Test Report

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

Report No	ER2258-2
Client	SignalFire Telemetry, Inc. Josh Schadel
Address	43 Broad Street, C-300 Hudson, MA 01749
Phone	(978) 212 - 2869
Items tested	Flow Totalizer
FCC ID	W8V-FT
IC	8373A-FT
FRN	0018614347
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	8/7/2017 -8/9/2017
Results	As detailed within this report
Prepared by	Zac Johnson – Test Engineer
Authorized by	Jason Haley – Sr. EMC Engineer
Issue Date	9/19/2017
Conditions of Issue	This Test Report is issued subject to the conditions stated in the '*Conditions of Testing*' section on page 26 of this report.

Contents

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, ISED Canada RSS-247 Issue 2

The Flow Totalizer is a frequency hopping transmitter that operates in the frequency range of 905MHz - 924.8MHz. It has an antenna with 5.8dBi peak gain. It is powered by an internal 3.6V DC battery.

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

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	September 19, 2017

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.

Radiated emissions were maximized around 3 orthogonal planes. EUT antenna is integral and therefore could not be maximized separately.

Conducted emissions testing at the antenna port was performed.

AC mains conducted emissions testing was not performed since the device is battery powered only.

3 channels were tested as follows:
Low channel = 905 MHz
Middle channel = 915 MHz
High channel = 924.8 MHz

When hopping, the product was configured for the transmission to be either in the range of 905-914.8MHz (Low Band), or 915-924.8MHz (High Band) respectively.

Following bandwidths were used during radiated spurious emissions testing.

Frequency	RBW	VBW
30-1000MHz	120kHz	1MHz
1-10GHz	1MHz	3MHz

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Product Tested - Configuration Documentation

EUT Configuration			
Work Order:	R2258		
Company:	Signal Fire Telemetry		
Company Address:	43 Broad St, Suite A-403		
	Hudson, MA, 01749		
Contact:	Josh Schadel		
	MN	**PN**	**SN**
EUT:	Flow Totalizer	--	Sample 1
EUT Description:	Wireless pressure sensor		
EUT Max Frequency:	924.8 MHz		
EUT Min Frequency:	0.032 MHz		
Support Equipment	**MN**	**SN**	
Lenovo Laptop	x100e	--	
Software Operating Mode Description:			
EUT is set to transmit on Low (905 MHz), Mid (915 MHz) and High (924.8 MHz) respectively.			
Performance Criteria:			
EMI testing only			

Clock Frequencies	
frequencies (MHz)	924.8, 915, 905, 32, 0.032

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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	The antenna for this device is internal PCB chip antenna with 2dBi 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
6.6				Occupied Bandwidth measurements were made.

