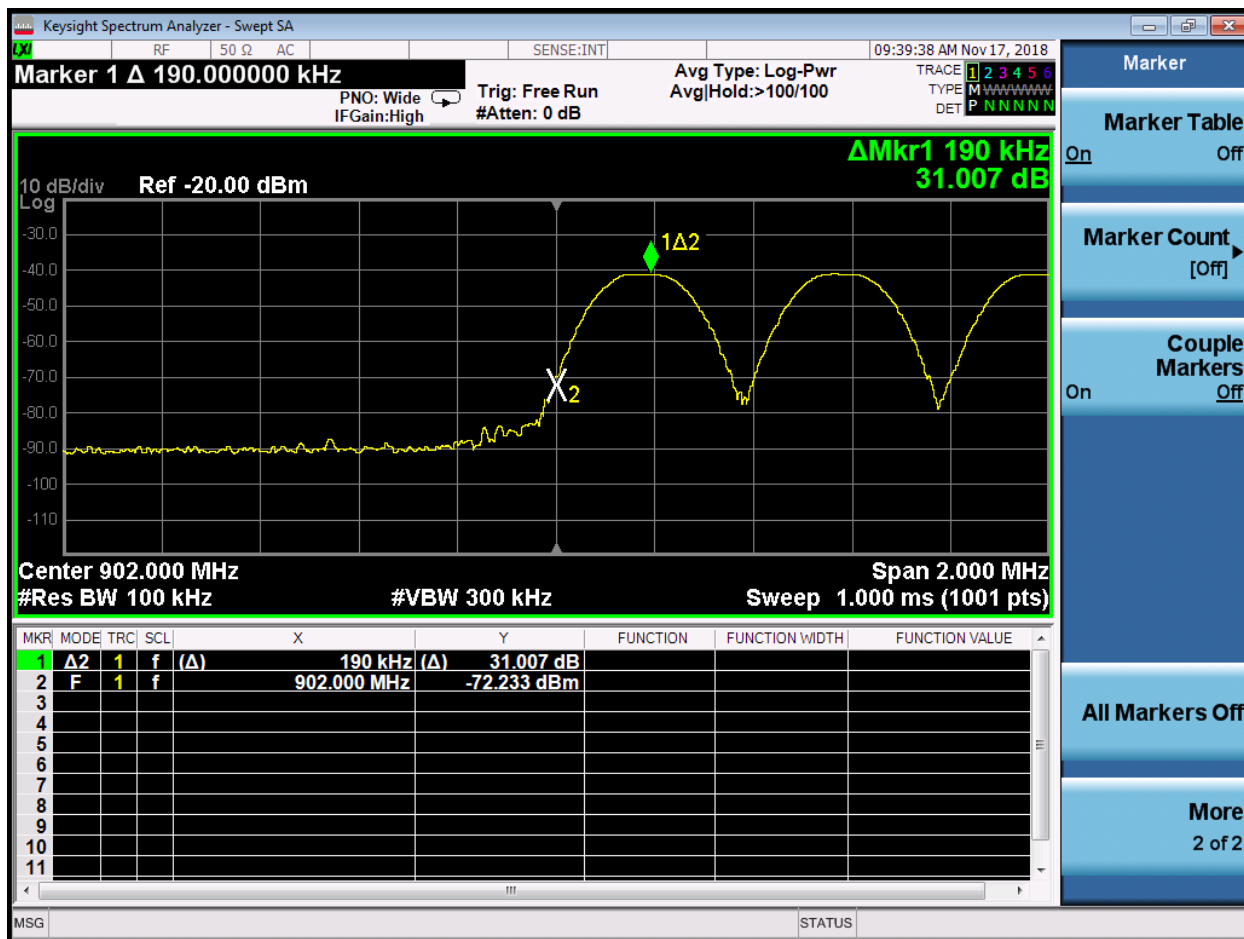


PLOTS



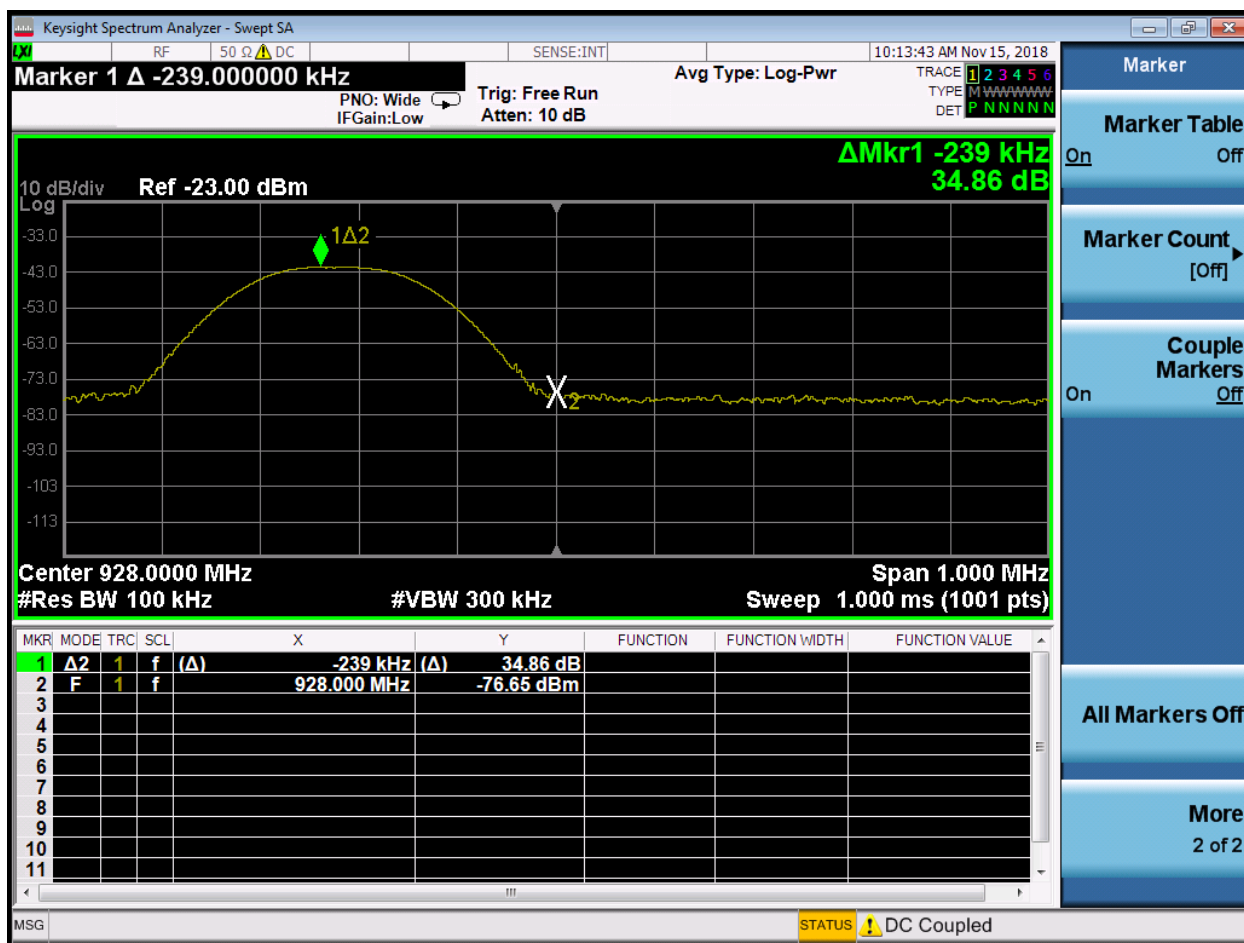
Low BE Non-hopping





