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Order Number: 10338213A
Date: August 18, 2014
Model: 001D8169-1

Electromagnetic Compatibility Test Report

For

Chamberlain Group Inc.

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Order Number: 10338213A
Model Number: 001D8169-1
Client Name: Chamberlain Group Inc.

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Test Report Details

Tests Performed By: **UL LLC**
333 Pfingsten Rd.
Northbrook, IL 60062

Tests Performed For: **Chamberlain Group Inc.**
845 Larch Av
Elmhurst, IL 60126

Applicant Contact: **Hank Sieradzki**
Phone: **(630) 993-6564**
E-mail: **Hank.Sieradzki@chamberlaingroup.com**

Test Report Date: **August 18, 2014**

Product Type: **GDO with 900MHz FHSS Transceiver and 2.4GHz WiFi Module**

Product standards **47 CFR Part 15, Subpart C, RSS-210, RSS-Gen**

Model Number: **001D8169-1**

EUT Category: **Wireless Device**

Testing Start Date: **June 24, 2014**

Date Testing Complete: **July 24, 2014**

Overall Results: **Compliant**

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

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Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
-			

1.0 GENERAL - Product Description

1.1 Equipment Description

The Equipment Under Test is a Garage Door Operator (CDO) with 900MHz FHSS Transceiver.

1.2 Device Configuration During Test

1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Garage Door Opener	Chamberlain	001D8169-1	None
AE	Pushbutton control	Chamberlain	Generic	None
AE	Photo-Eyes	Chamberlain	Generic	None

Note: **EUT** – Equipment Under Test, **AE** – Auxiliary/Associated Equipment, or **SIM** – Simulator (Not Subjected to Test)

1.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	N	N	None
2	Pushbutton Control	I/O	Y	N	None
3	Edge Sensor Cable	I/O	Y	N	None

Note:
 AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
 I/O = Signal Input or Output Port (Not Involved in Process Control)
 TP = Telecommunication Ports

1.2.3 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	120	-	-	AC - 60Hz	1	

1.3 EUT Configurations

Mode #	Description
1	EUT was setup on 80 cm support, connected to power source and set to transmit in specific mode.
2	EUT was placed on bench top, connected to power. The 900MHz RF output was terminated into standard RF connector and it was connected to spectrum analyzer.

1.4 EUT Operation Modes

Mode #	Description
1	EUT in TX Mode on either low, middle or high channels.

1.5 Rational for EUT Configuration

Mode #	Description
1	It was configured with gear up, typical ceiling mount configuration.

2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL LLC in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

2.1 Deviations from standard test methods

None

2.2 Device Modifications Necessary for Compliance

None

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Model Number: 001D8169-1
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2.3 Reference Standards

Standard Number	Standard Name	Standard Date
RSS-210	Spectrum Management and Telecommunications Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	Issue 8
RSS-Gen	Spectrum Management and Telecommunications Radio Standards Specification General Requirements and Information for the Certification of Radio Apparatus	Issue 3
47 CFR Part 15	Radio Frequency Devices	2012
Additional guidance used: FCC Document: DA 00-705 and ANSI C63.4:2003		

2.4 Results Summary

Requirement – Test	References	Result (Compliant / Non-Compliant)*
Mains Terminal – Conducted Emissions	47 CFR Part 15.207 RSS-Gen 7.2.4	Compliant
Spurious Emissions (Antenna Conducted and Radiated)	47 CFR Part 15.247(d) RSS-210, A8.5 RSS-Gen 7.2.5	Compliant
Bandedge Compliance	47 CFR Part 15.247(d) RSS-210, A8.5	Compliant
Carrier Frequency Separation	47 CFR Part 15.247(a)(1) RSS-210, A8.1(b)	Compliant
Number of Hopping Frequencies	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(c)	Compliant
Time of Occupancy and Duty Cycle Correction	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(c)	Compliant
20dB Bandwidth and 99% Bandwidth	47 CFR Part 15.247(a)(2) RSS-210, A8.1(a) RSS-Gen, 4.6.1	Compliant
Maximum Peak Output Power	47 CFR Part 15.247(b)(2) RSS-210, A8.4(1)	Compliant

Test Engineer:



Bartlomiej Mucha (Ext.41216)
WiSE Staff Engineer
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Verification Services

Reviewer:



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Wireless, Interoperability, payment Security, & EMC
Verification Services

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

----- US -----

47 CFR Part 15

----- Canada -----

RSS-210 and RSS-Gen

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150
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Measurement Uncertainty

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB

Sample Calculations

Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)

Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)

Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

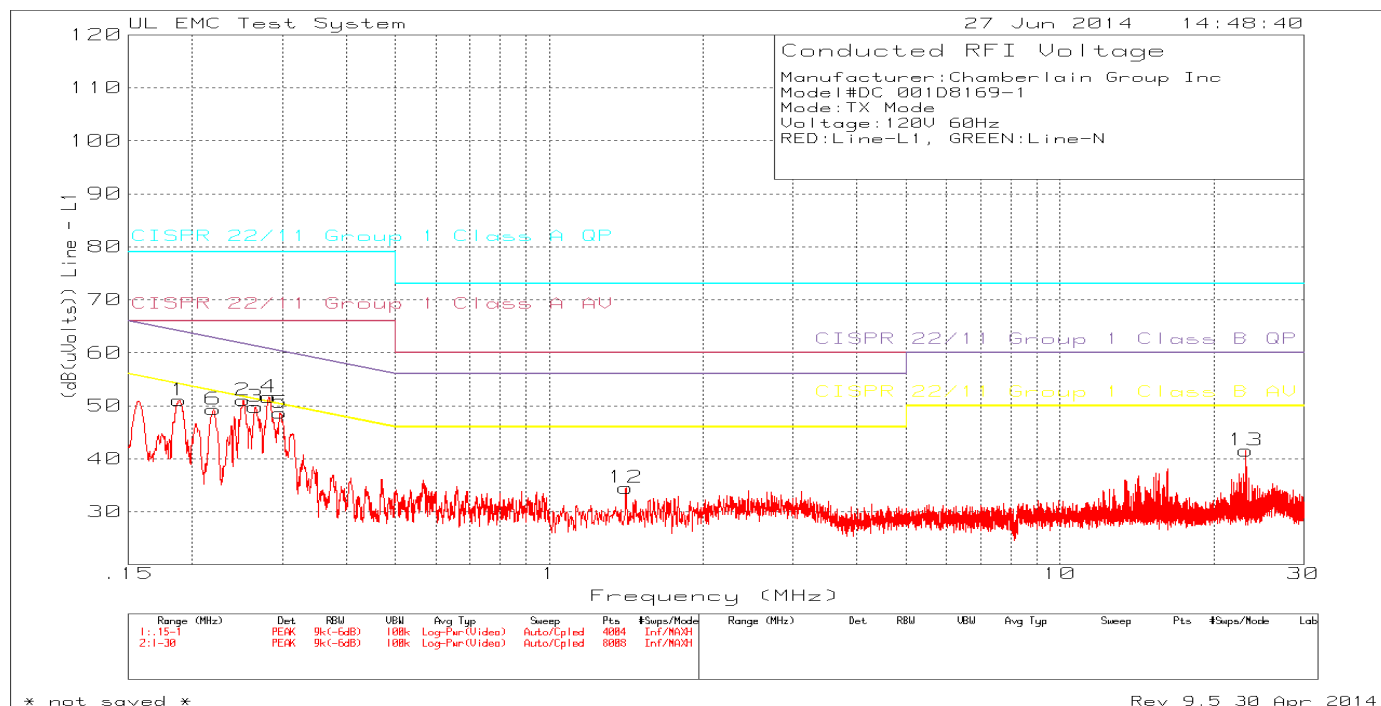
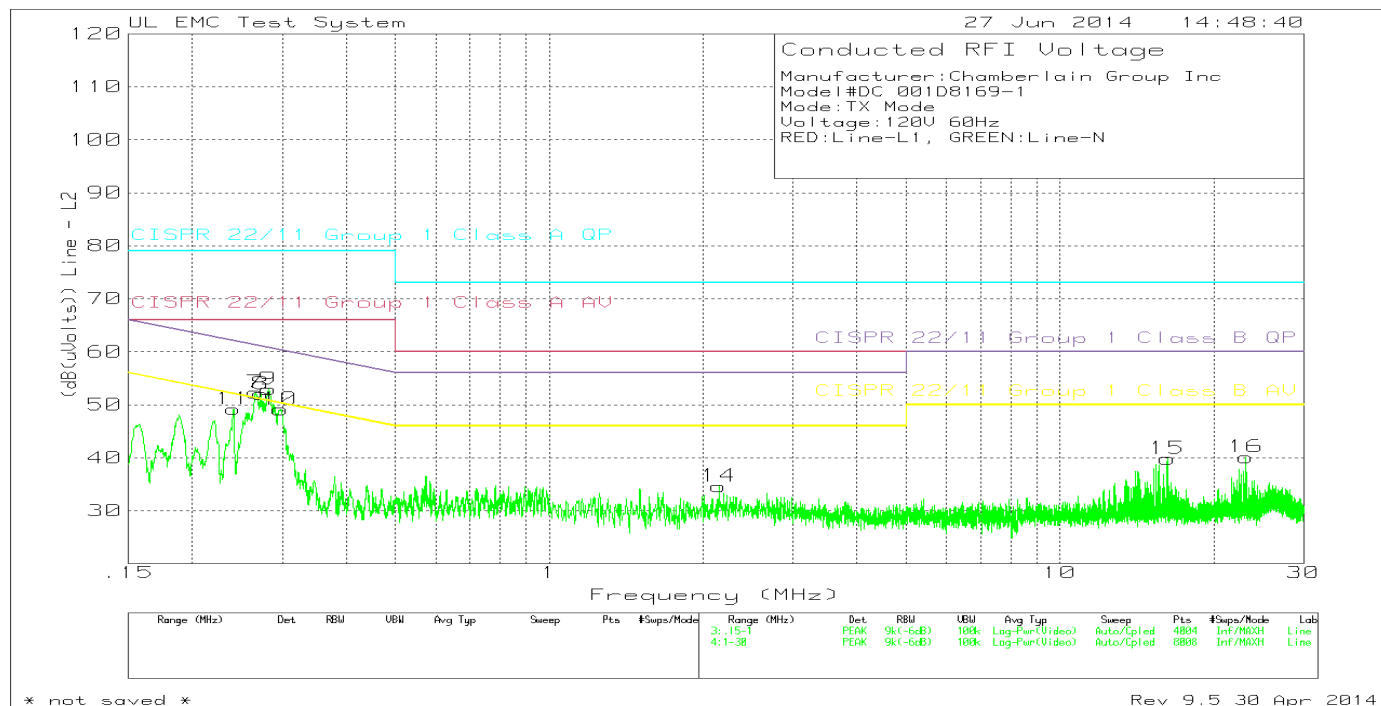
4.1 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	
Basic Standard	47 CFR Part 15.207, RSS-Gen 7.2.4	
UL LPG	80-EM-S0026	
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains
Limits - Class B		
Frequency (MHz)	Limit (dB μ V)	
	Quasi-Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
Supplementary information: None		

Table 1 Conducted Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 1 Conducted Emissions Graph (TX Middle Channel / with WiFi Active)



Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

Table 2 Conducted Emissions Data Points (TX)

Manufacturer:Chamberlain Group Inc										
Model#DC 001D8169-1										
Mode:TX Mode										
Voltage: 120V 60Hz										
RED:Line-L1, GREEN:Line-N										
Trace Markers										
Marker No.	Test Frequency (MHz)	Meter Reading dBuV	Detector	LISN Factor dB	Path Factor dB	Level dBuV	Limit 47 CFR 15.207 QP	Margin dB	Limit 47 CFR 15.207 AV	Margin dB
Line										
1	0.18858	39.35	PK	0.1	11.6	51.05	64.1	-13.05	54.1	-3.05
2	0.25176	39.75	PK	0.1	11.2	51.05	61.7	-10.65	51.7	-0.65
3	0.26618	38.63	PK	0.1	11.1	49.83	61.24	-11.41	51.24	-1.41
4	0.2825	40.53	PK	0.1	11	51.63	60.74	-9.11	50.74	0.89
5	0.29713	37.66	PK	0.1	10.9	48.66	60.32	-11.66	50.32	-1.66
6	0.22017	37.82	PK	0.1	11.4	49.32	62.81	-13.49	52.81	-3.49
12	1.41291	23.83	PK	0.1	10.6	34.53	56	-21.47	46	-11.47
13	23.13042	29.65	PK	0.3	11.6	41.55	60	-18.45	50	-8.45
Neutral										
7	0.26618	41.15	PK	0.1	11.1	52.35	61.24	-8.89	51.24	1.11
8	0.27275	40.82	PK	0.1	11.1	52.02	61.03	-9.01	51.03	0.99
9	0.28218	41.83	PK	0.1	11	52.93	60.75	-7.82	50.75	2.18
10	0.29734	38.09	PK	0.1	10.9	49.09	60.32	-11.23	50.32	-1.23
11	0.24074	37.8	PK	0.1	11.3	49.2	62.07	-12.87	52.07	-2.87
14	2.14817	23.9	PK	0.1	10.6	34.6	56	-21.4	46	-11.4
15	16.23051	28.2	PK	0.3	11.3	39.8	60	-20.2	50	-10.2
16	23.13042	28.13	PK	0.4	11.6	40.13	60	-19.87	50	-9.87
PK - Peak detector										
Average Data										
Line										
	0.18816	30.19	Av	0.1	11.6	41.89	64.12	-22.23	54.12	-12.23
	0.25169	25.57	Av	0.1	11.2	36.87	61.7	-24.83	51.7	-14.83
	0.26653	28.21	Av	0.1	11.1	39.41	61.23	-21.82	51.23	-11.82
	0.28228	27.29	Av	0.1	11	38.39	60.75	-22.36	50.75	-12.36
	0.29787	27.04	Av	0.1	10.9	38.04	60.3	-22.26	50.3	-12.26
	0.21987	27.63	Av	0.1	11.4	39.13	62.82	-23.69	52.82	-13.69
Neutral										
	0.26679	24.81	Av	0.1	11.1	36.01	61.22	-25.21	51.22	-15.21
	0.27244	18.97	Av	0.1	11.1	30.17	61.04	-30.87	51.04	-20.87
	0.28211	23.73	Av	0.1	11	34.83	60.75	-25.92	50.75	-15.92
	0.2984	6.93	Av	0.1	10.9	17.93	60.29	-42.36	50.29	-32.36
	0.24141	7.96	Av	0.1	11.3	19.36	62.05	-42.69	52.05	-32.69
Av - CISPR average detection										