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Test Results

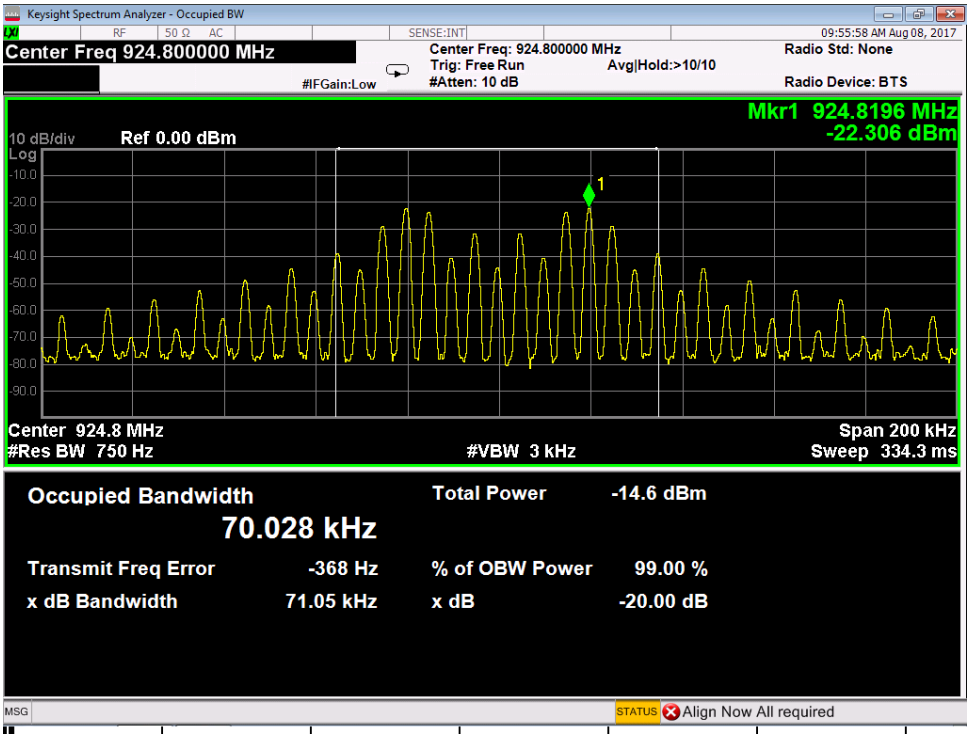
20dB Bandwidth

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

PLOTS



924.8MHz High Channel

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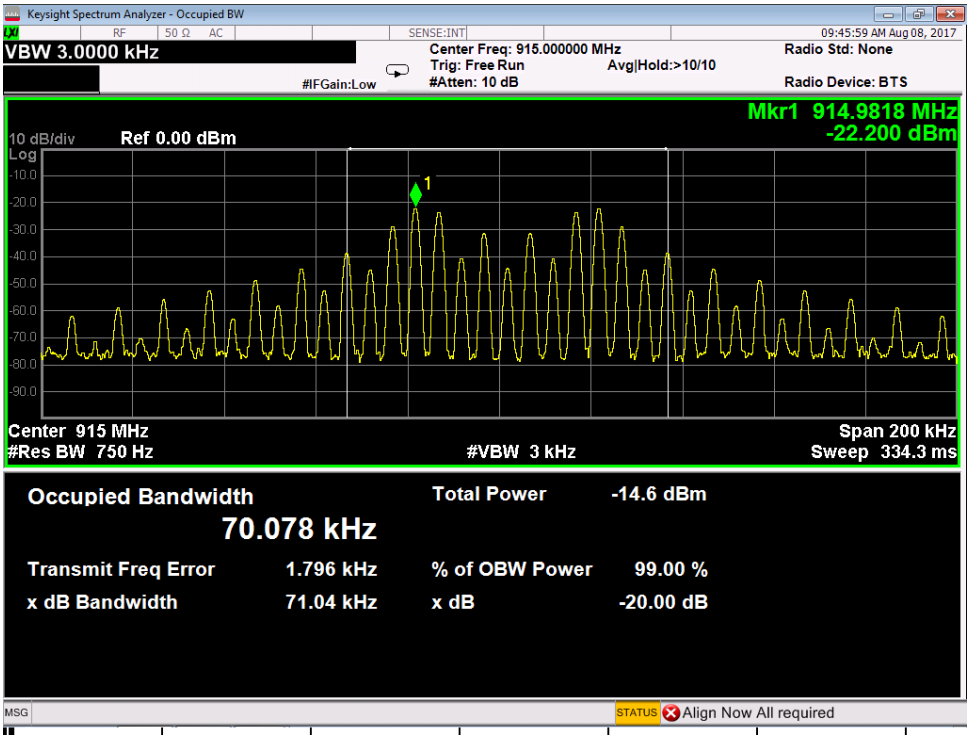
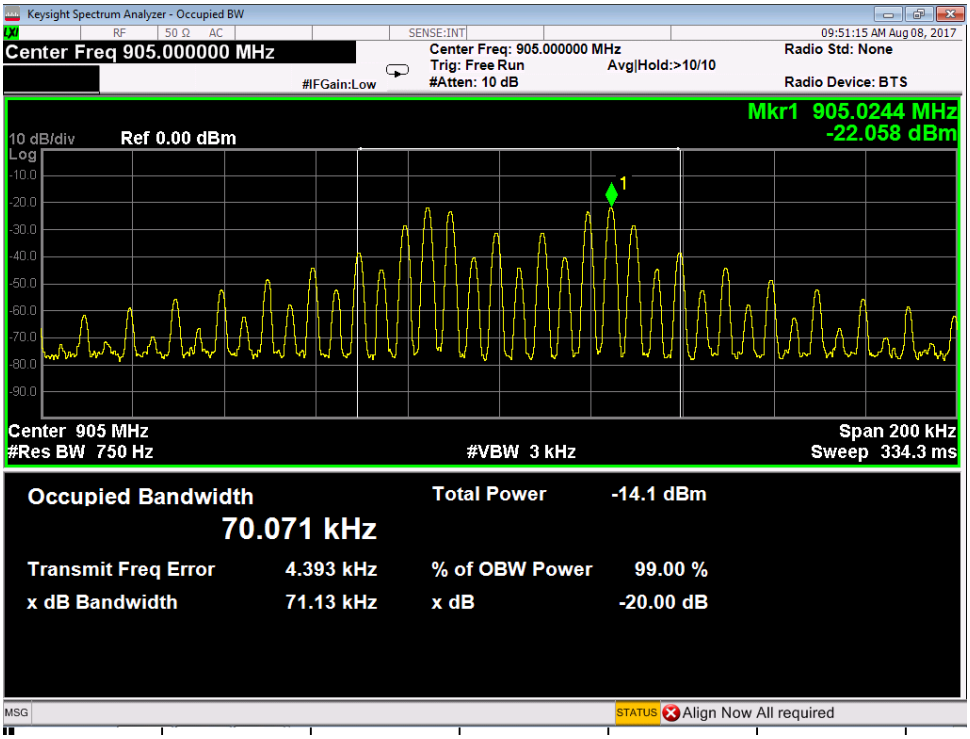


915MHz Mid Channel



905MHz Low Channel

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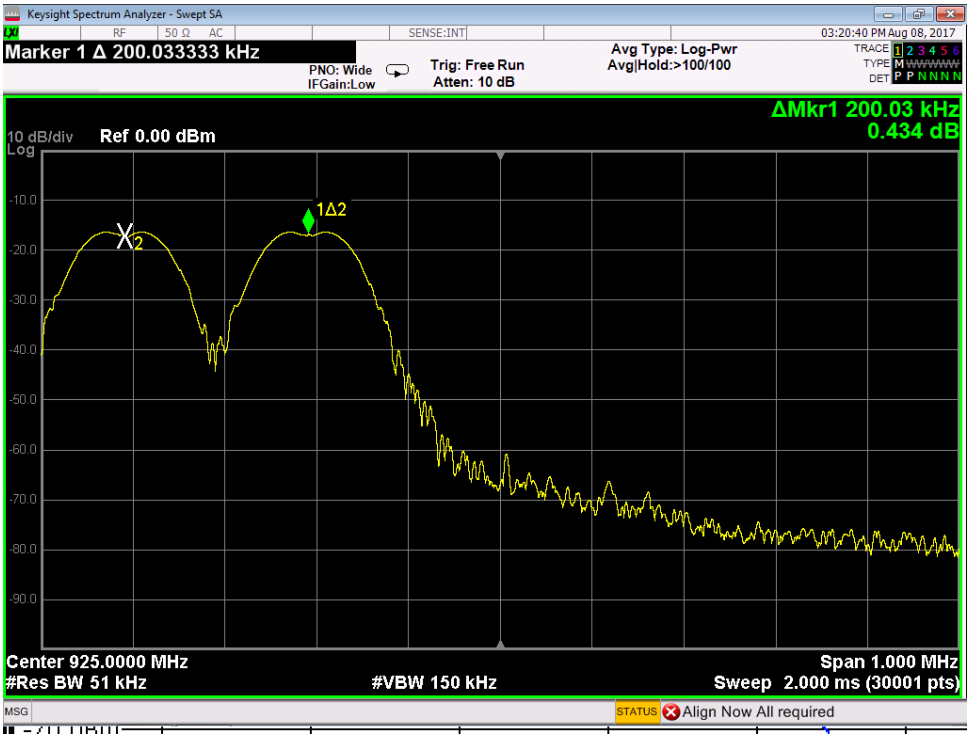
Channel Separation

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 200kHz as seen in the following plots. This is higher than both 25kHz and the 20dB bandwidth of the product.

Plots



High Band

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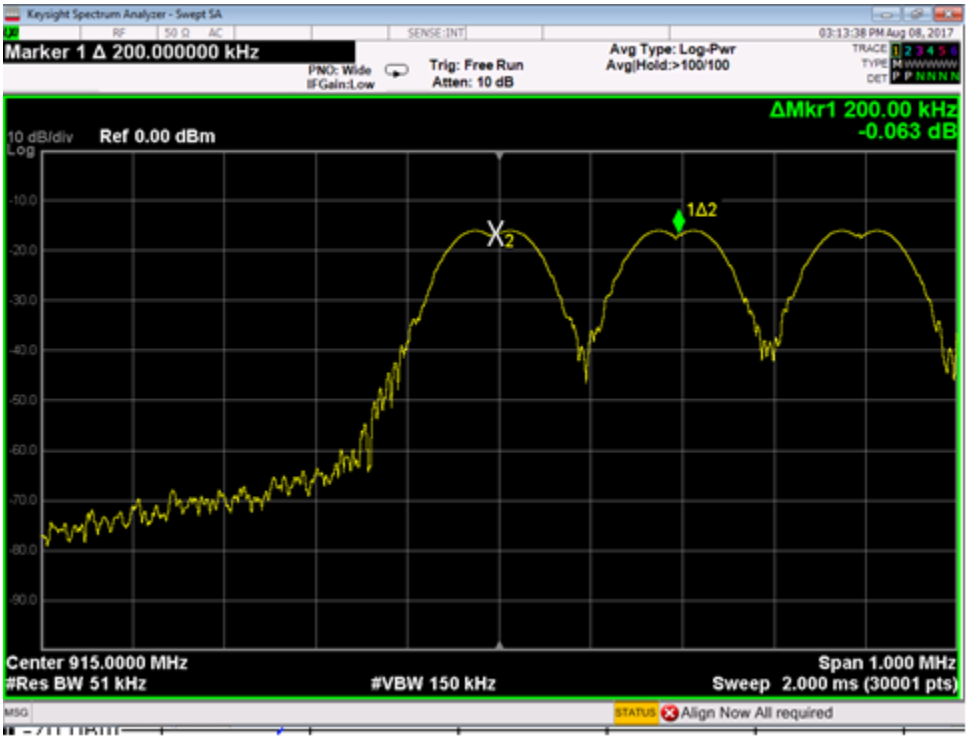
Mid Band I