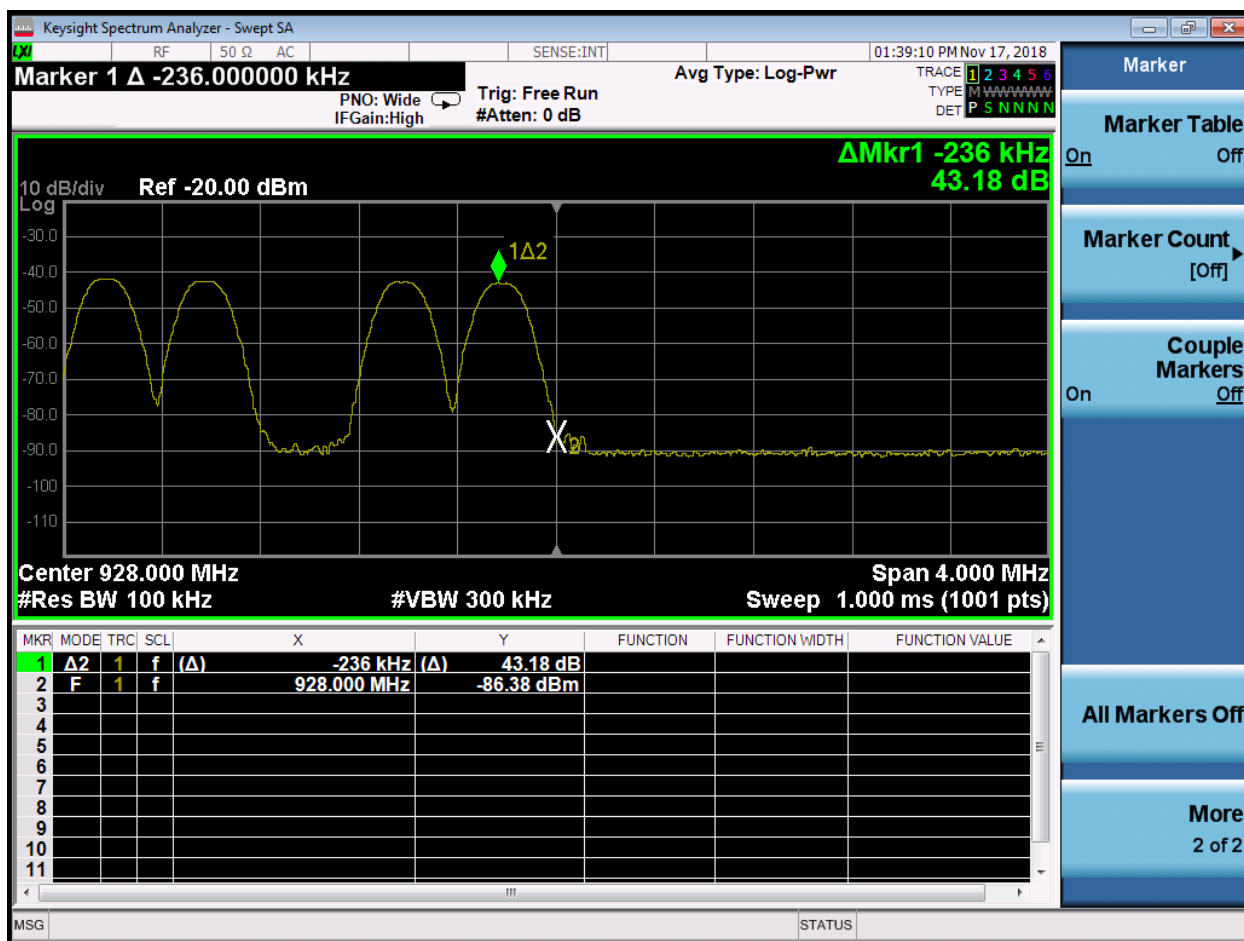
Low BE Hopping





High BE Non-hopping





High BE Hopping



Conducted Spurious

