UL LLC
333 Pfingsten Rd.
Northbrook, IL 60062

www.ul.com/emc
(847) 272-8800

Order Number:	10011450A
Project Number:	13N15104
Date:	2013 July 17
Rev1 Date	2013 August 02
Model:	821LM

Electromagnetic Compatibility Test Report

For

Chamberlain Group Inc.

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: Phone: E-mail:	**Hank Sieradzki** **(630) 993-6564** **Hank.Sieradzki@chamberlaingroup.com**
Test Report Date: Rev1 Report Date Product Type:	**2013 July 17** **2013 August 02** **Wireless Device**
Product standards	**47 CFR Part 15, Subpart C, RSS-210, RSS-Gen**
Model Number:	**821LM**
EUT Category:	**Wireless Device**
Testing Start Date:	**2013 May 30**
Date Testing Complete:	**2013 July 02**
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.

Report Directory

Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
20130802 Rev1	Editorial corrections and included missing data	BM	MF

1.0 G E N E R A L - Product Description

1.1 Equipment Description

The Equipment Under Test was a garage door gateway capable of controlling various garage door openers via multi frequency periodic transmitters and via Chamberlain FHSS 900MHz radio. In addition is equipped with WiFi and BT LE module allowing connection to mobile devices and control via internet. The 900MHz radio uses an wire antenna with -6dBi gain.

1.2 Device Configuration During Test

1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Garage Door Controller	Chamberlain Group Inc.	821LM	None
AE	Power Supply	Generic	GEO101a-075100W	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	AC to DC Adapter

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	AC to DC adapter

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.
2	EUT set to RX mode scanning all periodic transmitter frequency and 900MHz FHSS transmitter frequency for signals.

1.5 Rational for EUT Configuration

Mode #	Description
1	It is possible to mount the EUT either in ceiling mount configuration or wall mount configuration. During preliminary testing it was determined that the worst case emissions were observed when EUT is installed in wall mount configuration. All radiated emissions testing was conducted in wall mount orientation.

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

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, Subpart C	Radio Frequency Devices	2012
Additional guidance used FCC Document: DA 00-705		

2.4 Results Summary

Requirement – Test	References	Result (Compliant / Non-Compliant)*
Mains Terminal – Conducted Emissions	47 CFR Part 15.107, 15.207 RSS-Gen 7.2.4	Compliant
Digital Radiated Emissions	47 CFR Part 15.109	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
Dwell time and Duty Cycle	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
Wireless, Interoperability, payment Security, & EMC
Verification Services

Reviewer:

Michael Ferrer(Ext.41312)
WiSE Project Lead
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

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)