Mid Band II

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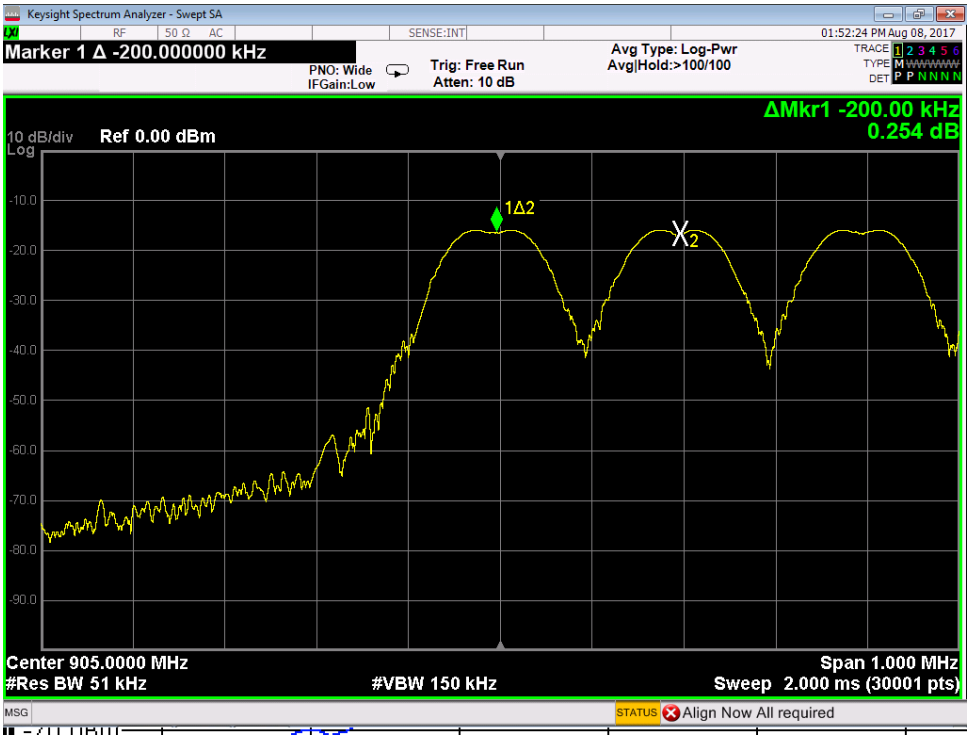

Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ -200.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
01:52:24 PM Aug 08, 2017
ΔMkr1 -200.00 kHz
0.254 dB
10 dB/div
Log
Ref 0.00 dBm
1Δ2
Center 905.0000 MHz
#Res BW 51 kHz
#VBW 150 kHz
Span 1.000 MHz
Sweep 2.000 ms (30001 pts)
Align Now All required