LIMITS

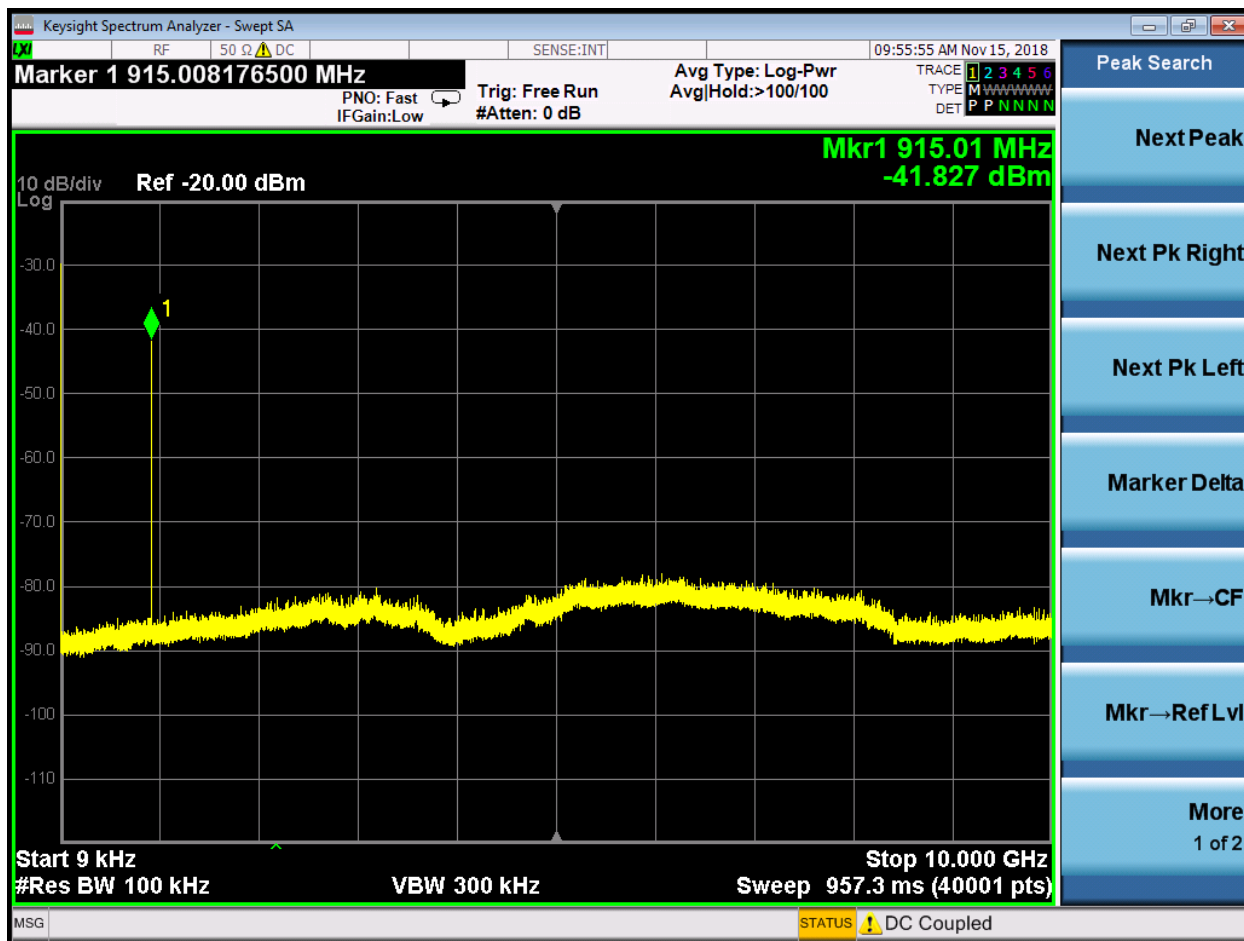
15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that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

No emissions found within 20dB of its corresponding fundamental.