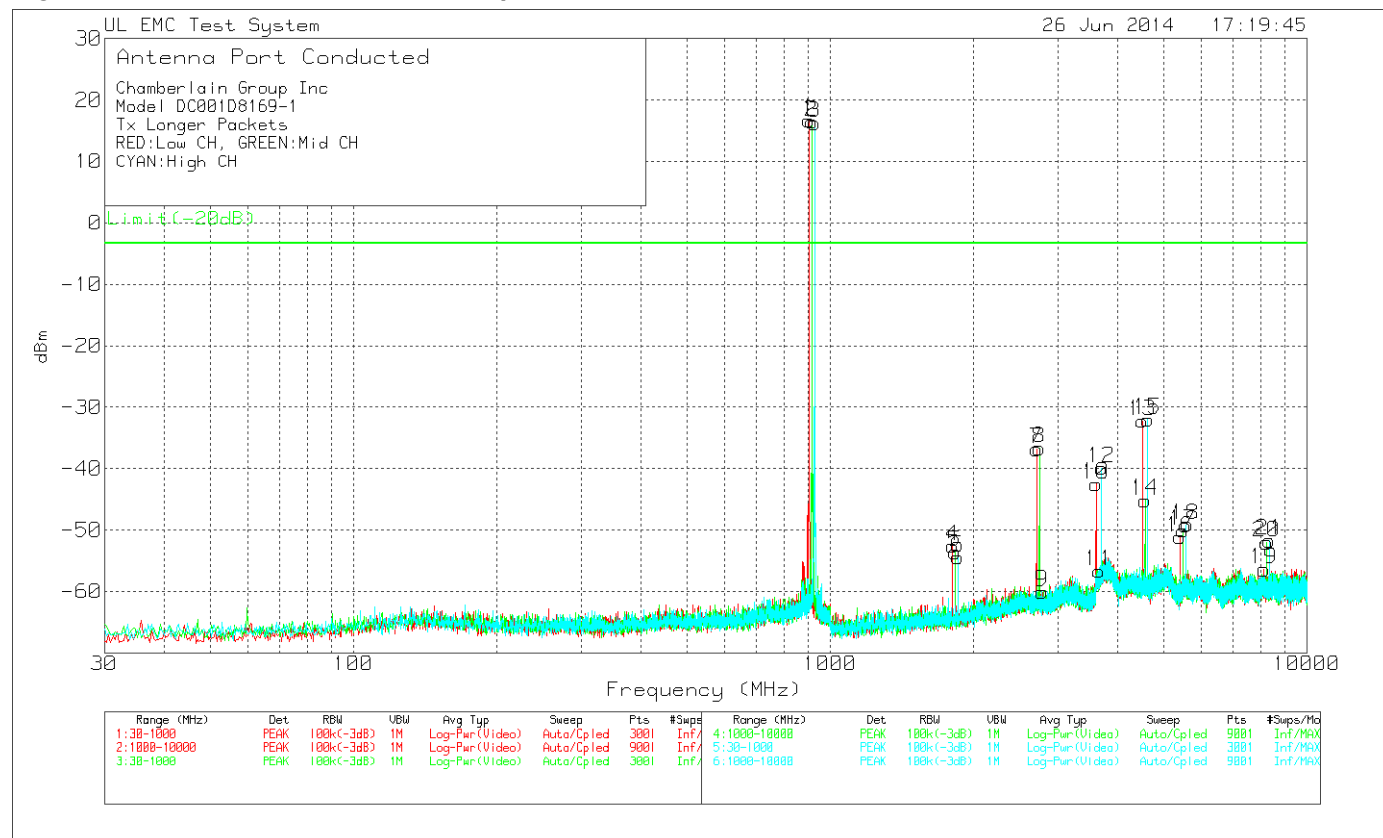
4.2 Test Conditions and Results – SPURIOUS & BANDEDGE EMISSIONS (Antenna Conducted and Radiated)

Test Description	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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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) (see Section15.205(c)). For Radiated Emissions above 1GHz the RBW/VBW=1MHz/3MHz for Peak Measurements and RBW/VBW 1MHz/10Hz for Average measurements.		
Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5 RSS-Gen 7.2.1 and 7.2.3		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance and / or antenna port	
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	3 meter distance and / or antenna port	
Limits (Antenna Conducted)			
All emissions must be 20dB below the level of the fundamental frequency. For all antenna port measurements the SA input was changed to 75 Ohms			
Limits (Radiated – Restricted Bands Only)			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Limit - detector	
	General Emissions	Fundamental	Spurious
30 – 88	40.00 QP	-	-
88 – 216	43.52 QP	-	-
216 - 960	46.02 QP	-	-
960 - 1000	53.98 QP	-	-
1,000 - 25,000	-	-	74PK, 54AV
Supplementary information: Below 1GHz, spectrum was checked. All emissions related to the transmitter below 1GHz are not in the restricted band therefore only antenna conducted limits apply (20dB below the peak level of the fundamental). For below 1GHz measurements levels were extrapolated to 3 meter distance. Actual measurements below 1GHz were conducted at 10 meter distance. Above limits are at 3m distance.			

Table 3 SPURIOUS EMISSIONS EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1 and 2	1
Supplementary information: None		

Figure 2 30MHz-10GHz Antenna Port Spurious Emissions Plot TX Mode, Short Packets



* The caption in the above table in line 3 is mislabeled. It should say TX Short Packets.

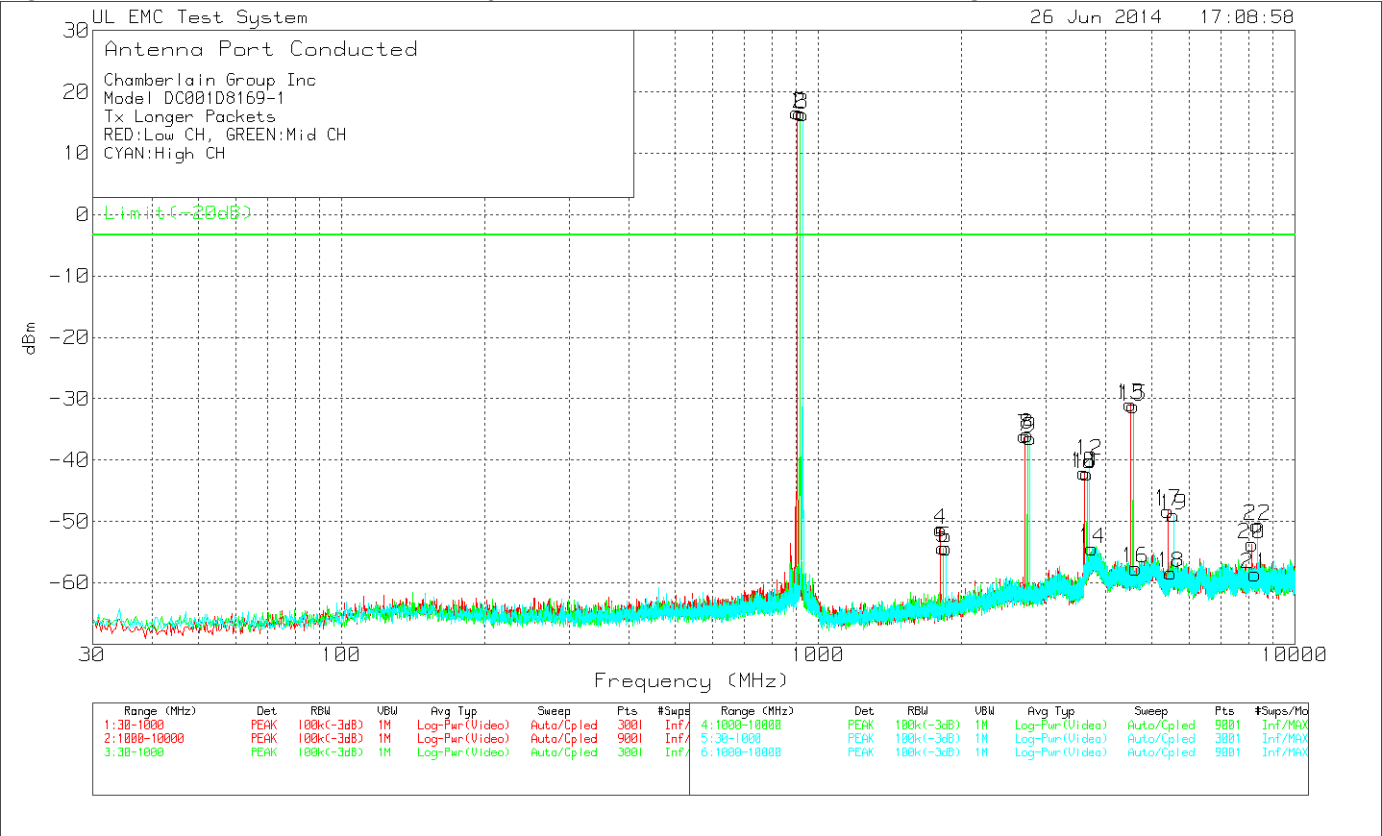
Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

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Table 4 Spurious Emissions Tabular Data for TX, Short Packets

Chamberlain Group Inc							
Model DC001D8169-1							
Tx Short Packets							
RED:Low CH, GREEN:Mid CH							
CYAN:High CH							
Trace Markers							
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Cable Factor dB	Level dBm	Limit	Margin (dB)
Low Channel							
1	902.3524	6.51	PK	10.2	16.71	-	-
4	1805	-62.89	PK	10.3	-52.59	-3.29	-49.3
7	2707	-47.3	PK	10.5	-36.8	-3.29	-33.51
10	3609	-53.2	PK	10.7	-42.5	-3.29	-39.21
13	4511	-43.02	PK	10.8	-32.22	-3.29	-28.93
16	5414	-62.03	PK	10.9	-51.13	-3.29	-47.84
19	8121	-67.37	PK	11	-56.37	-3.29	-53.08
Middle Channel							
2	914.6391	6.3	PK	10.2	16.5	-	-
5	1829	-63.96	PK	10.4	-53.56	-3.29	-50.27
8	2744	-47.17	PK	10.5	-36.67	-3.29	-33.38
11	3661	-67.34	PK	10.7	-56.64	-3.29	-53.35
14	4573	-55.95	PK	10.8	-45.15	-3.29	-41.86
17	5489	-60.96	PK	10.9	-50.06	-3.29	-46.77
20	8232	-63.09	PK	11.1	-51.99	-3.29	-48.7
High Channel							
3	926.9257	6.11	PK	10.2	16.31	-	-
6	1853	-64.8	PK	10.4	-54.4	-3.29	-51.11
9	2781	-70.53	PK	10.5	-60.03	-3.29	-56.74
12	3707	-50.58	PK	10.7	-39.88	-3.29	-36.59
15	4633	-42.81	PK	10.8	-32.01	-3.29	-28.72
18	5561	-60.09	PK	10.9	-49.19	-3.29	-45.9
21	8340	-62.81	PK	11.1	-51.71	-3.29	-48.42
PK - Peak detector							

Figure 3 30MHz-10GHz Antenna Port Spurious Emissions Plot TX Mode, Long Packet



Order Number: 10338213A
Model Number: 001D8169-1
Client Name: Chamberlain Group Inc.

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Table 5 Spurious Emissions Tabular Data for TX, Long Packet

Chamberlain Group Inc							
Model DC001D8169-1							
Tx Longer Packets							
RED:Low CH, GREEN:Mid CH							
CYAN:High CH							
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Cable Factor dB	Level dBm	Limit	Margin (dB)
Low Channel							
1	902.3524	6.47	PK	10.2	16.67	-	-
4	1805	-61.63	PK	10.3	-51.3	-3.3	-48
7	2707	-46.57	PK	10.5	-36.1	-3.3	-32.74
10	3609	-52.78	PK	10.7	-42.1	-3.3	-38.75
13	4511	-41.72	PK	10.8	-30.9	-3.3	-27.59
17	5413	-59.19	PK	10.9	-48.3	-3.3	-44.96
20	8120	-64.72	PK	11	-53.7	-3.3	-50.39
Middle Channel							
2	914.6391	6.3	PK	10.2	16.5	-	-
5	1829	-64.7	PK	10.4	-54.3	-3.3	-50.97
8	2744	-46.34	PK	10.5	-35.8	-3.3	-32.51
11	3659	-52.95	PK	10.7	-42.3	-3.3	-38.92
15	4574	-42.01	PK	10.8	-31.2	-3.3	-27.88
18	5489	-69.29	PK	10.9	-58.4	-3.3	-55.06
21	8238	-69.58	PK	11	-58.6	-3.3	-55.25
High Channel							
3	926.6024	6.16	PK	10.2	16.36	-	-
6	1853	-64.75	PK	10.4	-54.4	-3.3	-51.02
9	2780	-46.93	PK	10.5	-36.4	-3.3	-33.1
12	3707	-50.77	PK	10.7	-40.1	-3.3	-36.74
14	3753	-65.22	PK	10.8	-54.4	-3.3	-51.09
16	4631	-68.45	PK	10.8	-57.7	-3.3	-54.32
19	5561	-59.87	PK	10.9	-49	-3.3	-45.64
22	8341	-61.77	PK	11.1	-50.7	-3.3	-47.34
PK - Peak detector							