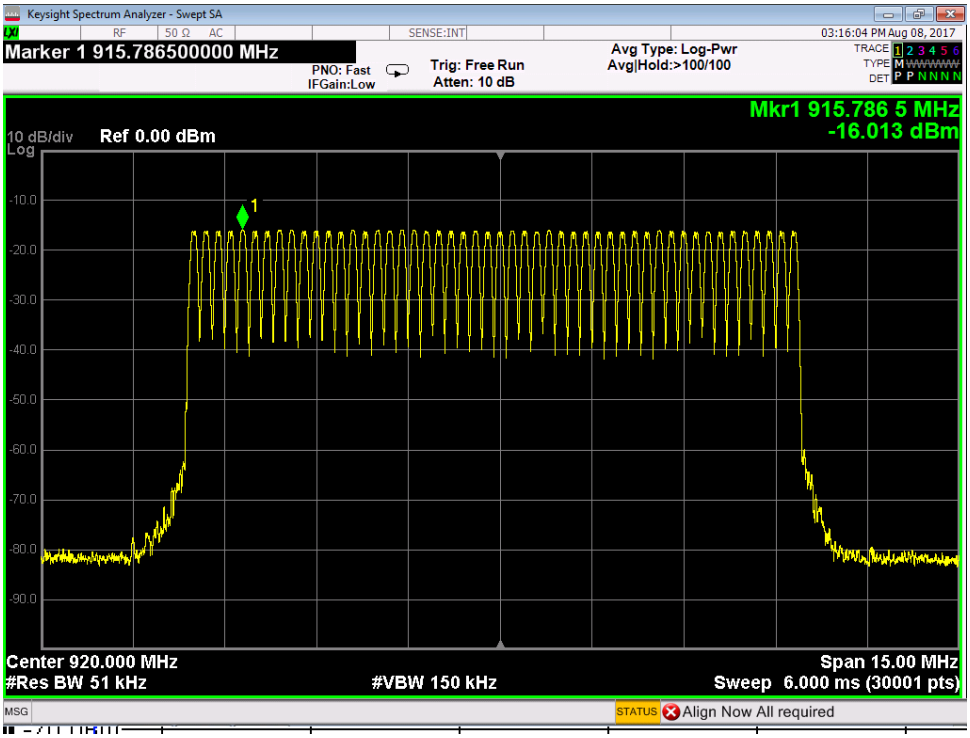
Low Band

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



50 Channels – High Band

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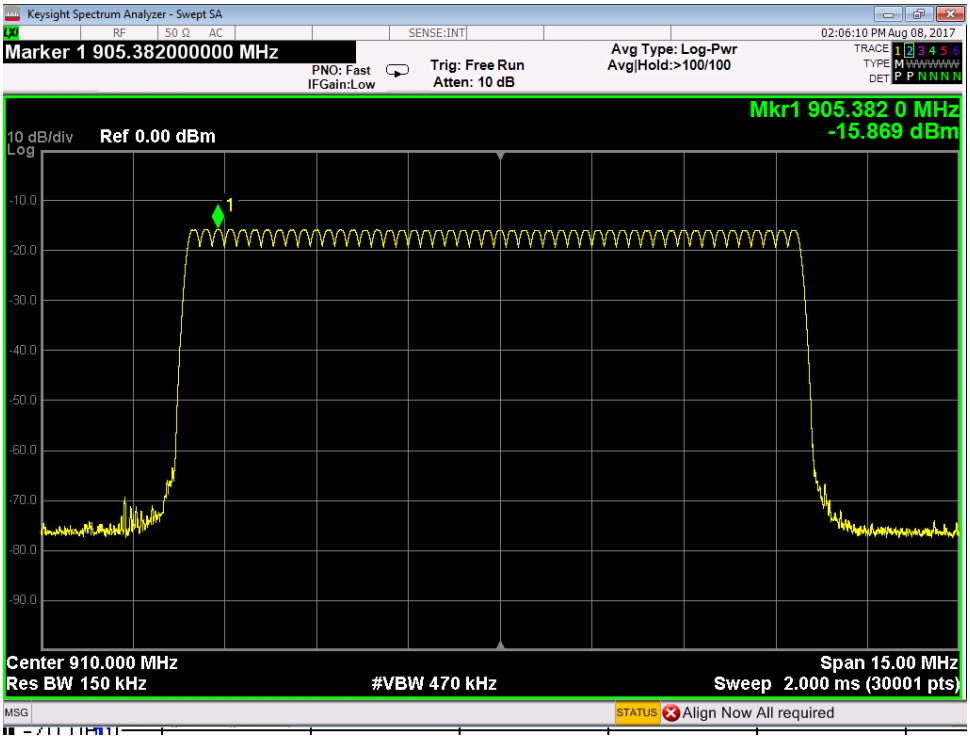


50 Channels – Low Band

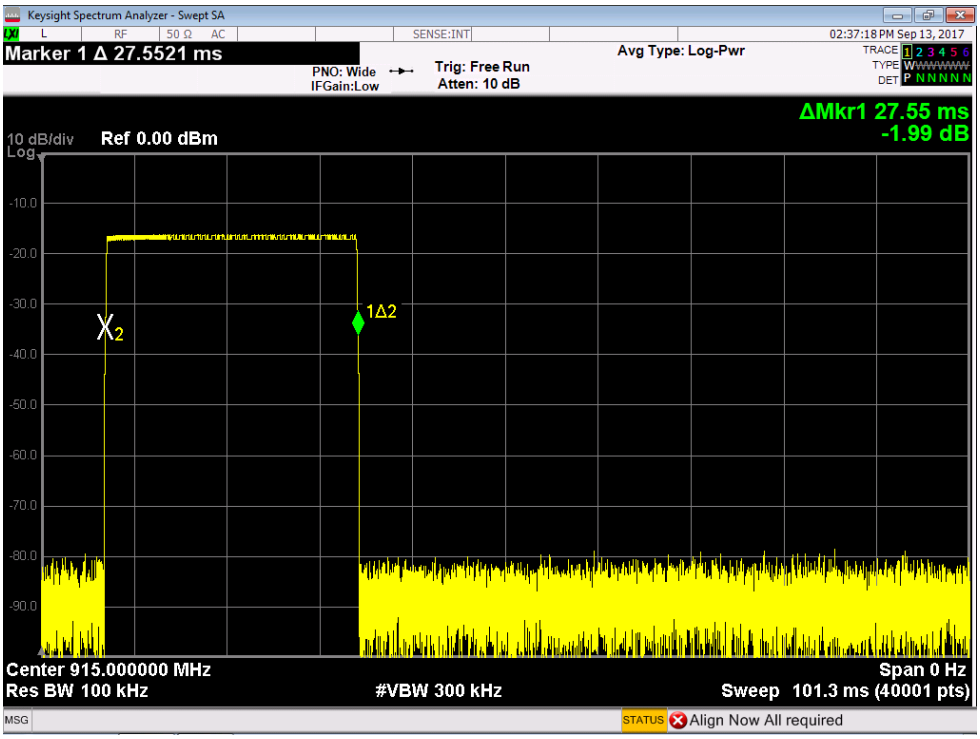
Dwell Time

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 = 27.55ms

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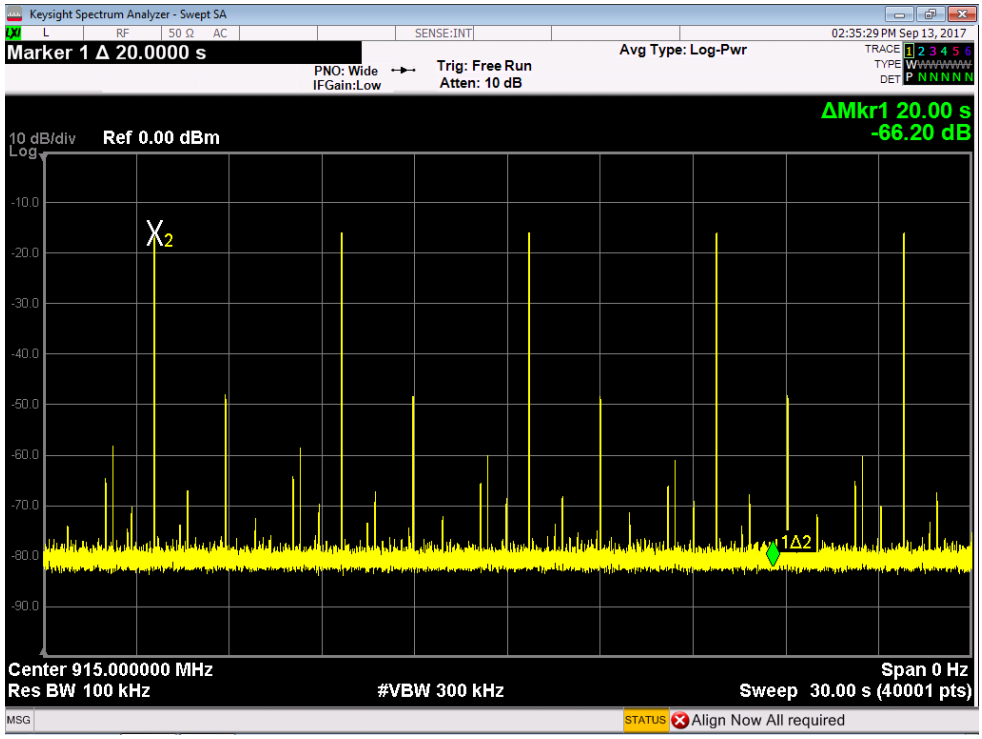