Low channel





Mid channel



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High channel



Equipment used for the following tests:*20dB Bandwidth and 99% OBW**Channel Separation**Number of Hopping Channels**Dwell Time**Peak Output Power**Conducted Bandedges**Conducted Spurious Emissions*

Rev. 11/29/2018

Spectrum Analyzers / Receivers / Preselectors
Rental EXA Signal Analyzer(1118472)**Range**
9KHz-26.5GHz**MN**
N9010A-526;K**Mfr**
AT**SN**
MY51170010**Asset**
1118472**Cat**
I**Calibration Due**
8/10/2019**Calibrated on**
8/10/2018**Cables**

Asset #2289

Range
9KHz-26.5GHz

FLC-1.5FT-SMSM+

Mfr
Mini-Circuits

16021039

Cat
II**Calibration Due**
1/29/2019**Calibrated on**
1/29/2018

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



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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)]

MEASUREMENTS / RESULTS

Curtis Straus - a Bureau Veritas Company							Work Order - S2970						
Radiated Emissions Electric Field 3m Distance							EUT Power Input - battery						
Top Peaks Horizontal 30-1000MHz							Test Site - CH-2						
Operator: AKZ							Conditions - 23°C; 14%RH; 1004mBar						
Notes:							0						
Mid Channel							0						
Data Taken at 05:36:33 PM, Monday, November 12, 2018													
Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_1 09_Class_B (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Lim2: FCC_pt15_2 09 (dBμV/m)	Lim2 Margin (dB)	Lim2 Test Results (Pass/Fail)	Worst Margin Lim2 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.315	36.3	-7.6	28.8	40	-11.2	PASS	-11.2	40	-11.2	PASS	-11.2	100	315
36.378	37.9	-12.7	25.1	40	-14.9	PASS		40	-14.9	PASS		250	270
171.814	37.4	-17	20.4	43.5	-23.1	PASS		43.5	-23.1	PASS		250	45
196.404	36.1	-16.5	19.7	43.5	-23.8	PASS		43.5	-23.8	PASS		100	45
466.379	40.1	-10.2	29.9	46	-16.2	PASS		46	-16.1	PASS		250	225
815.482	30.9	-2	28.9	46	-17.1	PASS		46	-17.1	PASS		200	270
Curtis Straus - a Bureau Veritas Company							Work Order - S2970						
Radiated Emissions Electric Field 3m Distance							EUT Power Input - battery						
Top Peaks Vertical 30-1000MHz							Test Site - CH-2						
Operator: AKZ							Conditions - 23°C; 14%RH; 1004mBar						
Notes:							0						
Mid Channel							0						
Data Taken at 05:36:33 PM, Monday, November 12, 2018													
Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_1 09_Class_B (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Lim2: FCC_pt15_2 09 (dBμV/m)	Lim2 Margin (dB)	Lim2 Test Results (Pass/Fail)	Worst Margin Lim2 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
30.315	36.7	-7.6	29.2	40	-10.8	PASS	-10.8	40	-10.8	PASS	-10.8	150	0
36.402	38.3	-12.7	25.6	40	-14.4	PASS		40	-14.4	PASS		150	315
441.838	35.6	-10.8	24.8	46	-21.2	PASS		46	-21.2	PASS		150	225
466.379	42	-10.2	31.7	46	-14.3	PASS		46	-14.3	PASS		100	225
490.896	36.2	-9.6	26.6	46	-19.4	PASS		46	-19.4	PASS		100	315
788.928	30.9	-2.3	28.6	46	-17.4	PASS		46	-17.4	PASS		200	180

30-1000MHz Mid Channel

Low and high channels were not tested in this range since passing margin on mid channel was more than 10dB.