Figure 4 Band Edge Antenna Port Plot TX Mode, Low & High Channel, Short Packet

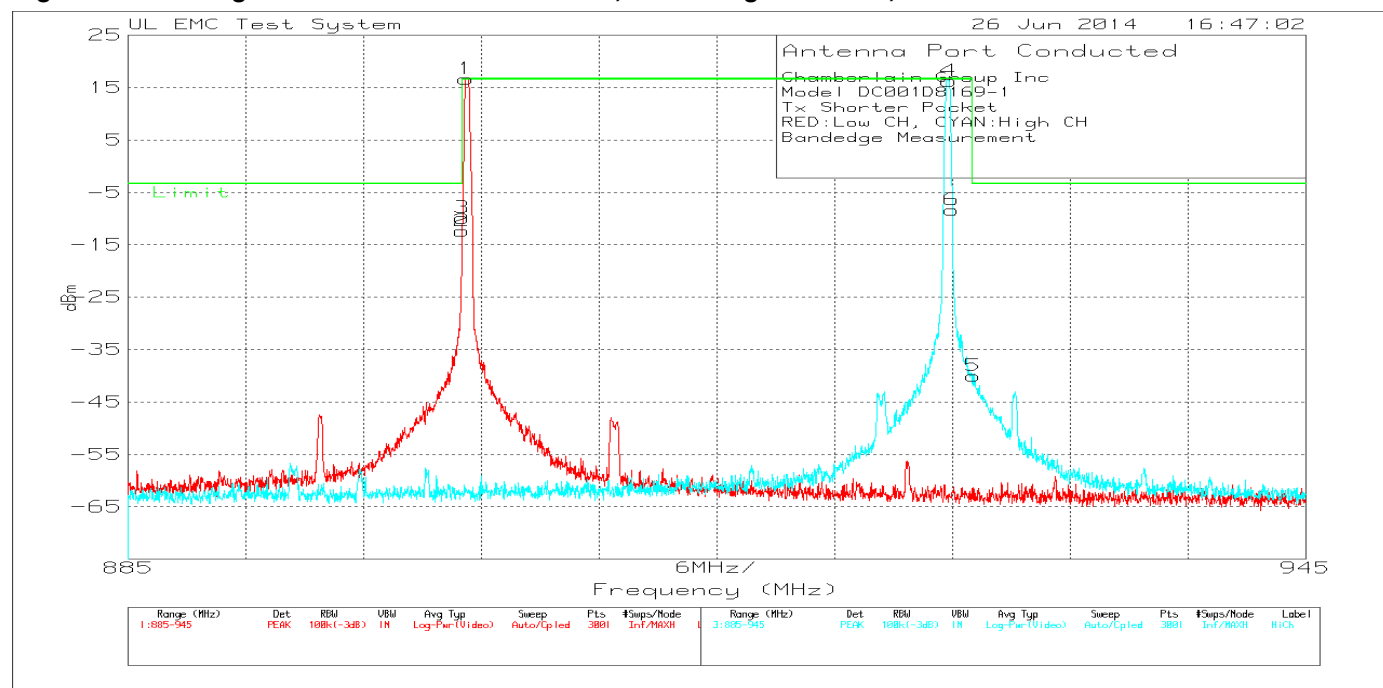


Table 6 Band Edge Antenna Port Mode, Low & High Channels, Short Packet

Chamberlain Group Inc							
Model DC001D8169-1							
Tx Shorter Packet							
RED:Low CH, CYAN:High CH							
Bandedge Measurement							
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Cable Factor dB	Level dBm	Limit	Margin (dB)
Low Channel							
1	902.21	6.46	PK	10.2	16.66	30	-13.34
2	902	-22.53	PK	10.2	-12.33	-3.33	-9
3	902.02	-20.06	PK	10.2	-9.86	30	-39.86
High Channel							
4	926.82	6.11	PK	10.2	16.31	30	-13.69
5	928	-50.24	PK	10.2	-40.04	-3.33	-36.71
6	926.98	-18.53	PK	10.2	-8.33	30	-38.33
PK - Peak detector							

Figure 5 Band Edge Antenna Port Plot TX Mode, Low & High Channel, Long Packet

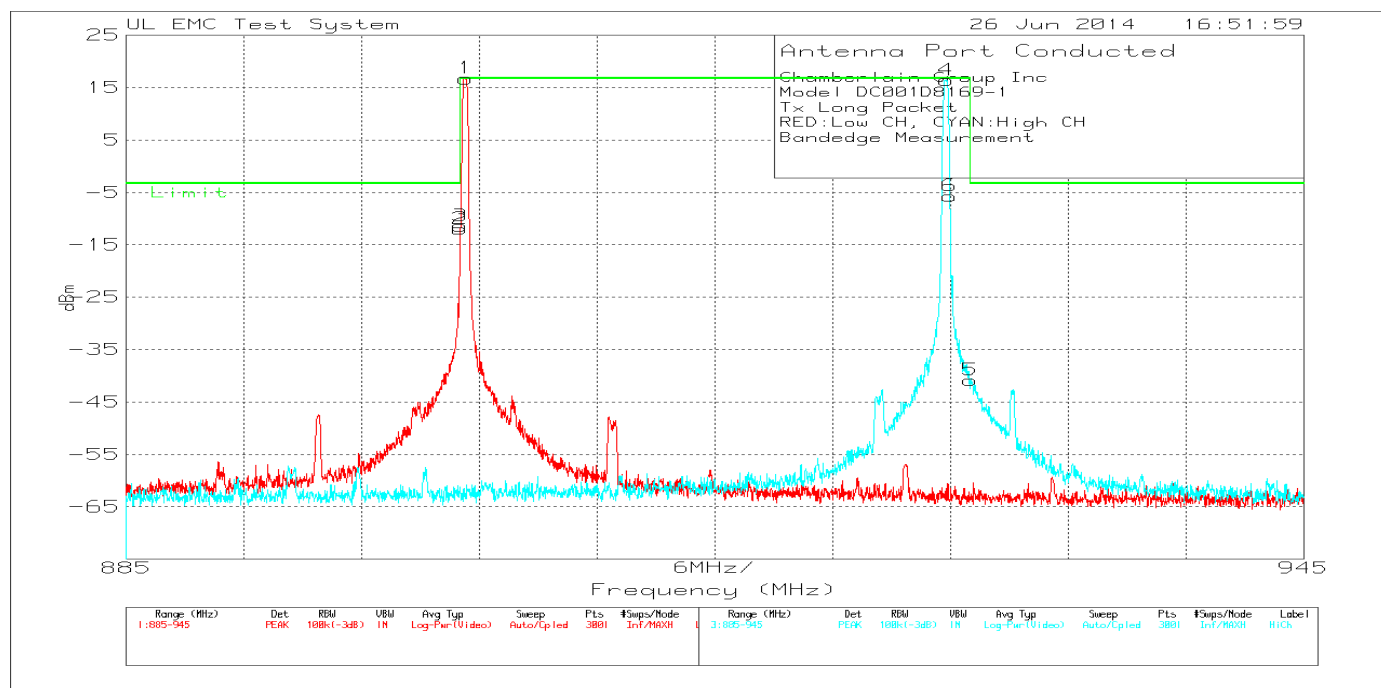


Table 7 Band Edge Antenna Port Mode, Low & High Channels, Long Packet

Chamberlain Group Inc							
Model DC001D8169-1							
Tx Long Packet							
RED:Low CH, CYAN:High CH							
Bandedge Measurement							
Marker No.	Test Frequency MHz	Meter Reading dBm	Cable Factor dB	Level dBm	Limit	Margin (dB)	
Channel							
1	902.3	6.54 PK	10.2	16.74	30	-13.26	
2	902	-22.18 PK	10.2	-12	-3.3	-8.72	
3	902.02	-21.56 PK	10.2	-11.4	30	-41.36	
High Channel							
4	926.8	6.22 PK	10.2	16.42	30	-13.58	
5	928	-51.02 PK	10.2	-40.8	-3.3	-37.56	
6	926.96	-15.91 PK	10.2	-5.71	30	-35.71	
PK - Peak detector							

Figure 6 Band Edge Antenna Port Plot TX Mode, Hopping

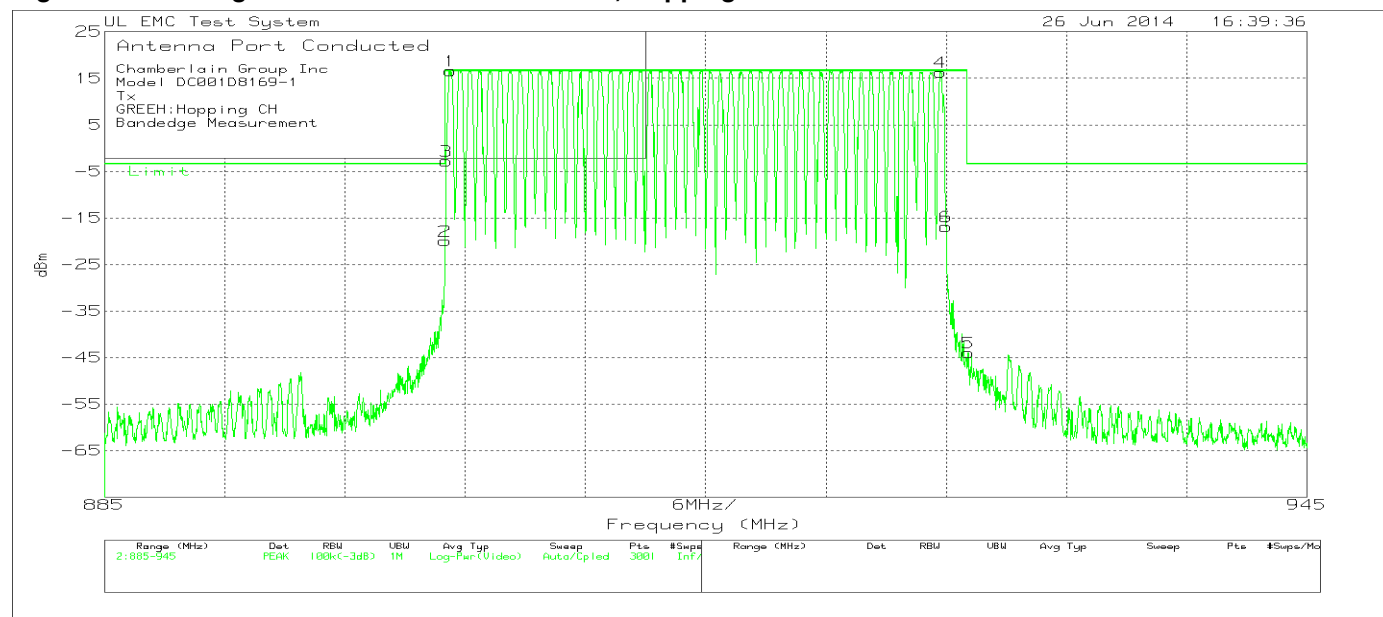
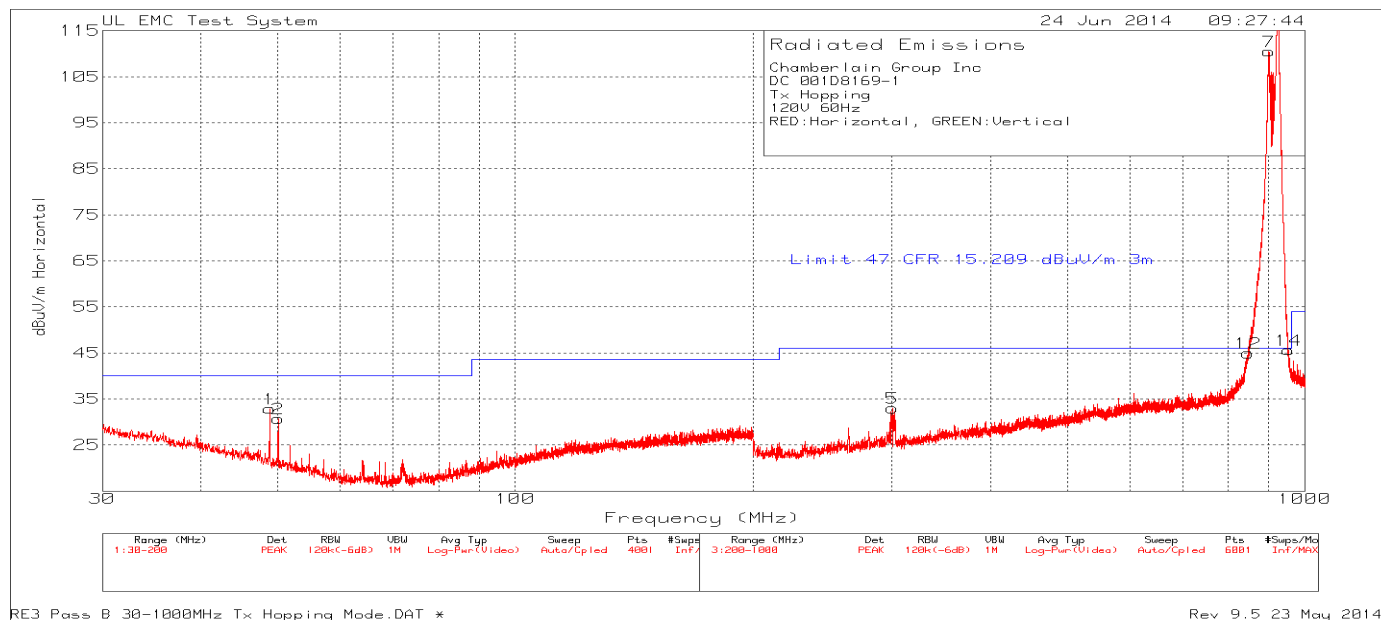
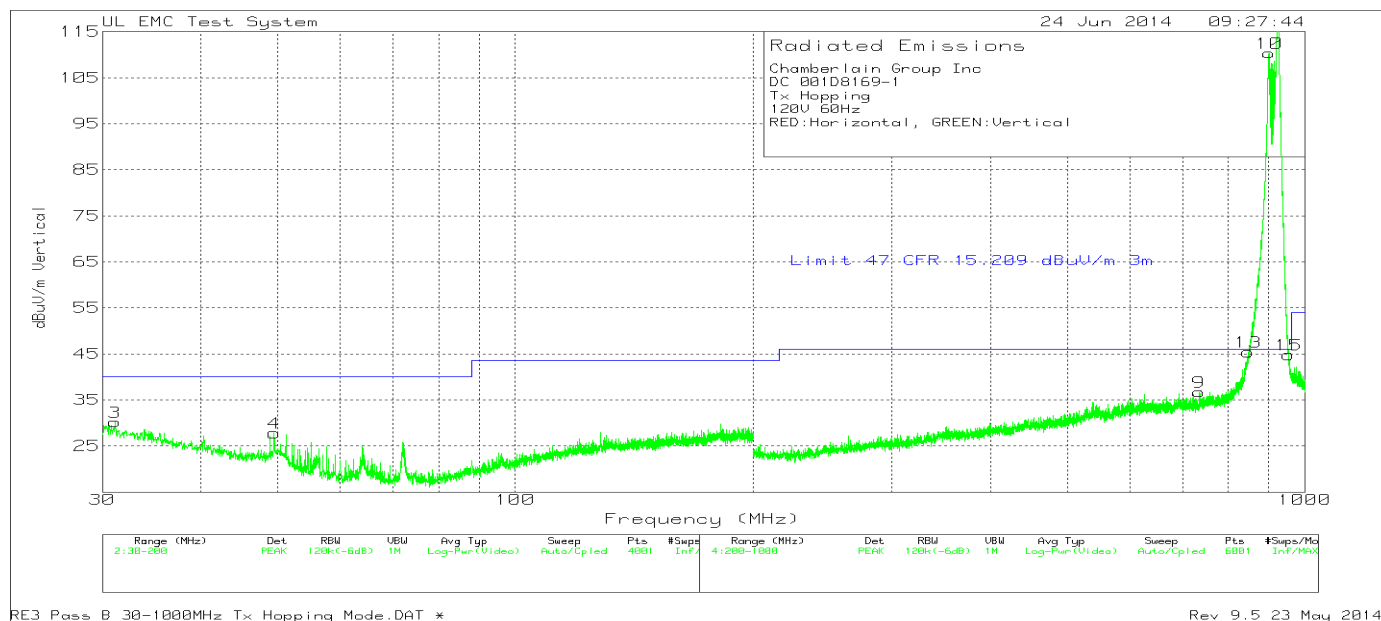


Table 8 Band Edge Antenna Port Mode, Low & High Channels

Chamberlain Group Inc							
Model DC001D8169-1							
Tx							
GREEN:Hopping CH							
Bandedge Measurement							
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Cable Factor dB	Level dBm	Limit	Margin (dB)
1	902.28	6.4	PK	10.2	16.6	30	-13.4
2	902	-30.16	PK	10.2	-19.96	-3.37	-16.59
3	902.06	-12.98	PK	10.2	-2.78	30	-32.78
4	926.72	6.05	PK	10.2	16.25	30	-13.75
5	928	-54.18	PK	10.2	-43.98	-3.37	-40.61
6	926.98	-27.04	PK	10.2	-16.84	30	-46.84
PK - Peak detector							

Figure 7 30MHz – 1GHz Radiated Emissions Graph TX Hopping



* Area between 840MHz to 955MHz is an attenuation product of the Band Reject Filter. The whole area is outside of the restricted bands therefore there is no radiated limits applicable. None of the marked frequencies are in restricted bands.

Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

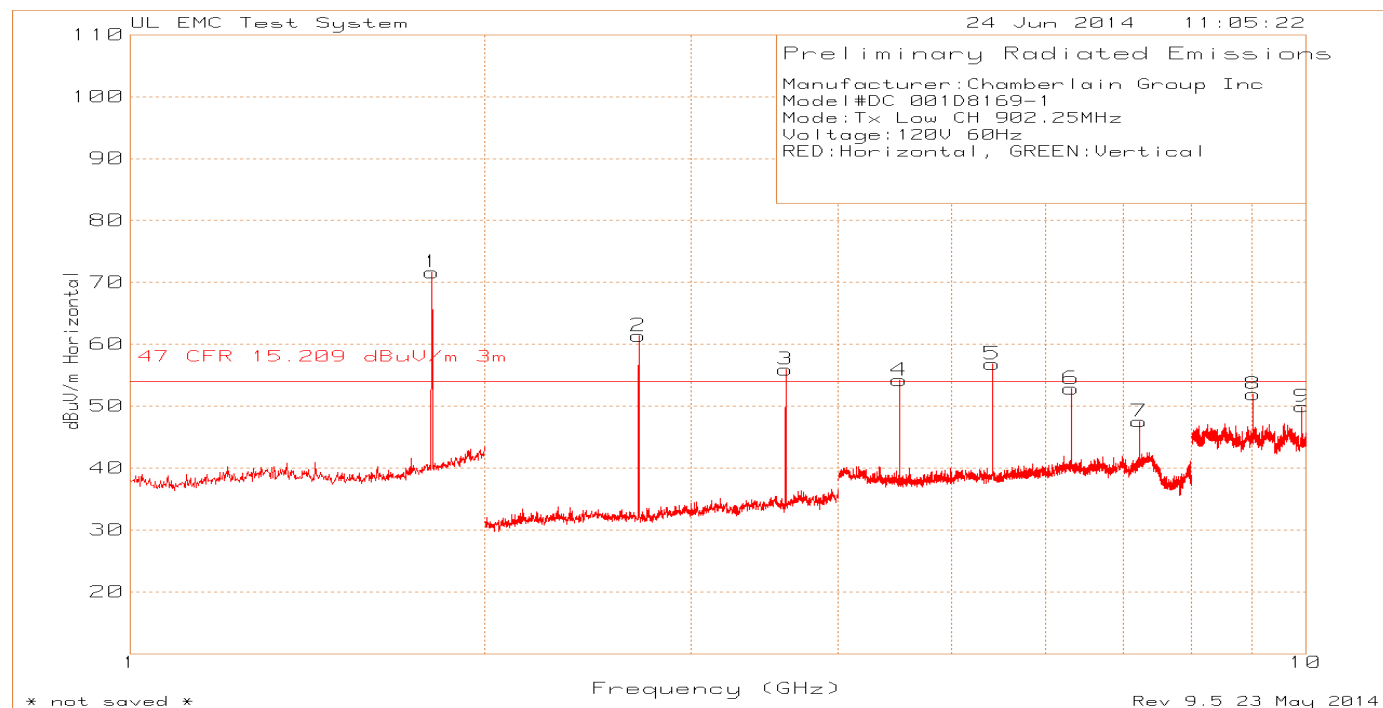
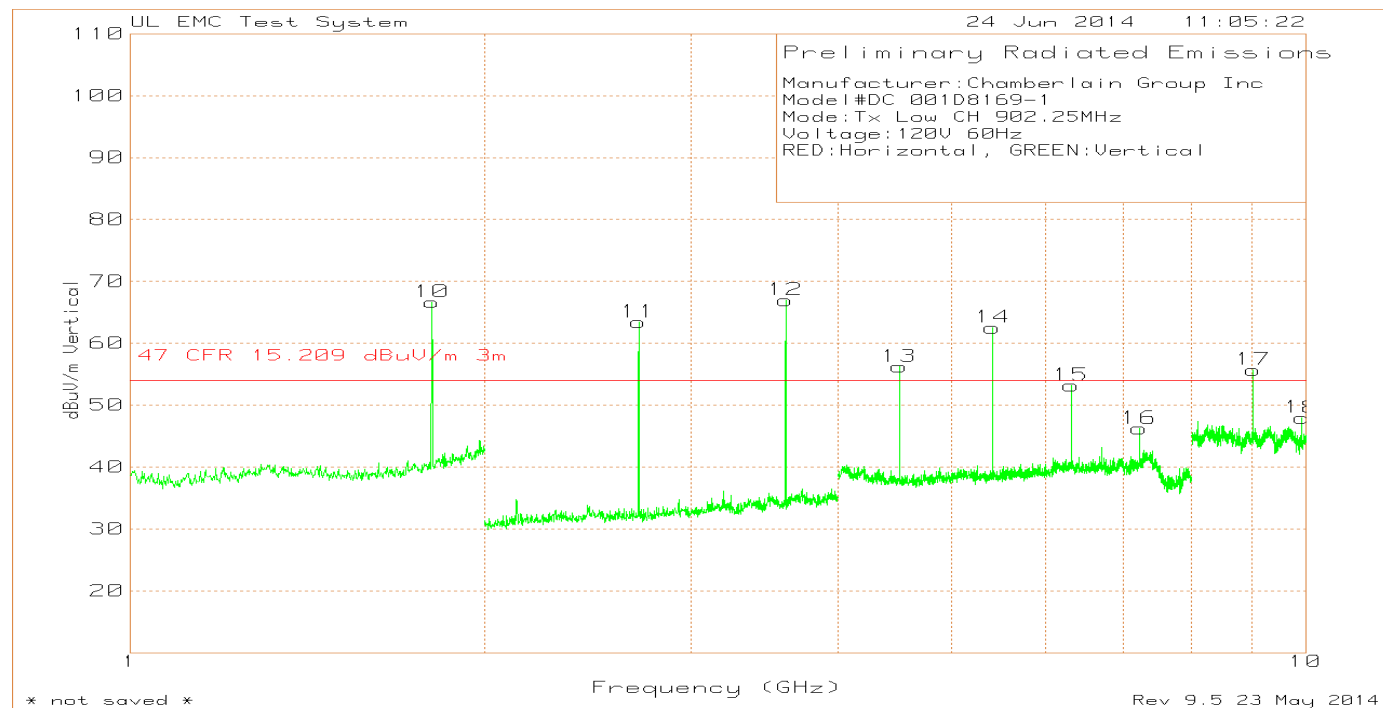
Table 9 30MHz – 1GHz Radiated Emissions Data Points TX Hopping

Chamberlain Group Inc
 DC 001D8169-1
 Tx Hopping
 120V 60Hz
 RED:Horizontal, GREEN:Vertical

Trace Markers											
No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dBuV/m	Limit:1	2	3	4	5	6
=====											
1	48.9125	41.93dBuV PK	10.6	-19.6	32.93	-	-	-	-	-	-
		Azimuth:0-360	Height:399	Horz	Margin (dB)	-	-	-	-	-	-
2	50.1025	40.04dBuV PK	10.2	-19.5	30.74	-	-	-	-	-	-
		Azimuth:0-360	Height:399	Horz	Margin (dB)	-	-	-	-	-	-
3	31.105	32.49dBuV PK	17.3	-19.6	30.19	-	-	-	-	-	-
		Azimuth:0-360	Height:250	Vert	Margin (dB)	-	-	-	-	-	-
4	49.5075	36.9dBuV PK	10.4	-19.5	27.8	-	-	-	-	-	-
		Azimuth:0-360	Height:99	Vert	Margin (dB)	-	-	-	-	-	-
5	300.2664	35.3dBuV PK	13.1	-15.4	33	-	-	-	-	-	-
		Azimuth:0-360	Height:299	Horz	Margin (dB)	-	-	-	-	-	-
6	923.8649	29.24dBuV PK	22.8	71.1	123.14	-	-	-	-	-	-
		Azimuth:0-360	Height:199	Horz	Margin (dB)	-	-	-	-	-	-
7	899.8649	27.93dBuV PK	22.8	59.8	110.53	-	-	-	-	-	-
		Azimuth:0-360	Height:98	Horz	Margin (dB)	-	-	-	-	-	-
8	923.8649	29.24dBuV PK	22.8	71.1	123.14	-	-	-	-	-	-
		Azimuth:0-360	Height:199	Horz	Margin (dB)	-	-	-	-	-	-
12	847.1984	27.57dBuV PK	22.7	-5.3	44.97	-	-	-	-	-	-
		Azimuth:0-360	Height:399	Horz	Margin (dB)	-	-	-	-	-	-
14	952.9315	28.92dBuV PK	23.4	-6.7	45.62	-	-	-	-	-	-
		Azimuth:0-360	Height:299	Horz	Margin (dB)	-	-	-	-	-	-
9	734.532	29.73dBuV PK	20.3	-13.3	36.73	-	-	-	-	-	-
		Azimuth:0-360	Height:99	Vert	Margin (dB)	-	-	-	-	-	-
10	900.6649	27.49dBuV PK	22.8	60.1	110.39	-	-	-	-	-	-
		Azimuth:0-360	Height:199	Vert	Margin (dB)	-	-	-	-	-	-
11	921.8649	31.5dBuV PK	22.9	68.9	123.3	-	-	-	-	-	-
		Azimuth:0-360	Height:199	Vert	Margin (dB)	-	-	-	-	-	-
13	847.5984	27.94dBuV PK	22.6	-5.1	45.44	-	-	-	-	-	-
		Azimuth:0-360	Height:199	Vert	Margin (dB)	-	-	-	-	-	-
15	953.1981	28.31dBuV PK	23.4	-6.9	44.81	-	-	-	-	-	-
		Azimuth:0-360	Height:399	Vert	Margin (dB)	-	-	-	-	-	-

LIMIT 1: Limit 47 CFR 15.209 dBuV/m 3m
 PK - Peak detector

Figure 8 Low Channel 1GHz – 10GHz Radiated Emissions Graph



Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

Table 10 Low Channel 1GHz – 10GHz Radiated Emissions Data Points

Manufacturer: Chamberlain Group Inc
 Model#DC 001D8169-1
 Mode:Tx Low CH 902.25MHz
 Voltage:120V 60Hz
 RED:Horizontal, GREEN:Vertical
 Trace Markers

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	BRF dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.8056	94.84	PK	29.9	0.4	-53.52	71.62	-	-	0-360	149	H
2	* 2.7067	89.95	PK	22.1	0	-50.69	61.36	54	7.36	0-360	150	H
3	* 3.6096	83.13	PK	23.2	0	-50.39	55.94	54	1.94	0-360	150	H
4	* 4.5103	78.05	PK	27.8	0	-51.68	54.17	54	0.17	0-360	150	H
5	* 5.4147	78.02	PK	27.9	0	-49.11	56.81	54	2.81	0-360	150	H
6	6.3172	70.44	PK	29.2	0	-46.82	52.82	-	-	0-360	150	H
7	7.2176	64.02	PK	29.8	0	-46.29	47.53	-	-	0-360	150	H
8	* 9.023	63.87	PK	36.1	0	-48.02	51.95	54	-2.05	0-360	150	H
9	9.9259	62.51	PK	36.4	0	-48.98	49.93	-	-	0-360	150	H
10	1.8056	89.86	PK	29.9	0.4	-53.52	66.64	-	-	0-360	150	V
11	* 2.7067	91.99	PK	22.1	0	-50.69	63.4	54	9.4	0-360	150	V
12	* 3.6096	94.15	PK	23.2	0	-50.39	66.96	54	12.96	0-360	150	V
13	* 4.5103	80.09	PK	27.8	0	-51.68	56.21	54	2.21	0-360	150	V
14	* 5.4147	83.73	PK	27.9	0	-49.11	62.52	54	8.52	0-360	150	V
15	6.3172	70.79	PK	29.2	0	-46.82	53.17	-	-	0-360	150	V
16	7.2196	62.68	PK	29.8	0	-46.26	46.22	-	-	0-360	150	V
17	* 9.023	67.6	PK	36.1	0	-48.02	55.68	54	1.68	0-360	150	V
18	9.9259	60.52	PK	36.4	0	-48.98	47.94	-	-	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