4 hops within a 20sec period

Dwell time in a 20sec period = 4*27.55ms = 110.2ms. Limit (maximum) = 400ms

***Duty Cycle Correction Factor is not needed since all peak readings over 1GHz pass average limit

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Peak Output Power

LIMIT

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

MEASUREMENTS / RESULTS

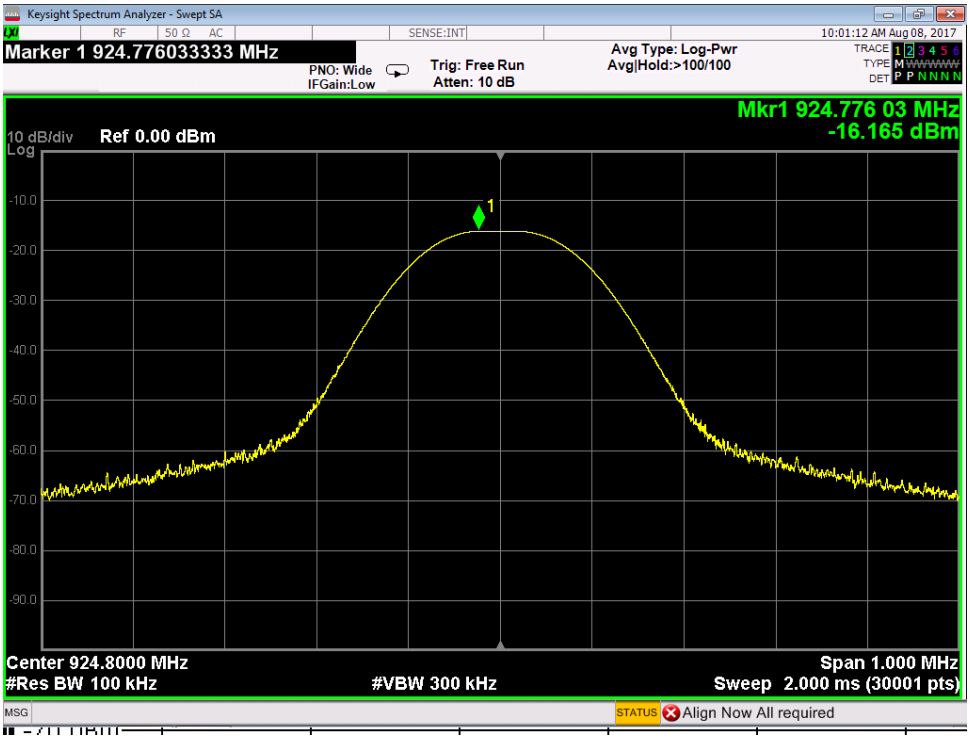
Peak Output Power

Date: 8/8/2017 **Company:** Signal Fire Telemetry **Work Order:** R2258
Engineer: Zac Johnson **EUT:** Pressure Scout Flow Totalizer **Operating Voltage/Frequency:** 3.6V DC
Temp: 22.6°C **Humidity:** 49% **Pressure:** 1010mBar
Frequency Range: 2402-2480 MHz **Measurement Type:** Conducted
Notes:

Frequency (MHz)	Peak Reading (dBm)	Cable Loss (dB)	Attenuator Loss (dB)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result (Pass/Fail)
905	-15.97	0.32	29.30	13.65	30.0	-16.35	Pass
915	-16.05	0.32	29.30	13.57	30.0	-16.43	Pass
925	-16.17	0.32	29.30	13.46	30.0	-16.55	Pass

Test Site: Wireless Test Room **Cable:** 2287 Cbl **Attenuator:** A2121
Analyzer: A2200
Peak Output Power (dBm)= Peak Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dB)

PLOTS



924.8MHz High Channel

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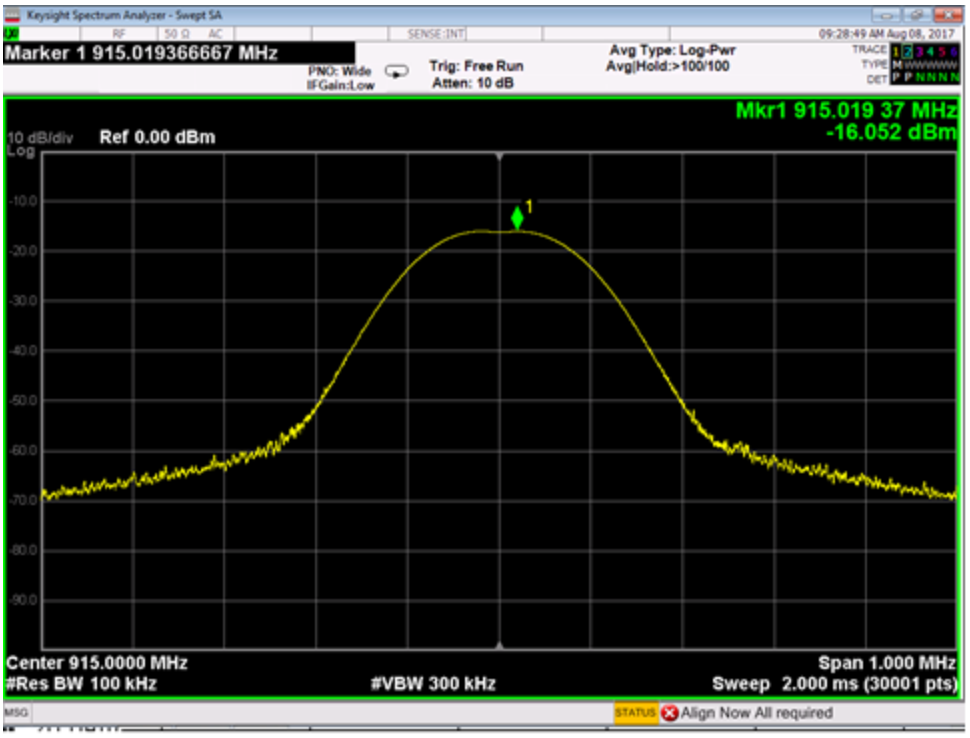
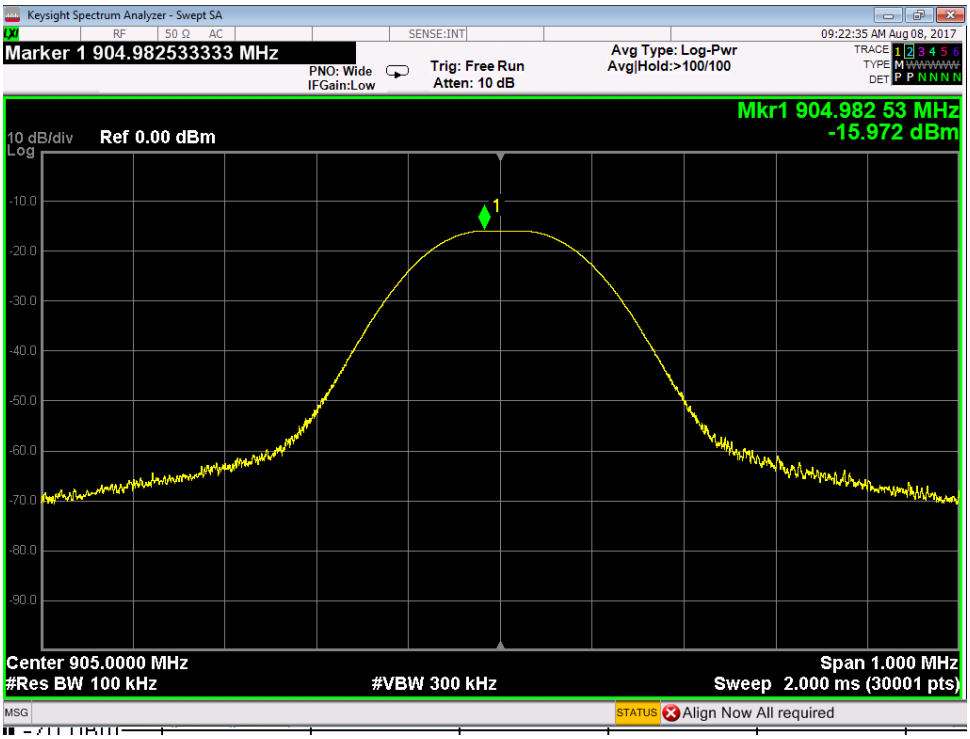