Radiated Emissions Table

Date: 07-Nov-18		Company: Slingmax Technologies, LLC							Work Order: S2970					
Engineer: AZ / ZJ		EUT Desc: Checkfast							EUT Operating Voltage/Frequency: 3.7V DC					
Temp: 22.4°C		Humidity: 44%							Pressure: 1007mBar					
Frequency Range: 2700-2800MHz										Measurement Distance: 3 m				
Notes: Reduced output power to 9dBm Added 0.3dB for notch filter														
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)
Low Channel														
H	2706.6	46.0	42.5	25.3	32.5	3.3	56.5	53.0	74.0	-17.5	Pass	54.0	-1.0	Pass
V	2706.6	45.4	42.1	25.3	32.5	3.3	55.9	52.6	74.0	-18.1	Pass	54.0	-1.4	Pass
Mid Channel														
H	2745.0	43.9	39.6	25.3	32.5	3.3	54.4	50.1	74.0	-19.6	Pass	54.0	-3.9	Pass
V	2745.0	44.8	41.7	25.3	32.5	3.3	55.3	52.2	74.0	-18.7	Pass	54.0	-1.8	Pass
High Channel														
H	2783.4	44.8	41.5	25.3	32.6	3.3	55.4	52.1	74.0	-18.6	Pass	54.0	-1.9	Pass
V	2783.4	44.7	39.9	25.3	32.6	3.3	55.3	50.5	74.0	-18.7	Pass	54.0	-3.5	Pass
Table Result:				Pass		by		-1.0 dB		Worst Freq: 2706.6 MHz				
Test Site: EMI Chamber 2		Cable 1: Asset #2459							Cable 2: Asset #2480			Cable 3: ---		
Analyzer: 2093 SA		Preamp: Asset #2444							Antenna: Blue Horn			Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.210														
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														
Filter: 2130 Notch														
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Third Harmonic Data Table

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Curtis Straus - a Bureau Veritas Company	Work Order - S2970
Radiated Emissions Electric Field 3m Distance	EUT Power Input - battery
1-6GHz Horizontal Data	Test Site - CH-2
Operator: AKZ	Conditions - 23°C; 14%RH; 1004mBar
Notes:	0
Low Channel	0

Data Taken at 11:58:45 AM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
1804.4	45.1	39.4	-6	39.2	74	-34.8	PASS		33.5	54	-20.5	PASS		225	38
5596.9	39.5	30.6	4.6	44.1	74	-29.9	PASS		35.2	54	-18.7	PASS		297	0

Curtis Straus - a Bureau Veritas Company	Work Order - S2970
Radiated Emissions Electric Field 3m Distance	EUT Power Input - battery
1-6GHz Vertical Data	Test Site - CH-2
Operator: AKZ	Conditions - 23°C; 14%RH; 1004mBar
Notes:	0
Low Channel	0

Data Taken at 11:58:45 AM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5852	39.1	30.4	5.1	44.2	74	-29.8	PASS		35.5	54	-18.5	PASS		194	227

1-6GHz Low Channel



Curtis Straus - a Bureau Veritas Company	Work Order - S2970
Radiated Emissions Electric Field 3m Distance	EUT Power Input - battery
1-6GHz Horizontal Data	Test Site - CH-2
Operator: AKZ	Conditions - 23°C; 14%RH; 1004mBar
Notes:	0
Mid Channel	0

Data Taken at 02:04:07 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5897.4	38.6	30.6	5.1	43.7	74	-30.3	PASS	-30.3	35.6	54	-18.4	PASS		175	242

Curtis Straus - a Bureau Veritas Company	Work Order - S2970
Radiated Emissions Electric Field 3m Distance	EUT Power Input - battery
1-6GHz Vertical Data	Test Site - CH-2
Operator: AKZ	Conditions - 23°C; 14%RH; 1004mBar
Notes:	0
Mid Channel	0

Data Taken at 02:04:07 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5908.5	38.7	30.5	5.1	43.8	74	-30.2	PASS		35.6	54	-18.4	PASS		288	144