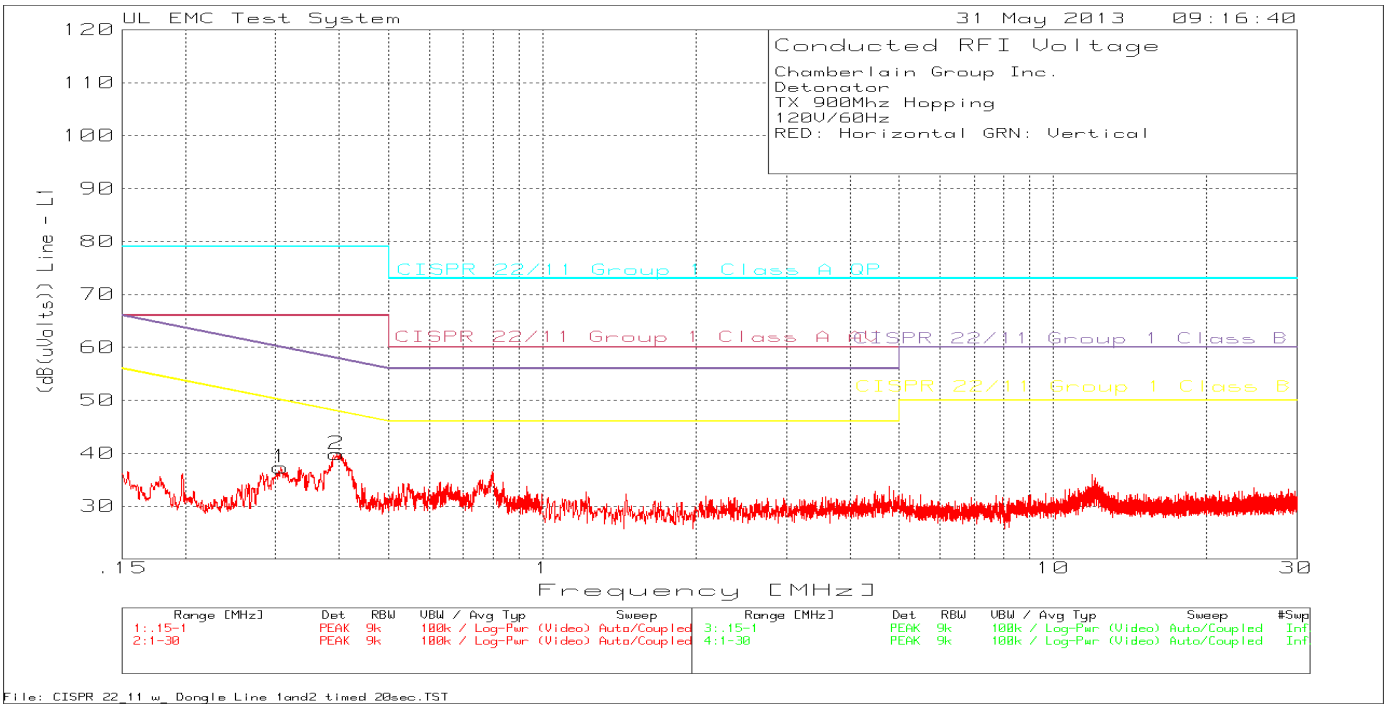
4.1 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

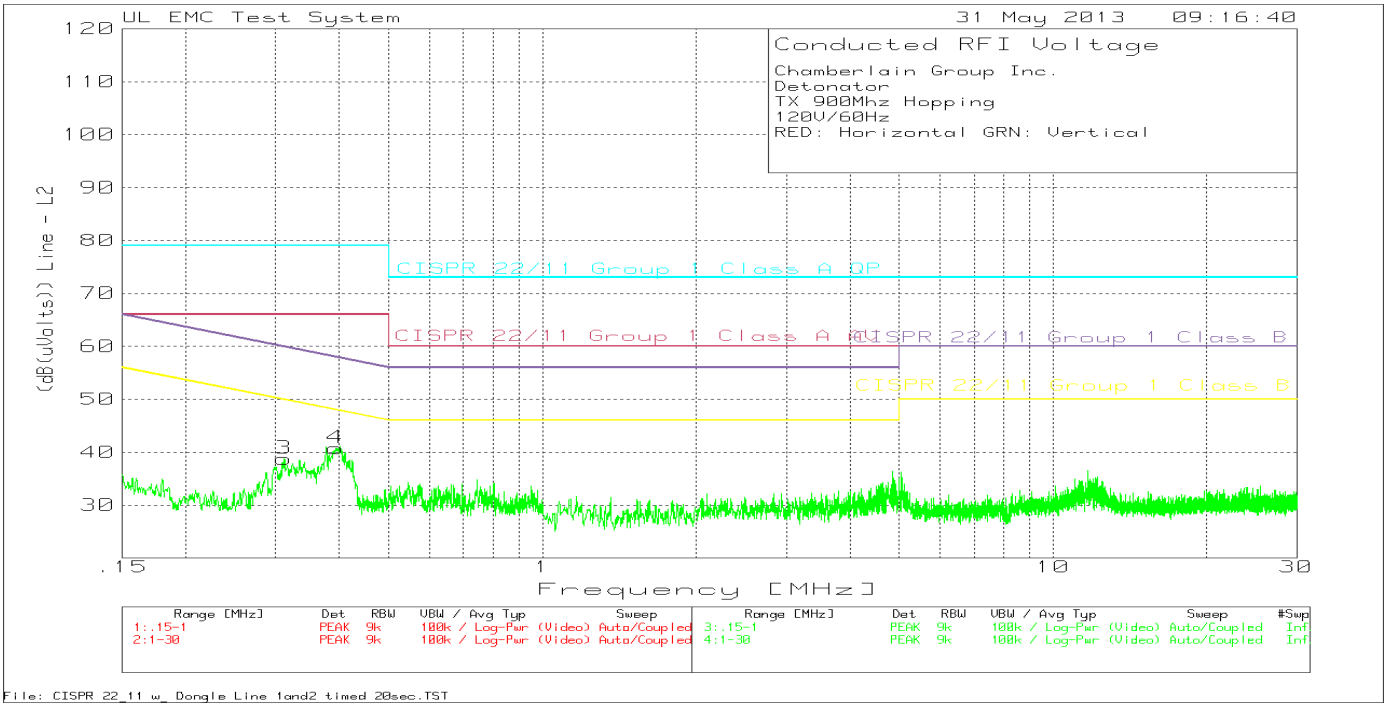
Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.		
Basic Standard		47 CFR Part 15.207, RSS-Gen 7.2.4	
UL LPG		80-EM-S0026	
		Frequency 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 (dBµV)		
	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