915MHz Mid Channel



905MHz Low Channel

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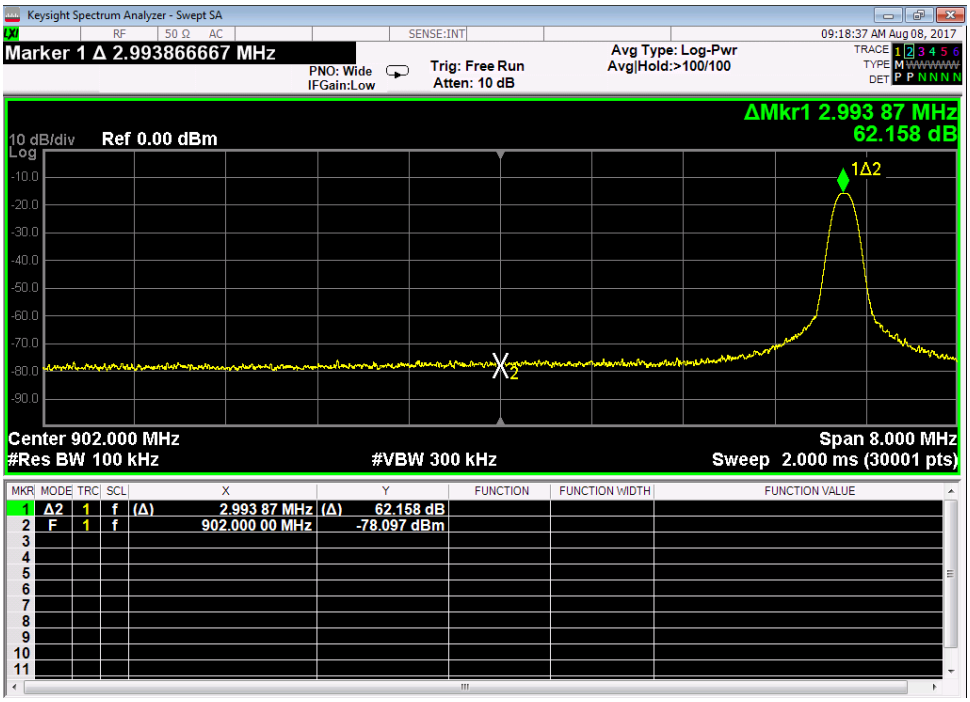
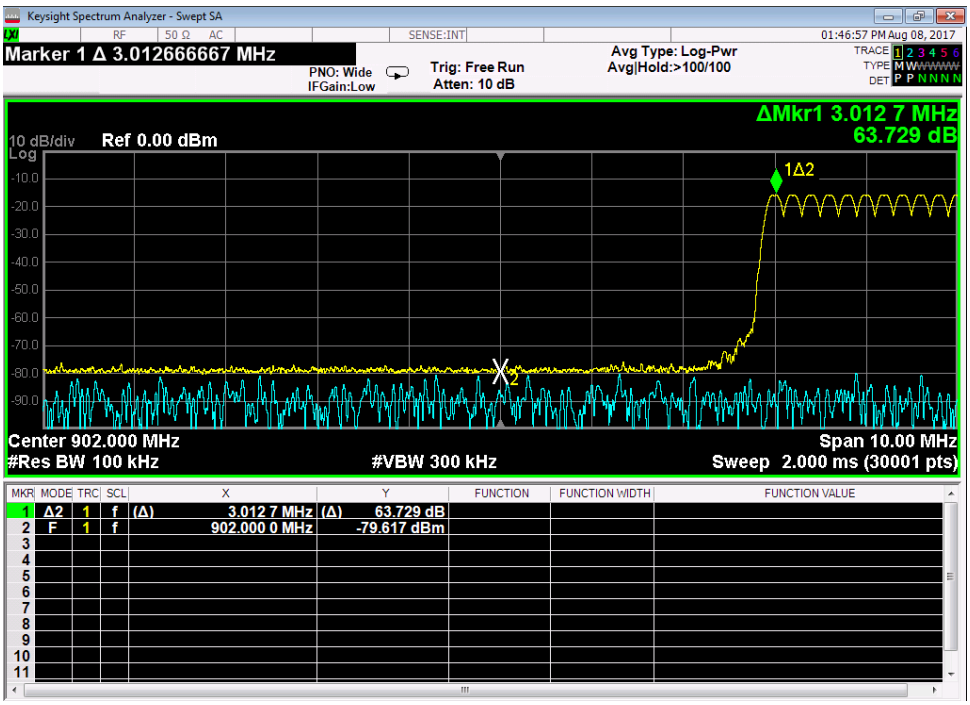
Conducted Bandedges