Radiated Emission Data

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	DC Factor dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
* 2.7067	96.48	PK	22.1	0	-50.69	67.89	74	-6.11	95	100	H
* 2.7068	96.23	LnAv	22.1	-24.9	-50.69	42.71	54	-11.29	95	100	H
* 3.609	92.15	PK	23.2	0	-50.4	64.95	74	-9.05	165	100	H
* 3.609	91.84	LnAv	23.2	-24.9	-50.4	39.71	54	-14.29	165	100	H
* 5.4135	87.03	PK	27.9	0	-49.12	65.81	74	-8.19	186	105	H
* 5.4135	86.57	LnAv	27.9	-24.9	-49.12	40.42	54	-13.58	186	105	H
* 4.5112	84.26	PK	27.8	0	-51.68	60.38	74	-13.62	185	100	H
* 4.5113	83.5	LnAv	27.8	-24.9	-51.68	34.69	54	-19.31	185	100	H
* 9.0225	69.97	PK	36.1	0	-48.02	58.05	74	-15.95	189	100	H
* 9.0225	66.68	LnAv	36.1	-24.9	-48.02	29.83	54	-24.17	189	100	H
* 3.609	98.06	PK	23.2	0	-50.4	70.86	74	-3.14	158	104	V
* 3.609	97.5	LnAv	23.2	-24.9	-50.4	45.37	54	-8.63	158	104	V
* 2.7067	93.79	PK	22.1	0	-50.69	65.2	74	-8.8	236	106	V
* 2.7068	93.49	LnAv	22.1	-24.9	-50.69	39.97	54	-14.03	236	106	V
* 5.4135	83.76	PK	27.9	0	-49.12	62.54	74	-11.46	89	100	V
* 5.4135	83.18	LnAv	27.9	-24.9	-49.12	37.03	54	-16.97	89	100	V
* 4.5112	85.27	PK	27.8	0	-51.68	61.39	74	-12.61	188	103	V
* 4.5112	84.34	LnAv	27.8	-24.9	-51.68	35.53	54	-18.47	188	103	V
* 9.0224	71.61	PK	36.1	0	-48.02	59.69	74	-14.31	218	129	V
** 9.0224	71.61	PK	36.1	-24.9	-48.02	34.76	54	-19.24	218	129	V

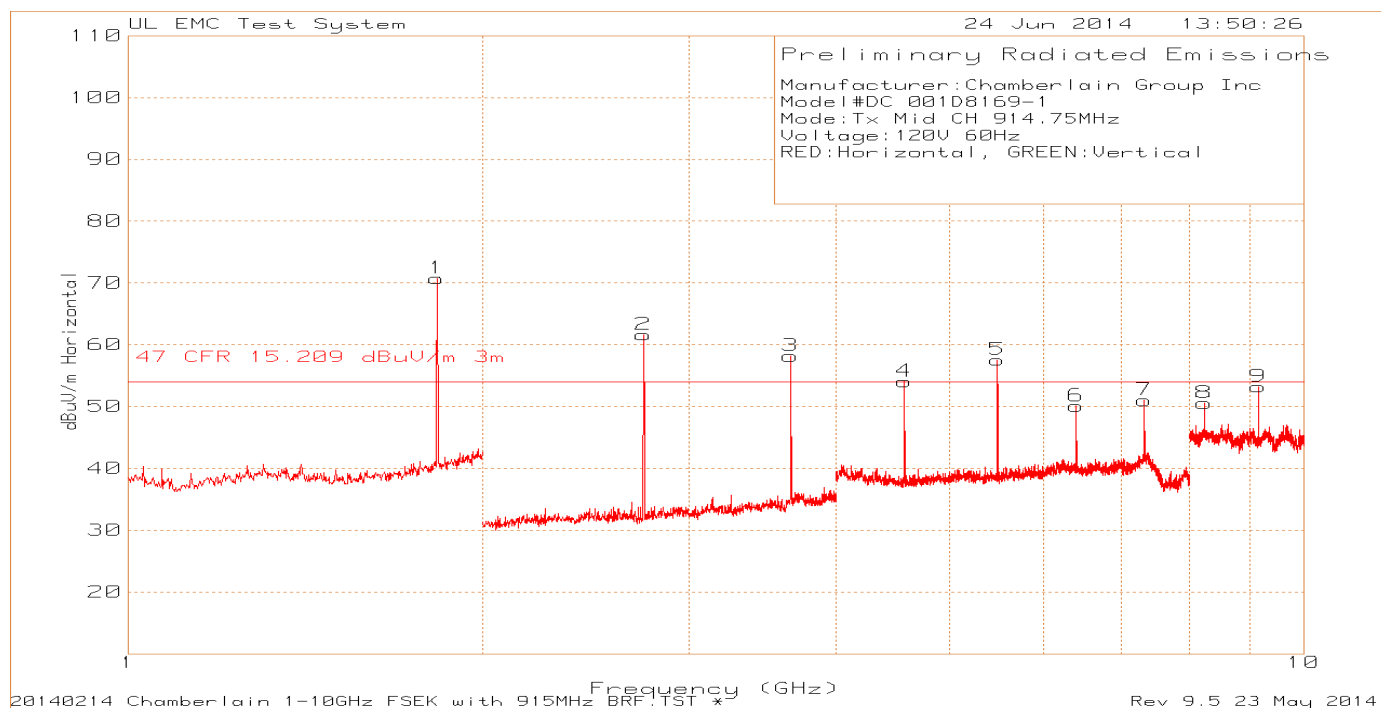
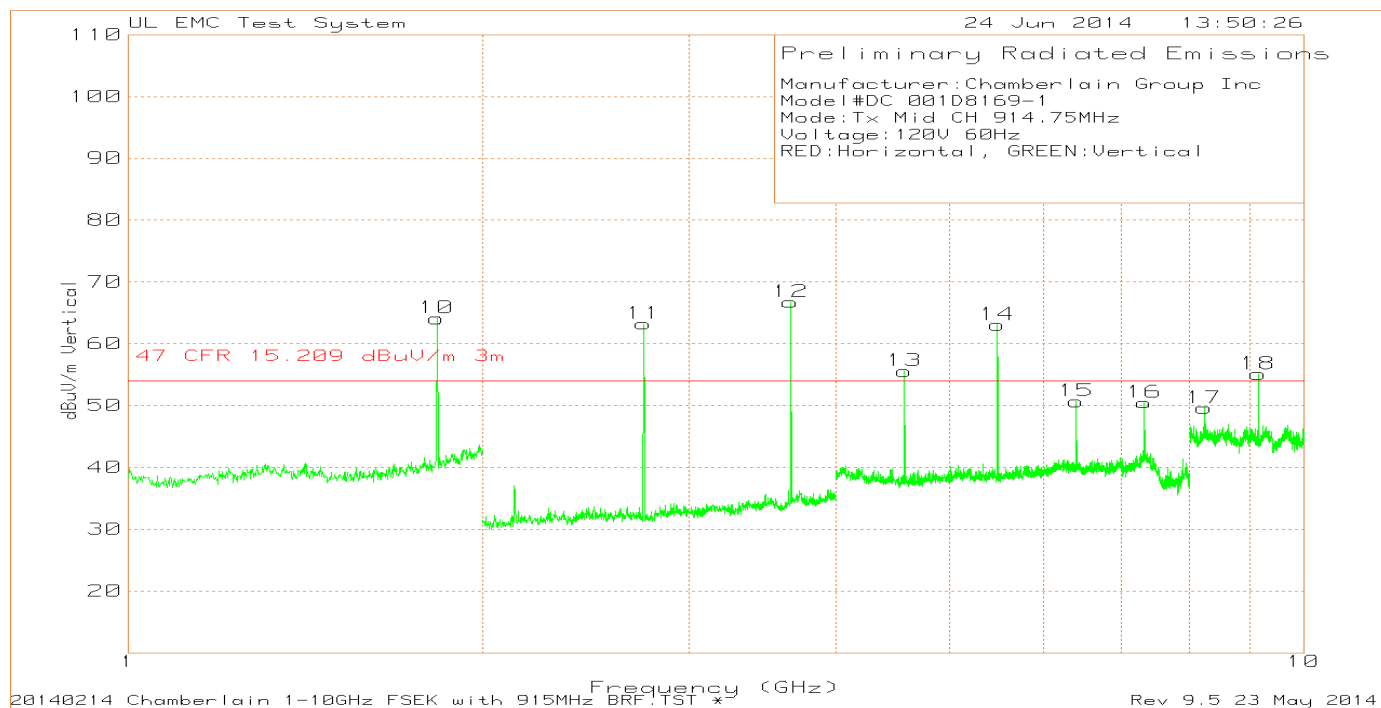
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

** - indicates frequency in CFR15.205/IC7.2.2 Restricted Band. Average measurement was not conducted but duty cycle factor was applied to maximum peak level. The end result shows worst case level under the average limit.

PK - Peak detector

LnAv - Linear (voltage) average detector

Figure 9 Middle Channel 1GHz – 10GHz Radiated Emissions Graph



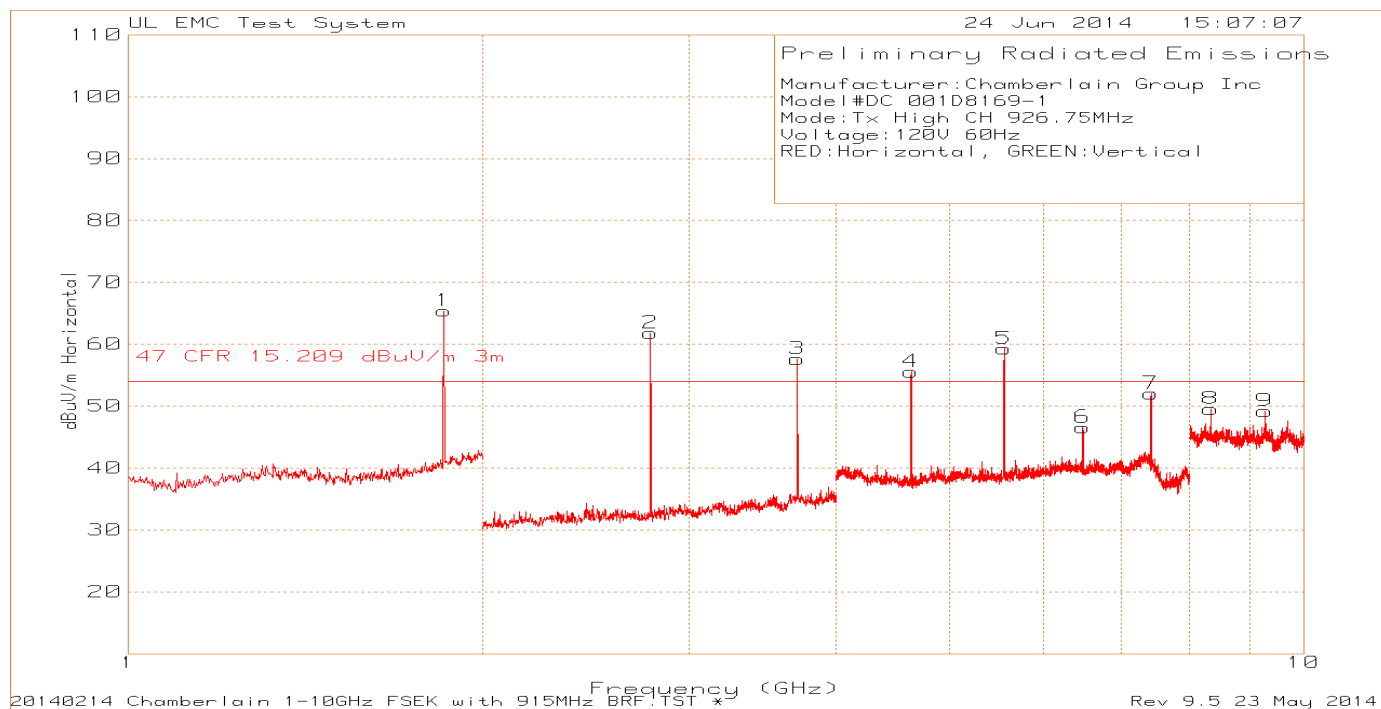
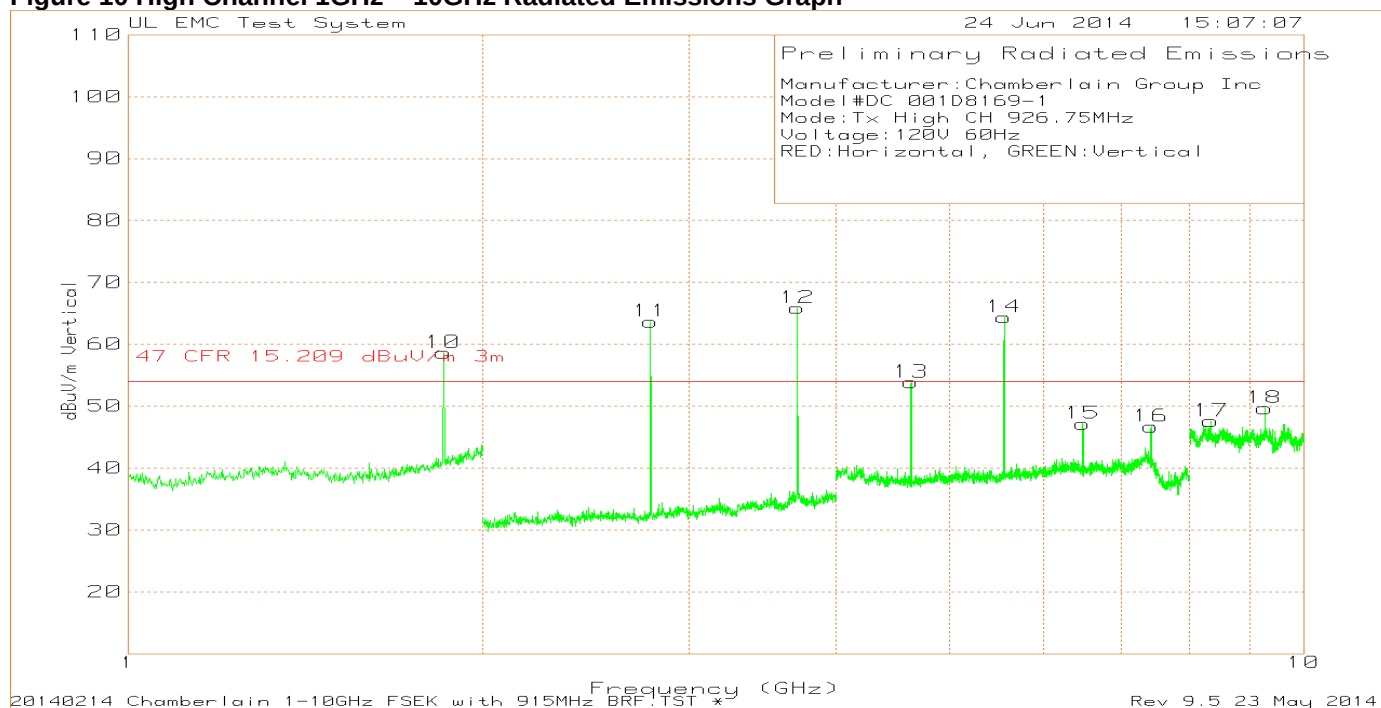
Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