* The above plots are mislabeled, the title block in last line should say RED: L1, GRN: N

Table 2 Conducted Emissions Data Points

Chamberlain Group Inc.
Detonator
TX 900Mhz Hopping
120V/60Hz

No.	Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.30713	26.32 PK	.1	10.9	37.32	79	66	60	50	-	-
				Margin [dB]		-41.68	-28.68	-22.68	-12.68	-	-
2	.39525	28.99 PK	.1	10.8	39.89	79	66	58	48	-	-
				Margin [dB]		-39.11	-26.11	-18.11	-8.11	-	-
Line - L2											
3	.3117	27.91 PK	.1	10.8	38.81	79	66	59.9	49.9	-	-
				Margin [dB]		-40.19	-27.19	-21.09	-11.09	-	-
4	.39377	29.92 PK	.1	10.8	40.82	79	66	58	48	-	-
				Margin [dB]		-38.18	-25.18	-17.18	-7.18	-	-

Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1										
.30798	20.91 QP	.1	10.9	31.91	79	66	60.02	50.02	-	-
			Margin [dB]:		-47.09	-34.09	-28.11	-18.11	-	-
.39623	25.61 QP	.1	10.7	36.41	79	66	57.93	47.93	-	-
			Margin [dB]:		-42.59	-29.59	-21.52	-11.52	-	-
Line - L2										
.31326	21.59 QP	.1	10.8	32.49	79	66	59.88	49.88	-	-
			Margin [dB]:		-46.51	-33.51	-27.39	-17.39	-	-
.39447	25.91 QP	.1	10.8	36.81	79	66	57.97	47.97	-	-
			Margin [dB]:		-42.19	-29.19	-21.16	-11.16	-	-

Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1										
.30798	10.44 Av	.1	10.9	21.44	79	66	60.02	50.02	-	-
			Margin [dB]:		-57.56	-44.56	-38.58	-28.58	-	-
.39623	15.67 Av	.1	10.7	26.47	79	66	57.93	47.93	-	-
			Margin [dB]:		-52.53	-39.53	-31.46	-21.46	-	-
Line - L2										
.31326	6.32 Av	.1	10.8	17.22	79	66	59.88	49.88	-	-
			Margin [dB]:		-61.78	-48.78	-42.66	-32.66	-	-
.39447	11.81 Av	.1	10.8	22.71	79	66	57.97	47.97	-	-
			Margin [dB]:		-56.29	-43.29	-35.26	-25.26	-	-

NOTE: "+" - Indicates an emission level in excess of the applicable limit (s).