All band edges over 20dB from peak



Low Bandedge Non-hopping



Low Bandedge Hopping

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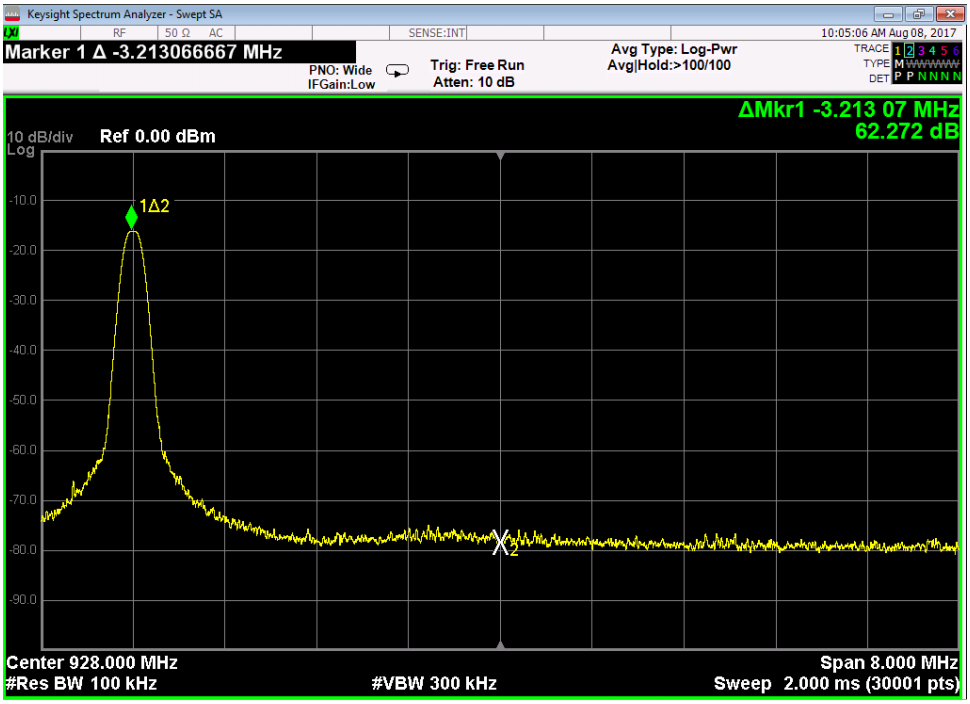
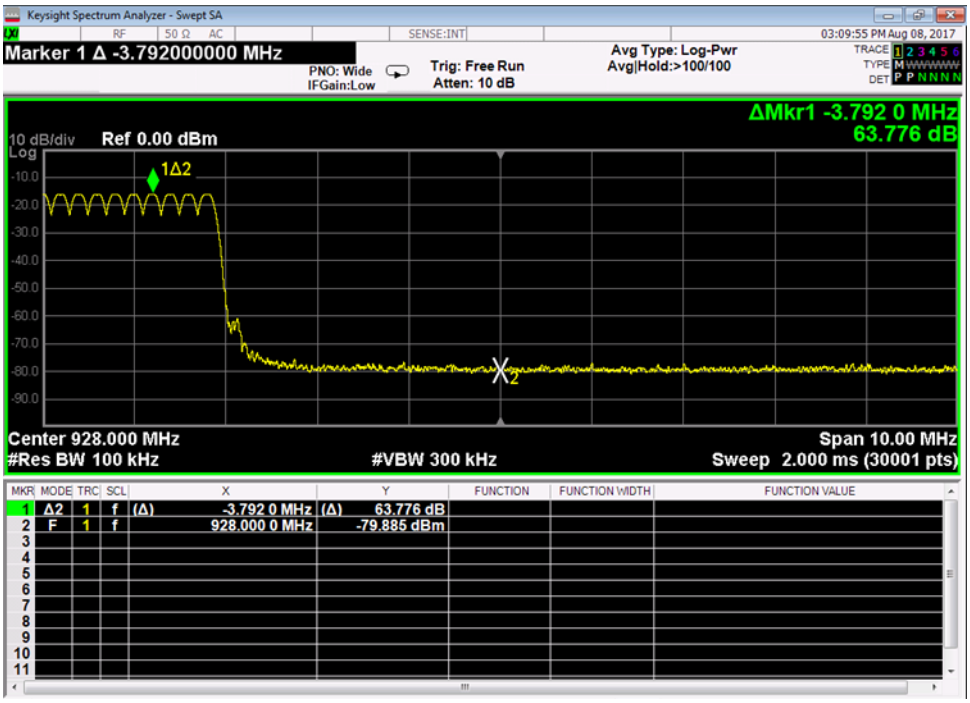


High Bandedge Non-hopping



High Bandedge Hopping

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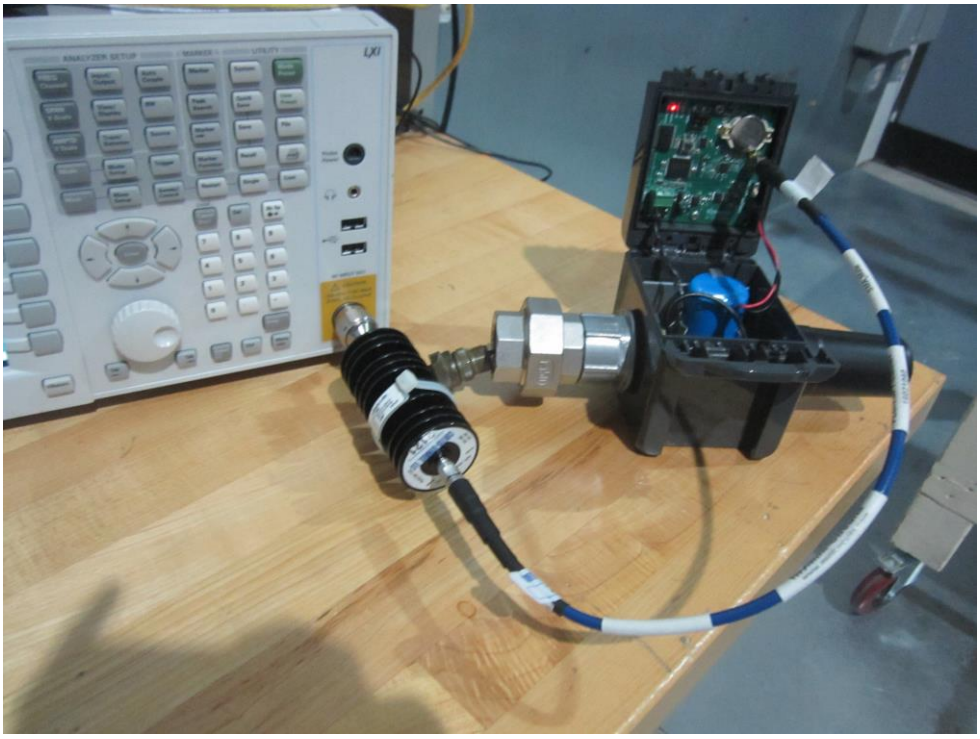
Equipment used for the following tests:

20dB Bandwidth
Channel Separation
Number of Hopping Channels
Dwell Time
Peak Output Power
Conducted Bandedges

Rev. 8/5/2017

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
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
Meteorological Meters		**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#2082		HTC-1	HDE		2082	II	3/23/2018	3/23/2017
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #2287	9KHz-26.5GHz	FLC-1.5FT-SMSM+	Mini-Circuits	16021040		II	1/27/2018	1/27/2017

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



Conducted Test Setup Photo

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									
Radiated Emissions Electric Field 3m Distance									
Top Peaks Horizontal 30-1000MHz									
Operator: AKZ									
Temp; Humid; Pres - 24°C; 43%RH; 1008mBar									
Mid Channel (worst case)									
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Req 1 Limit	Req 1 Margin	Req 1 Test Results	Antenna Height	EUT Azimuth	Worst Margin Req 1
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
722.968	46.3	-3.5	42.8	46	-3.2	PASS	100	0	
751.244	46.3	-3	43.3	46	-2.7	PASS	100	270	-2.7
778.67	45.6	-2.8	42.8	46	-3.2	PASS	100	270	
783.157	44.6	-2.8	41.8	46	-4.2	PASS	100	270	
818.998	44.3	-2	42.3	46	-3.7	PASS	100	270	