1-6GHz Mid Channel



Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Horizontal Data
 Operator: AKZ
 Notes:
 High Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar
 0
 0

Data Taken at 02:49:16 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
1855.6	48.1	42.3	-5.7	42.4	74	-31.6	PASS		36.6	54	-17.4	PASS		100	25
5463.4	40.2	30.6	5.3	45.5	74	-28.4	PASS		36	54	-18	PASS		292	71

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Vertical Data
 Operator: AKZ
 Notes:
 High Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar
 0
 0

Data Taken at 02:49:16 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_1 09_ClassB_ AVG (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
5730.7	40.6	30.6	4.8	45.4	74	-28.6	PASS	-28.6	35.4	54	-18.6	PASS		125	6

1-6GHz High Channel



Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Horizontal 6-18GHz
 Operator: AKZ
 Notes:
 Low Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar
 0
 0

Data Taken at 04:21:09 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_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)
9757.6	43.7	11.4	55	83.5	-28.5	PASS	-28.5	63.5	-8.5	PASS	-8.5	150	120

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Vertical 6-18GHz
 Operator: AKZ
 Notes:
 Low Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar
 0
 0

Data Taken at 04:21:09 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_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)
9964	43.6	11.5	55.1	83.5	-28.4	PASS	-28.4	63.5	-8.4	PASS	-8.4	200	22

6-10GHz Low Channel



Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Horizontal 6-18GHz
 Operator: AKZ
 Notes:
 Mid Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar

Data Taken at 04:00:40 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_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)
9955.6	43.1	11.5	54.6	83.5	-28.9	PASS	-28.9	63.5	-8.9	PASS	-8.9	175	170

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Vertical 6-18GHz
 Operator: AKZ
 Notes:
 Mid Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar

Data Taken at 04:00:40 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_ Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_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)
9950.2	44.7	11.6	56.3	83.5	-27.2	PASS	-27.2	63.5	-7.2	PASS	-7.2	150	145

6-10GHz Mid Channel



Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Horizontal 6-18GHz
 Operator: AKZ
 Notes:
 High Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar

Data Taken at 04:49:04 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_1 Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_ClassB_1 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)
9957.3	43.6	11.5	55.1	83.5	-28.4	PASS	-28.4	63.5	-8.4	PASS	-8.4	200	71

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 Top Peaks Vertical 6-18GHz
 Operator: AKZ
 Notes:
 High Channel

Work Order - S2970
 EUT Power Input - battery
 Test Site - CH-2
 Conditions - 23°C; 14%RH; 1004mBar

Data Taken at 04:49:04 PM, Monday, November 12, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_1 09_ClassB_1 Peak (dBμV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_1 09_ClassB_1 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)
9716.1	43.7	11.5	55.2	83.5	-28.3	PASS	-28.3	63.5	-8.3	PASS	-8.3	100	269

6-10GHz High Channel

Rev. 11/8/2018

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 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	12/21/2018	12/21/2016
EMI Chamber 2	719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018	12/21/2016
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2310 PA	1-1000MHz	PAM-103	COM-POWER	441175	2310	II	10/29/2019	10/29/2018
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
Yellow Horn	1-18GHz	3115	EMCO	9608-4898	37	I	8/20/2020	8/20/2018
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	5/15/2020	5/15/2018
TH A#2080		HTC-1	HDE		2080	II	3/23/2019	3/23/2018
Cables	Range		Mfr		Cat		Calibration Due	Calibrated on
Asset #2459	9KHz-18GHz		MegaPhase		II		10/31/2019	10/31/2018
Asset #2464	9KHz-18GHz		MegaPhase		II		10/31/2019	10/31/2018
Asset #2480	9KHz-18GHz		MegaPhase		II		10/29/2019	10/29/2018
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.



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
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AC Line Conducted Emissions

LIMITS

AC line conducted emissions must comply with the conducted emission limits specified in Section 15.207.

Results: N/A. EUT is battery powered only.



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.

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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