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Table 11 Middle Channel 1GHz – 10GHz Radiated Emissions Data Points

Manufacturer:Chamberlain Group Inc Model#DC 001D8169-1 Mode:Tx Mid CH 914.75MHz Voltage:120V 60Hz RED:Horizontal, GREEN:Vertical Trace Markers												
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	BRF dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Deps]	Height [cm]	Polarity
1	1.8297	93.66	PK	30.2	0.4	-53.52	70.74	-	-	0-360	100	H
2	* 2.7447	90.21	PK	22.1	0	-50.67	61.64	54	7.64	0-360	150	H
3	* 3.6597	83.79	PK	23.4	0	-49	58.19	54	4.19	0-360	150	H
4	* 4.5743	77.91	PK	27.7	0	-51.56	54.05	54	0.05	0-360	150	H
5	5.4887	78.69	PK	28.1	0	-49.24	57.55	-	-	0-360	150	H
6	6.4032	67.91	PK	29.2	0	-47.02	50.09	-	-	0-360	150	H
7	* 7.3197	66.14	PK	30.6	0	-45.71	51.03	54	-2.97	0-360	150	H
8	* 8.2322	61.15	PK	36.4	0	-46.99	50.56	54	-3.44	0-360	150	H
9	* 9.1471	66.35	PK	36.3	0	-49.43	53.22	54	-0.78	0-360	150	H
10	1.8297	87.03	PK	30.2	0.4	-53.52	64.11	-	-	0-360	150	V
11	* 2.7447	91.82	PK	22.1	0	-50.67	63.25	54	9.25	0-360	150	V
12	* 3.6597	92.36	PK	23.4	0	-49	66.76	54	12.76	0-360	150	V
13	* 4.5743	79.46	PK	27.7	0	-51.56	55.6	54	1.6	0-360	150	V
14	5.4887	84.2	PK	28.1	0	-49.24	63.06	-	-	0-360	150	V
15	6.4032	68.49	PK	29.2	0	-47.02	50.67	-	-	0-360	150	V
16	* 7.3197	65.59	PK	30.6	0	-45.71	50.48	54	-3.52	0-360	150	V
17	* 8.2322	60.2	PK	36.4	0	-46.99	49.61	54	-4.39	0-360	150	V
18	* 9.1471	68.21	PK	36.3	0	-49.43	55.08	54	1.08	0-360	150	V
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band PK - Peak detector Radiated Emission Data												
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	DC Factor dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Deps]	Height [cm]	Polarity	
* 2.7442	97.16	PK	22.1	0	-50.67	68.59	74	-5.41	114	100	H	
* 2.7443	97	LnAv	22.1	-24.9	-50.67	43.5	54	-10.5	114	100	H	
* 3.6589	92.97	PK	23.4	0	-49.02	67.35	74	-6.65	161	100	H	
* 3.659	92.67	LnAv	23.4	-24.9	-49.02	42.12	54	-11.88	161	100	H	
* 4.5737	84.16	PK	27.7	0	-51.56	60.3	74	-13.7	182	100	H	
* 4.5737	83.44	LnAv	27.7	-24.9	-51.56	34.65	54	-19.35	182	100	H	
* 7.3179	74.39	PK	30.6	0	-45.71	59.28	74	-14.72	226	100	H	
* 7.318	73.11	LnAv	30.6	-24.9	-45.71	33.07	54	-20.93	226	100	H	
* 9.1474	71.8	PK	36.3	0	-49.43	58.67	74	-15.33	180	100	H	
* 9.1474	68.55	LnAv	36.3	-24.9	-49.43	30.49	54	-23.51	180	100	H	
* 8.2328	67.11	PK	36.4	0	-46.99	56.52	74	-17.48	210	103	H	
* 8.2327	61.99	LnAv	36.4	-24.9	-46.99	26.47	54	-27.53	210	103	H	
* 3.6589	97.05	PK	23.4	0	-49.02	71.43	74	-2.57	159	103	V	
* 3.659	96.67	LnAv	23.4	-24.9	-49.02	46.12	54	-7.88	159	103	V	
* 2.7442	91.67	PK	22.1	0	-50.67	63.1	74	-10.9	327	105	V	
* 2.7443	91.37	LnAv	22.1	-24.9	-50.67	37.87	54	-16.13	327	105	V	
* 4.5737	83.87	PK	27.7	0	-51.56	60.01	74	-13.99	185	100	V	
* 4.5737	83.08	LnAv	27.7	-24.9	-51.56	34.29	54	-19.71	185	100	V	
* 7.3179	72.15	PK	30.6	0	-45.71	57.04	74	-16.96	162	100	V	
* 7.318	70.4	LnAv	30.6	-24.9	-45.71	30.36	54	-23.64	162	100	V	
* 9.1474	72.73	PK	36.3	0	-49.43	59.6	74	-14.4	169	100	V	
* 9.1474	70.43	LnAv	36.3	-24.9	-49.43	32.37	54	-21.63	169	100	V	
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band PK - Peak detector LnAv - Linear (voltage) average detector												

Figure 10 High Channel 1GHz – 10GHz Radiated Emissions Graph



Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

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Table 12 High Channel 1GHz – 10GHz Radiated Emissions Data Points

Manufacturer:Chamberlain Group Inc

Model#DC 001D8169-1

Mode:Tx High CH 926.75MHz

Voltage:120V 60Hz

RED:Horizontal, GREEN:Vertical

Trace Markers

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	BRF dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.8557	87.82	PK	30.6	0.4	-53.4	65.42	-	-	0-360	103	H
2	* 2.7808	90.09	PK	22.2	0	-50.48	61.81	54	7.81	0-360	150	H
3	* 3.7077	83.04	PK	23.5	0	-48.91	57.63	54	3.63	0-360	150	H
4	* 4.6343	79.37	PK	27.7	0	-51.53	55.54	54	1.54	0-360	150	H
5	5.5608	80.47	PK	28.3	0	-49.49	59.28	-	-	0-360	150	H
6	6.4872	64.8	PK	29.1	0	-47.36	46.54	-	-	0-360	150	H
7	* 7.4157	67.61	PK	30.9	0	-46.48	52.03	54	-1.97	0-360	150	H
8	* 8.3403	61.46	PK	36.5	0	-48.41	49.55	54	-4.45	0-360	150	H
9	9.2673	60.67	PK	36.4	0	-47.87	49.2	-	-	0-360	150	H
10	1.8537	81.13	PK	30.5	0.4	-53.41	58.62	-	-	0-360	150	V
11	* 2.7808	91.93	PK	22.2	0	-50.48	63.65	54	9.65	0-360	150	V
12	* 3.7077	91.27	PK	23.5	0	-48.91	65.86	54	11.86	0-360	150	V
13	* 4.6343	77.67	PK	27.7	0	-51.53	53.84	54	-0.16	0-360	150	V
14	5.5608	85.56	PK	28.3	0	-49.49	64.37	-	-	0-360	150	V
15	6.4872	65.43	PK	29.1	0	-47.36	47.17	-	-	0-360	150	V
16	* 7.4157	62.27	PK	30.9	0	-46.48	46.69	54	-7.31	0-360	150	V
17	* 8.3403	59.5	PK	36.5	0	-48.41	47.59	54	-6.41	0-360	150	V
18	9.2673	61.13	PK	36.4	0	-47.87	49.66	-	-	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

Radiated Emission Data

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	DC Factor dB	Cable Factor dB	Level dBuV/m	Limit 47 CFR Part 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
* 2.7802	97.7	PK	22.2	0	-50.49	69.41	74	-4.59	114	100	H
* 2.7803	97.49	LnAv	22.2	-24.9	-50.49	44.27	54	-9.73	114	100	H
* 3.707	91.6	PK	23.5	0	-48.9	66.2	74	-7.8	160	100	H
* 3.707	91.31	LnAv	23.5	-24.9	-48.9	40.98	54	-13.02	160	100	H
* 4.6337	82.69	PK	27.7	0	-51.53	58.86	74	-15.14	188	100	H
* 4.6338	81.73	LnAv	27.7	-24.9	-51.53	32.97	54	-21.03	188	100	H
* 7.414	75.02	PK	31	0	-46.46	59.56	74	-14.44	222	100	H
* 7.414	73.78	LnAv	31	-24.9	-46.46	33.39	54	-20.61	222	100	H
* 3.7069	96.47	PK	23.5	0	-48.9	71.07	74	-2.93	167	102	V
* 3.707	96.2	LnAv	23.5	-24.9	-48.9	45.87	54	-8.13	167	102	V
* 2.7802	91.27	PK	22.2	0	-50.49	62.98	74	-11.02	360	103	V
* 2.7803	90.97	LnAv	22.2	-24.9	-50.49	37.75	54	-16.25	360	103	V
* 4.6336	81.9	PK	27.7	0	-51.53	58.07	74	-15.93	162	101	V
* 4.6337	80.8	LnAv	27.7	-24.9	-51.53	32.04	54	-21.96	162	101	V

PK - Peak detector

LnAv - Linear (voltage) average detector

4.3 Test Conditions and Results – MAXIMUM PEAK OUTPUT POWER

Test Description	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	
Basic Standard	47 CFR Part 15.247(b)(2) RSS-210, A8.4(2)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902MHz – 928MHz	Antenna Conducted
Limits		
Frequency (MHz)	Limit mW	
	Peak	
902 - 928	1000 (30dBm – gain of Antenna over 6dBi)	
Supplementary information: None		

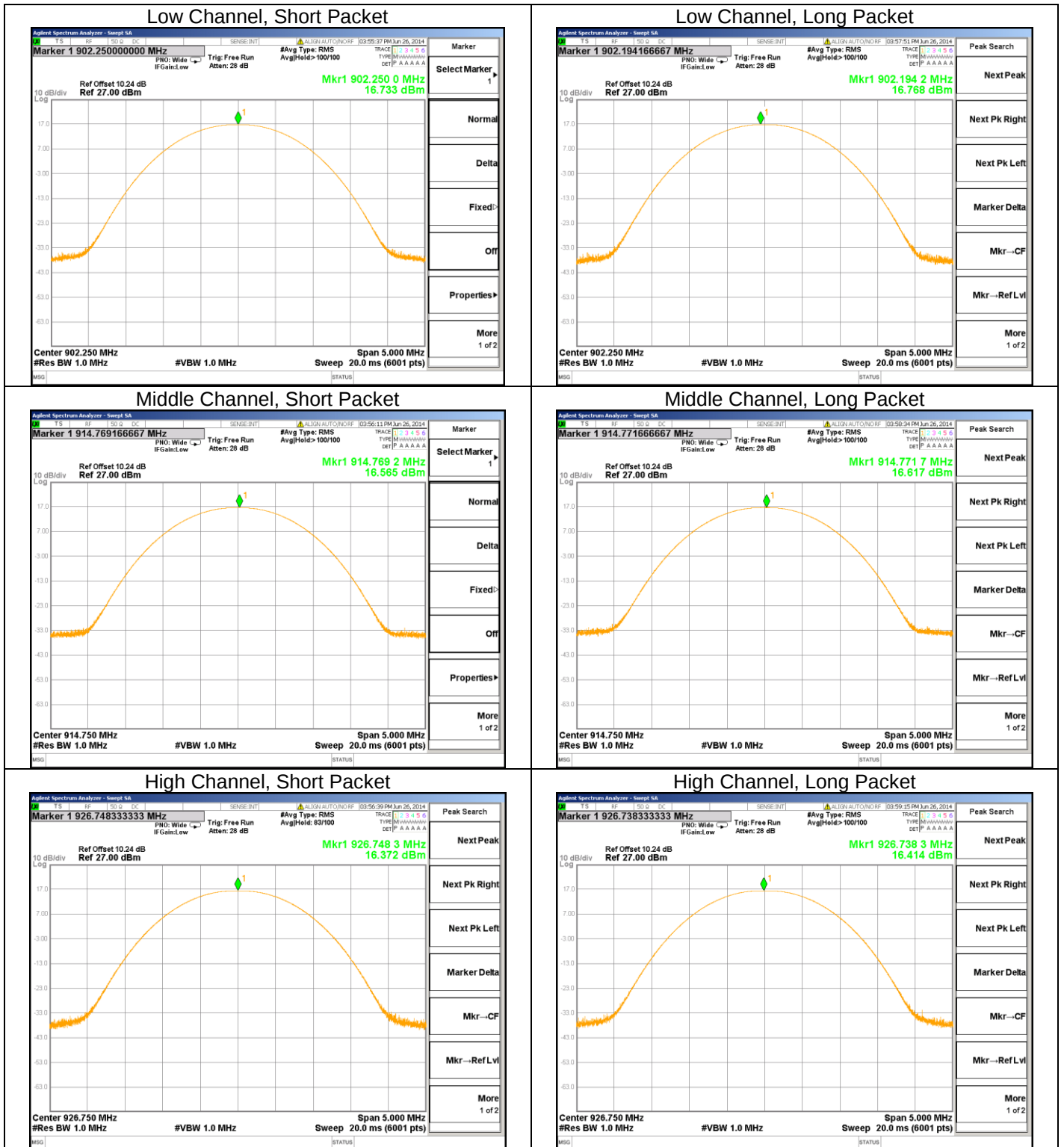
Table 13 Maximum Peak Output Power EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

Table 14 Maximum Peak Output Power Results

Channel	Limit (dBm)	Power dBm	Power mW
Low Channel, Short Packet	30	16.733	47.13
Middle Channel, Short Packet	30	16.565	45.34
High Channel, Short Packet	30	16.372	43.37
Low Channel, Long Packet	30	16.768	47.51
Middle Channel, Long Packet	30	16.617	45.89
High Channel, Long Packet	30	16.414	43.79

Figure 11 Maximum Peak Output Power Graph



4.4 Test Conditions and Results – Time of Occupancy and Duty Cycle Correction

Test Description	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(d)

Table 15 Dwell Time Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: Duty cycle also measured/calculated for use in radiated spurious measurements		