Curtis Straus - a Bureau Veritas Company									
Radiated Emissions Electric Field 3m Distance									
Top Peaks Vertical 30-1000MHz									
Operator: AKZ									
Temp; Humid; Pres - 24°C; 43%RH; 1008mBar									
Mid Channel (worst case)									
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Req 1 Limit	Req 1 Margin	Req 1 Test Results	Antenna Height	Turntable Azimuth	Worst Margin Req 1 Limit
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
722.968	43.2	-3.5	39.7	46	-6.3	PASS	200	315	-6.3
741.325	42.1	-3.2	38.8	46	-7.2	PASS	200	315	
749.595	42.8	-3	39.8	46	-6.3	PASS	200	315	
761.283	42.4	-2.9	39.5	46	-6.6	PASS	200	315	
918.132	40.2	-0.6	39.5	46	-6.5	PASS	150	315	

30-1000MHz - 915MHz Mid Channel

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Horizontal 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted I	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Avg Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1849.63	32	11.5	43.5	74	-30.4	PASS	54	-10.4	PASS	200	43			
3699.13	32.5	17.2	49.8	74	-24.2	PASS	54	-4.2	PASS	100	203	-24.2		
5756.88	26.7	21.3	48	74	-26	PASS	54	-6	PASS	300	30			

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Vertical 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted I	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Average Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1009	31.8	6.4	38.3	74	-35.7	PASS	54	-15.7	PASS	300	134			
1849.63	34.9	11.5	46.5	74	-27.5	PASS	54	-7.5	PASS	100	271			
2774.25	33.9	11.9	45.8	74	-28.1	PASS	54	-8.1	PASS	200	78			
3699.13	33.7	17.2	50.9	74	-23	PASS	54	-3	PASS	100	236	-23	-3	
5991.13	25.5	22.2	47.7	74	-26.3	PASS	54	-6.3	PASS	200	78			

1GHz-6GHz - 924.8MHz High Channel

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Horizontal 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted I	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Avg Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1007.38	31.8	6.5	38.3	74	-35.7	PASS	54	-15.7	PASS	300	64			
1829.88	33.7	11.4	45.1	74	-28.9	PASS	54	-8.9	PASS	100	102			
2114.13	30.2	11.7	41.9	74	-32.1	PASS	54	-12.1	PASS	300	168			
2745.13	34.7	11.7	46.4	74	-27.5	PASS	54	-7.5	PASS	100	311			
3659.88	32.2	16.8	49	74	-25	PASS	54	-5	PASS	300	202	-25		
5299.63	27.1	21.1	48.2	74	-25.8	PASS	54	-5.8	PASS	200	42			

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Vertical 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted I	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Average Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1830	37.2	11.4	48.6	74	-25.3	PASS	54	-5.3	PASS	100	99			
2146	31.2	11.4	42.6	74	-31.4	PASS	54	-11.4	PASS	300	99			
2745	36.2	11.7	47.9	74	-26	PASS	54	-6	PASS	200	285			
3659.88	33.2	16.8	50.1	74	-23.9	PASS	54	-3.9	PASS	100	0	-23.9	-3.9	
5719.25	26.9	21.2	48.1	74	-25.9	PASS	54	-5.9	PASS	100	169			

1GHz-6GHz – 915MHz Mid Channel

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Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Horizontal 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Avg Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1068.63	34.1	6.4	40.5	74	-33.4	PASS	54	-13.4	PASS	200	77			
1810	38.5	11.3	49.8	74	-24.2	PASS	54	-4.2	PASS	200	43	-24.2	-4.2	
2714.88	37.3	11.5	48.8	74	-25.2	PASS	54	-5.2	PASS	100	134			
3620.13	33.2	16.4	49.6	74	-24.4	PASS	54	-4.4	PASS	200	250			
5988.5	25.9	22.2	48.1	74	-25.9	PASS	54	-5.9	PASS	200	112			

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 3m Distance							EUT Power Input - Battery							
Top Peaks Vertical 1-6GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Average Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
1810.13	40	11.3	51.2	74	-22.7	PASS	54	-2.7	PASS	100	286			
2714.88	37.6	11.5	49.1	74	-24.8	PASS	54	-4.8	PASS	200	77			
3620.13	35.3	16.4	51.7	74	-22.3	PASS	54	-2.3	PASS	200	111	-22.3	-2.3	
5863.13	26.4	21.5	47.9	74	-26	PASS	54	-6	PASS	100	315			

1GHz-6GHz – 905MHz Low Channel

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 1m Distance							EUT Power Input - Battery							
Top Peaks Horizontal 6-18GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Average Limit	Worst Margin
MHz	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
9972.9	27.3	27.8	55.1	83.5	-28.4	PASS	63.5	-8.4	PASS	175	216	-28.4	-8.4	

Curtis Straus - a Bureau Veritas Company							Work Order - R2258							
Radiated Emissions Electric Field 1m Distance							EUT Power Input - Battery							
Top Peaks Vertical 6-18GHz							Test Site - CH-2							
Operator: AKZ							Temp; Humid; Pres - 24°C; 43%RH; 1008mBar							
							EUT Maximum Frequency - 924.8MHz							
Frequency	Raw Peak	Correction	Adjusted	Peak Limit	Margin to	Peak Limit	Average L	Margin to	Average L	Antenna H	EUT Azimu	Peak Limit	Average Limit	Worst Margin
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail	(dBµV/m)	(dB)	(Pass/Fail	(cm)	(degrees)	(dB)	(dB)	
8197.1	27	26.7	53.7	83.5	-29.8	PASS	63.5	-9.8	PASS	175	78			
9826.3	26.9	27.8	54.7	83.5	-28.8	PASS	63.5	-8.8	PASS	100	30	-28.8	-8.8	

6GHz-18GHz - 924.8MHz High Channel

Test Equipment Used for 30-1000MHz:

Rev. 8/15/2017

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental MXE EMI Receiver(1170725)	20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I	12/22/2017	12/22/2016
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**
Red-White	0.009-2000MHz	ZFL-1000-LN	CS	N/A	1258	II	10/30/2017	10/30/2016
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
Meteorological Meters		**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#2082		HTC-1	HDE		2082	II	3/23/2018	3/23/2017
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #2052	9kHz - 18GHz		Florida RF			II	3/5/2018	3/5/2017
Asset #2053	9kHz - 18GHz		Florida RF			II	10/30/3017	10/30/2016

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

Test Equipment Used for 1-18GHz:

Rev. 8/15/2017

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental MXE EMI Receiver(1170725)	20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I	12/22/2017	12/22/2016
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**
1517 HF Preamp	1-20GHz	CS	CS	N/A	1517	II	9/14/2017	8/14/2016
2130 BRF	0.009-18000MHz	BRM18770	Micro-Tronics	1	2130	II	1/7/2018	1/7/2017
Antennas	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Orange Horn	1-18GHz	3115	EMCO	0004-6123	390	I	10/13/2018	10/13/2016
Meteorological Meters		**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**
Asset #2052	9kHz - 18GHz		Florida RF			II	3/5/2018	3/5/2017
Asset #2053	9kHz - 18GHz		Florida RF			II	10/30/3017	10/30/2016

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

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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		

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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

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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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