Table 16 Dwell Time Results

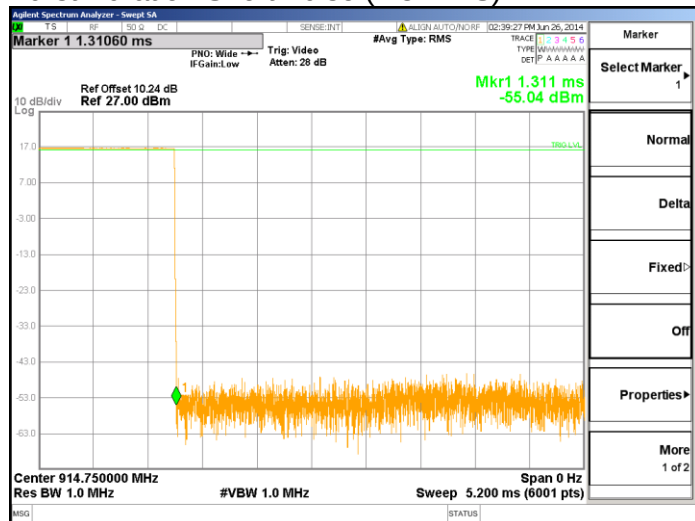
Mode	Number of Channels	Maximum Time Allowed in 20s.	Measured Dwell Time in 20s.
TX Hopping	50	0.4s	0.11537s

Table 17 Duty Cycle Correction Factor

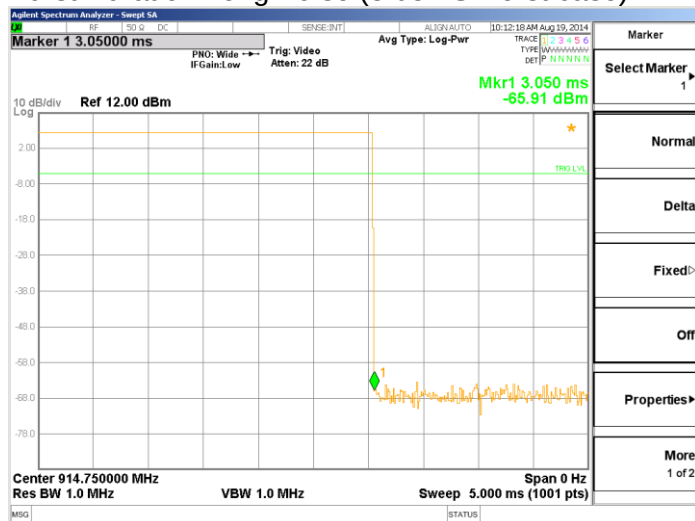
Mode	Number of TX in 100mS	TX Duration in 100mS	Duty Cycle Correction (dB) $20 \times \log\left(\frac{TX(ms)}{100ms}\right)$
TX Short Packet	1	1.311	-37.65
TX Long Packet	1	3.05	-30.31
Per the operational descriptions there is a rare worst case possibility where transmission may take place when two short pulses and one long pulse is transmitted within 100mS window. This case is almost impossible to capture. If this case ever happens the duty cycle correction factor will decrease from -30.31dB to -24.93dB based on the measured individual pulse lengths. This is slightly less than what is reported by the manufacturer in the operational description. The manufacturer uses theoretical values for the Log Pulse TX duration where measured values are used in this test report. For Radiated Spurious Emissions the worst case is used.			

Figure 12 Dwell Time Graphs

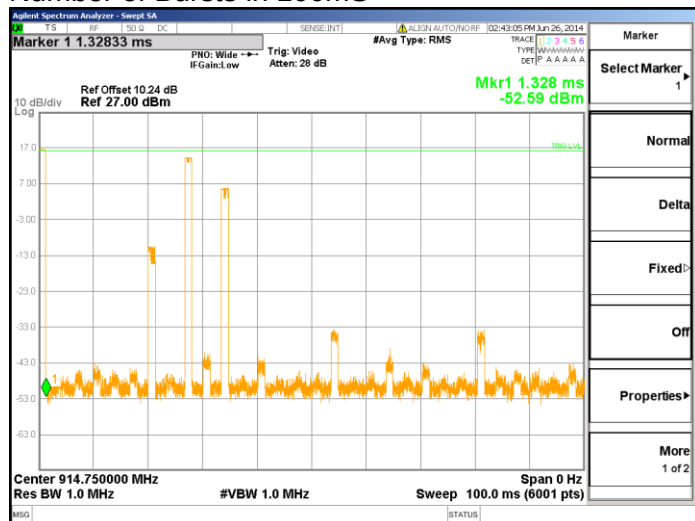
Burst Duration Short Pulse (1.311ms)



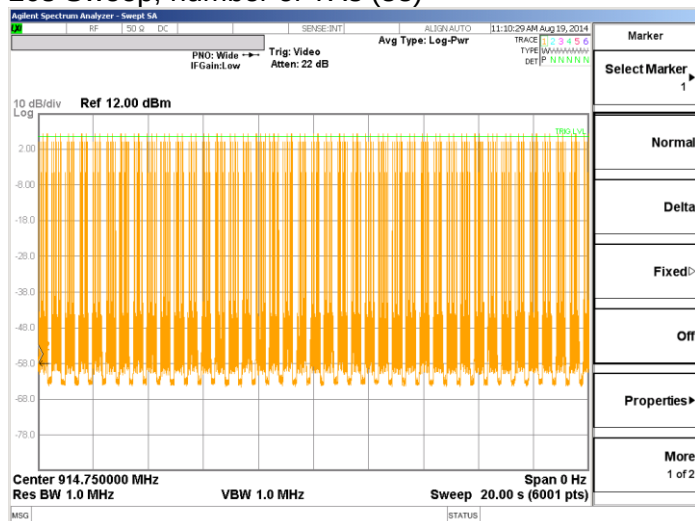
Burst Duration Long Pulse (3.05mS worst case)



Number of Bursts in 100mS



20s Sweep, number of TXs (88)



In 100mS only single pulse on the same frequency is transmitted. This is independent of short or long pulses.

The number of transitions plots show only the single channel. It was checked that the number of transitions was the same on other channels do to equal channel use. The total number of TX pulses counted in 20s is: 88. Total maximum transmit time: 115.37mS within 20s.

4.5 Test Conditions and Results – NUMBER OF HOPPING FREQUENCIES

Test Description	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.	
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(d)	

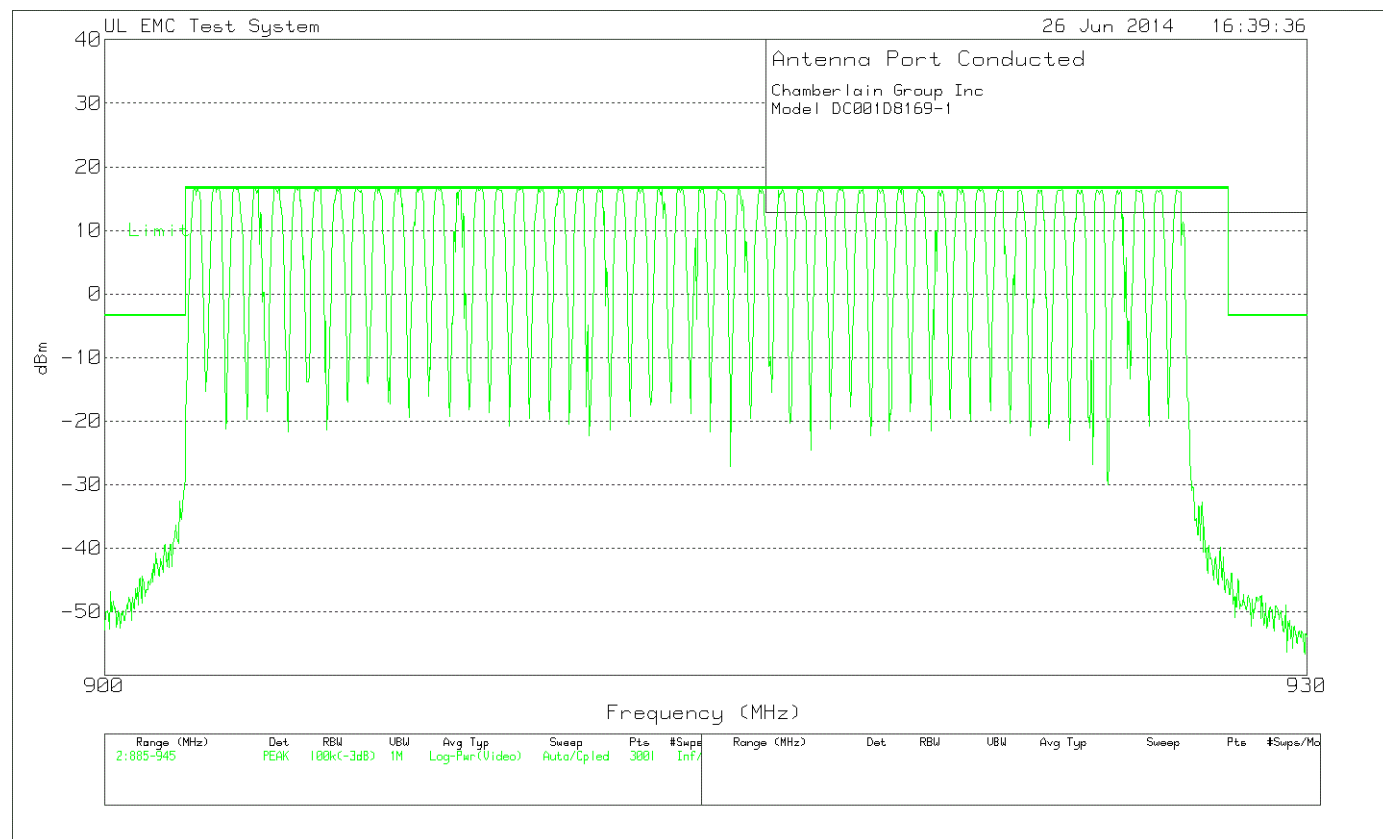
Table 18 Number of Hopping Frequencies Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

Table 19 Number of Hopping Frequencies Results

Mode	Number of Channels	Minimum Number Required
TX, Hopping	50	50

Figure 13 Number of Hopping Frequencies Graphs



4.6 Test Conditions and Results – 20DB BANDWIDTH & 99% BANDWIDTH

Test Description	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.		
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(b)		

Table 20 20dB Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

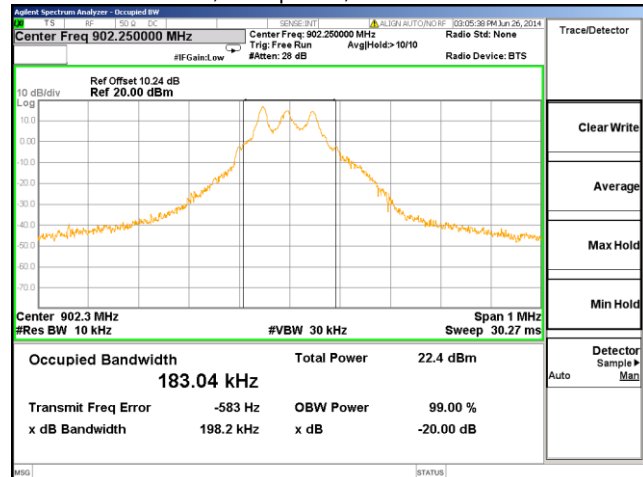
Table 21 20dB Bandwidth Results

Mode	Channel	20dB Bandwidth kHz	99% Bandwidth kHz
TX, Short Packet	Low	201.0	183.04
	Middle	207.1	191.50
	High	206.7	196.18
TX, Long Packet	Low	202.6	194.00
	Middle	207.3	195.73
	High	227.4	215.62

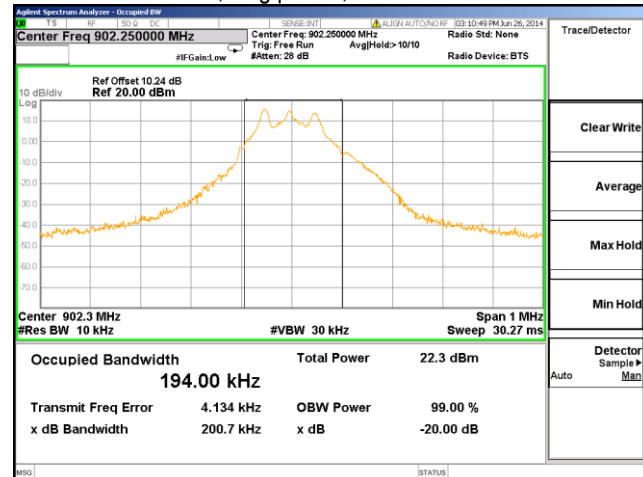
Figure 14 20dB Bandwidth Graphs & 99% Power Bandwidth Graphs



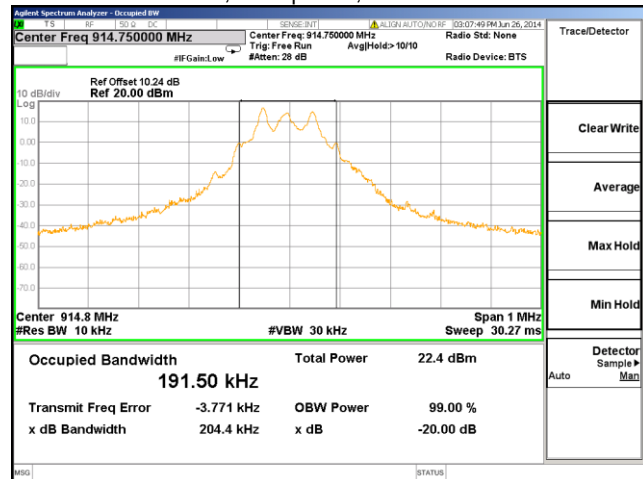
Low Channel, short packet, 99% Power Bandwidth



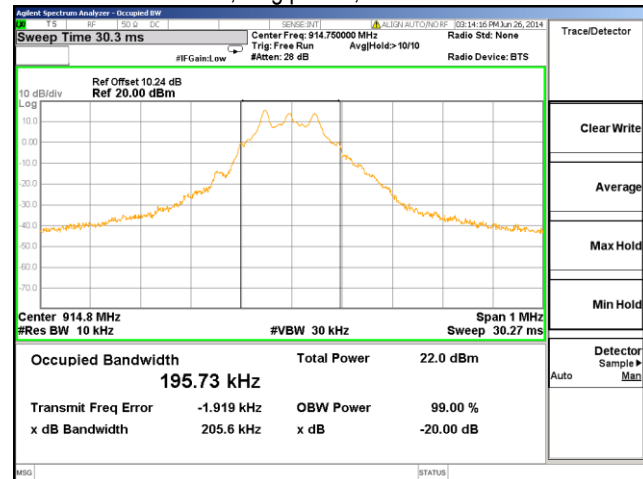
Low Channel, long packet, 99% Power Bandwidth



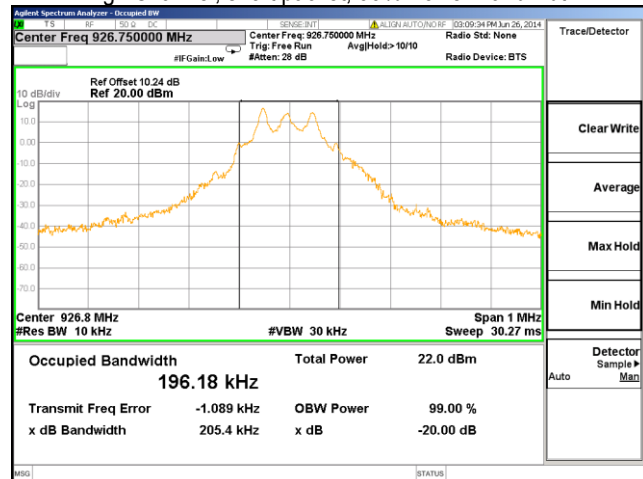
Middle Channel, short packet, 99% Power Bandwidth



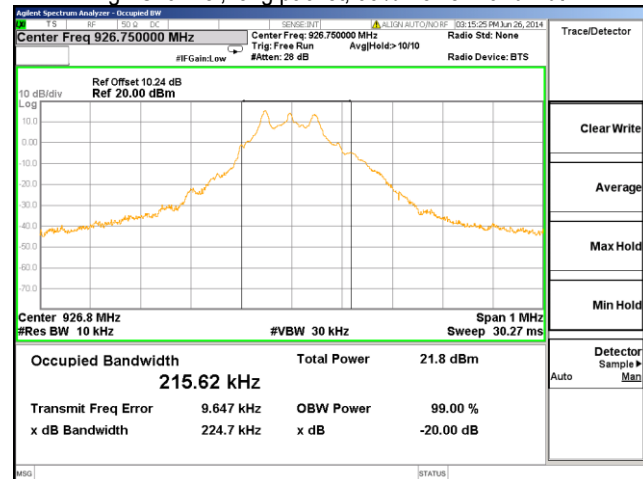
Middle Channel, long packet, 99% Power Bandwidth



High Channel, short packet, 99% Power Bandwidth



High Channel, long packet, 99% Power Bandwidth



4.7 Test Conditions and Results – Carrier Frequency Separation

Test Description	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.	
Basic Standard	47 CFR Part 15.247(a)(1) RSS-210, A8.1(b)	

Table 22 Carrier Frequency Separation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: Separation frequencies were measured for each channel and then averaged.		

Table 23 Carrier Frequency Separation Results

Mode	Channel	Carrier Frequency Separation Limit	Channel Separation
TX Hopping	Low Side	> 20dB Bandwidth (aprx. 200kHz)	499.50kHz
	Middle		501.75kHz
	High Side		502.75kHz

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Agilent Spectrum Analyzer - Swept SA

TS RF 50 Ω DC SENSE:INT ALIGN AUTO/NORF 02:20:10 PM Jun 26, 2014

Marker 1 Δ 499.500000 kHz

#Avg Type: RMS
Avg|Hold> 100/100

Trig: Free Run
Atten: 28 dB

Ref Offset 10.24 dB
Ref 27.00 dBm

10 dB/div
Log

Δ Mkr1 499.50 kHz
-0.059 dB

1X2

1 Δ 2

Center 902.2500 MHz
#Res BW 20 kHz

Span 1.500 MHz
Sweep 20.0 ms (6001 pts)

MSG STATUS

Marker

Select Marker 1

Normal

Delta

Fixed

Off

Properties

More
1 of 2

Figure 16 Carrier Frequency Separation Graph Middle Channels

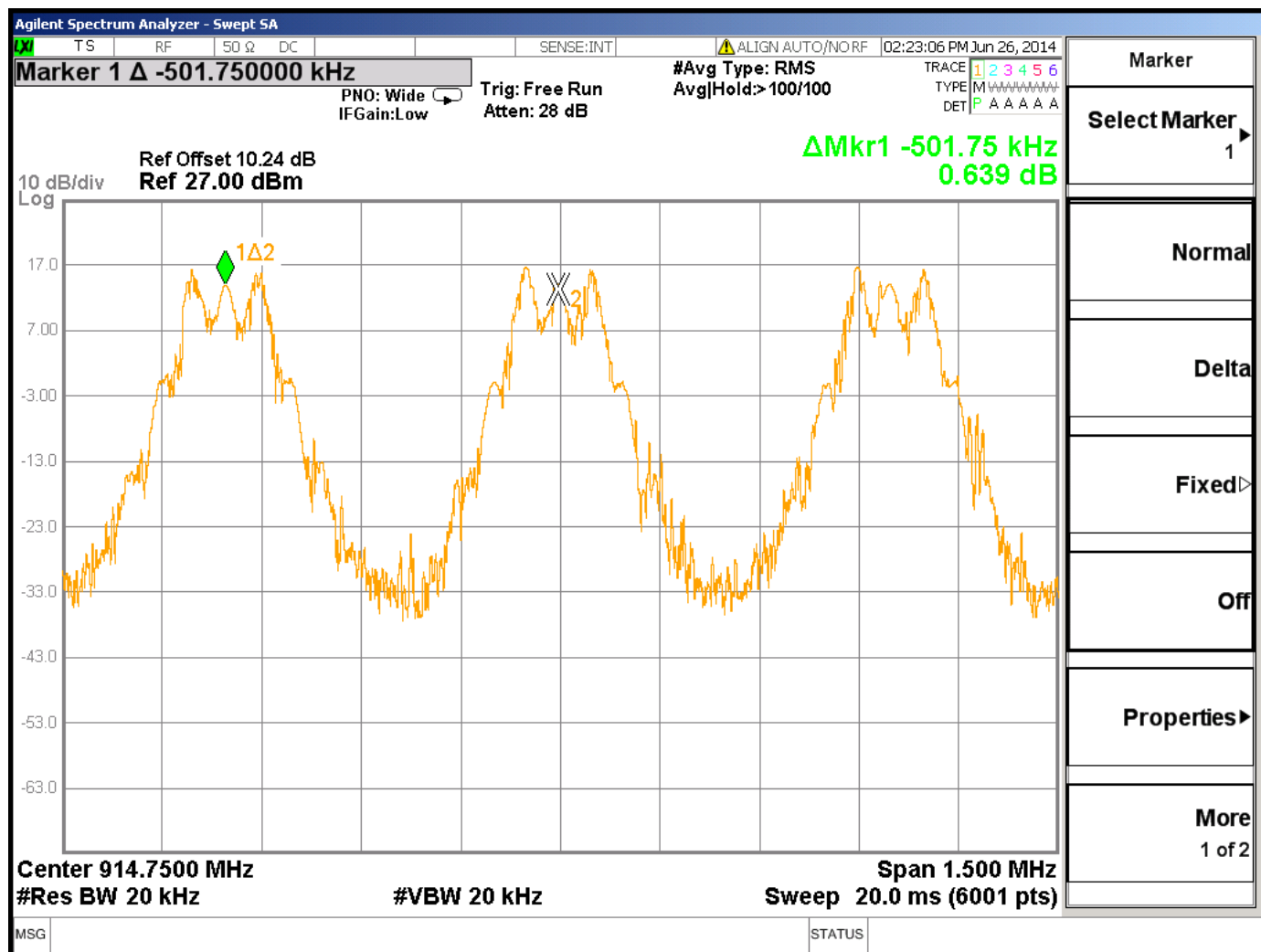
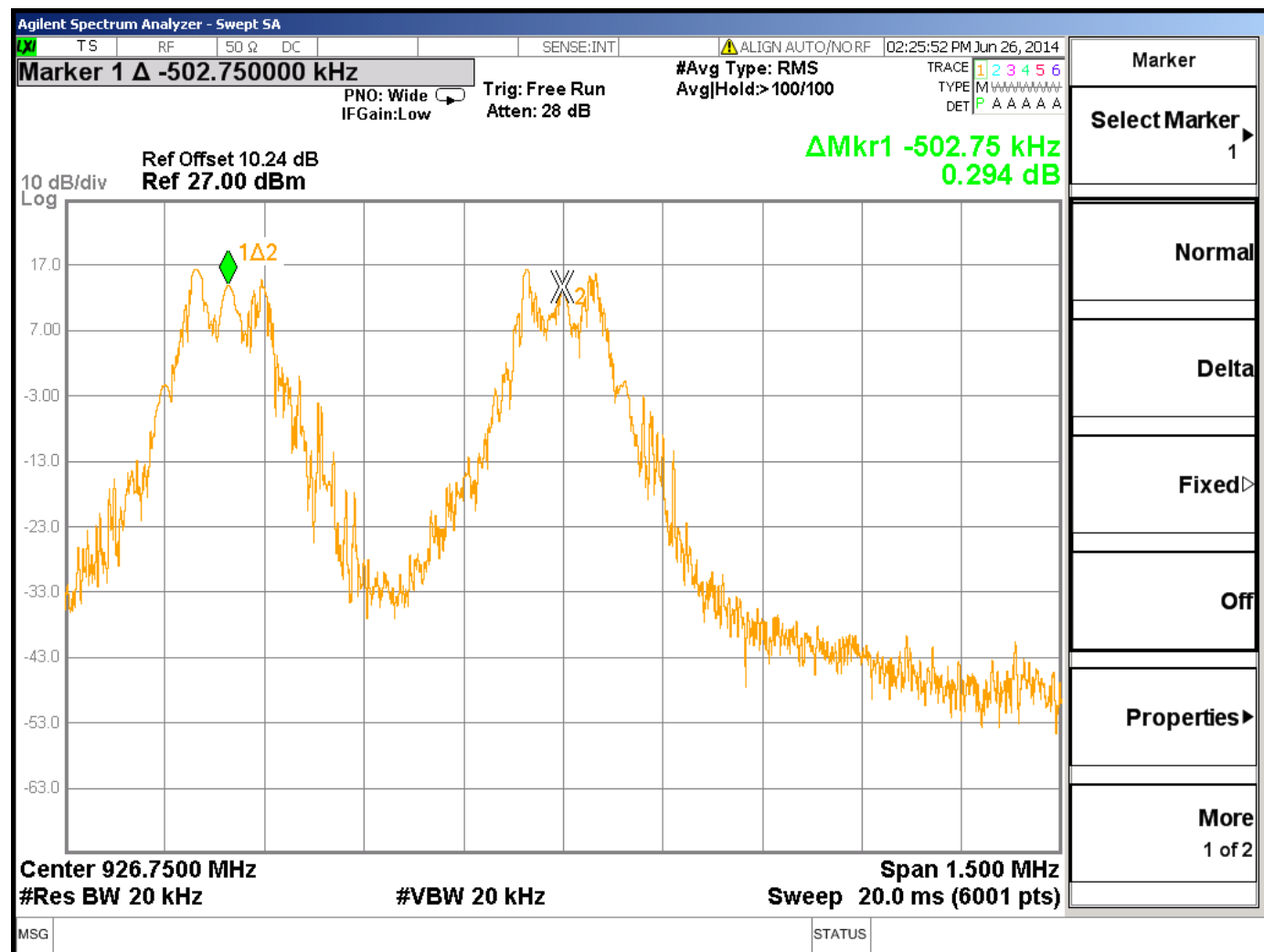


Figure 17 Carrier Frequency Separation Graph high Channels



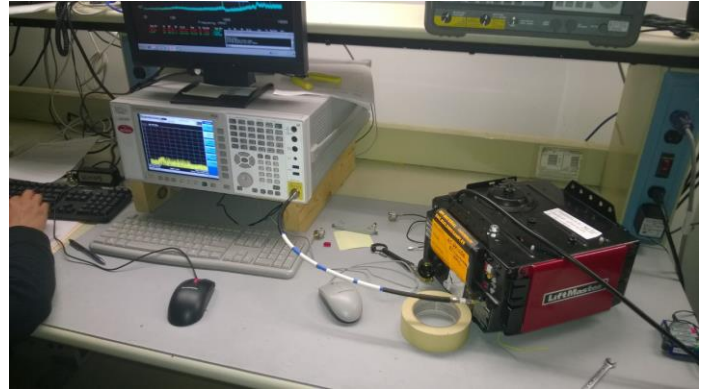
Appendix A

Test Setup Photos

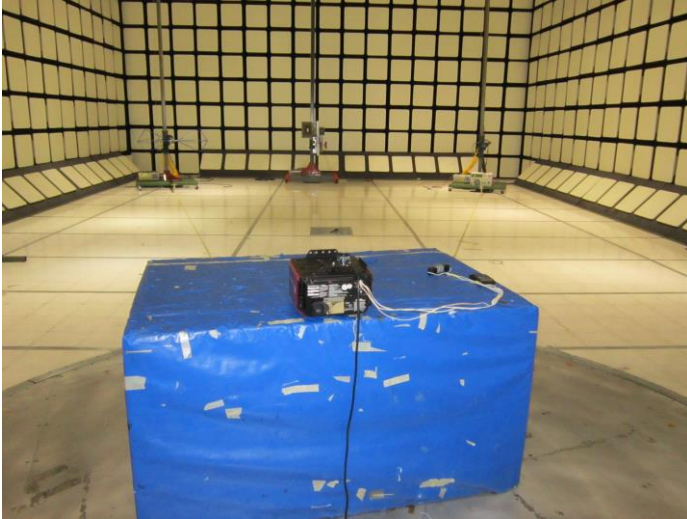
Line Conducted Emissions



Antenna Port Emissions



Radiated Spurious Emissions above below 1GHz



Radiated Spurious Emissions above 1GHz



Order Number: 10338213A
 Model Number: 001D8169-1
 Client Name: Chamberlain Group Inc.

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Appendix B

Test Equipment

Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20131217	20141231
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	20140115	20150116
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	20140115	20150116

Radiated Emissions – 10-Meter Chamber

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131220	20141231
Bicon Antenna	Chase	VBA6106A	EMC4078	20140401	20150401
Log-P Antenna	Chase	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131226	20141231
Antenna Array	UL	BOMS	EMC4276	20130912	20140930

Antenna Port Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Spectrum analyzer	Agilent	N9030A	EMC4360	20131221	20141221
Cable and Attenuator	-	-	-	*	*
* measured at the time of testing					

Appendix C

Accreditations and Authorizations



NVLAP Lab code: 100414-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see <http://ts.nist.gov/standards/scopes/1004140.htm>



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).



Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180A



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: A0140.



ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).



NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.

NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).

NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6