PK - Peak detector
QP - Quasi-Peak detector
Av - average detection

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

4.2 Test Conditions and Results – DIGITAL RADIATED EMISSIONS

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

Basic Standard	47 CFR Part 15.109 / ICES-003	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 5GHz	3m distance

Limits - Class B

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Average
30 – 88	40	NA
88 – 216	43.52	NA
216 – 960	46.02	NA
960 and above	54	NA

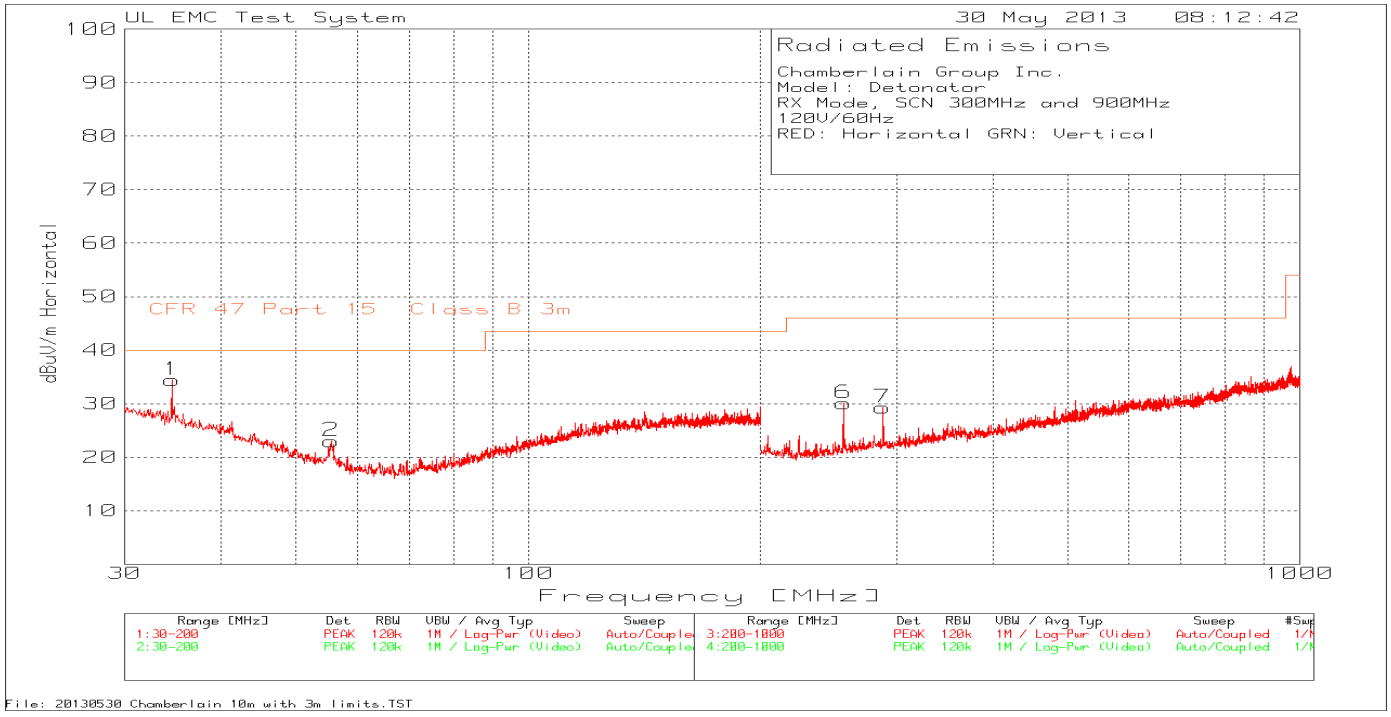
Supplementary information: None

Table 3 Radiated Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	2

Supplementary information: None

Figure 2 Receive Mode 30MHz-1GHz Radiated Emissions Graph



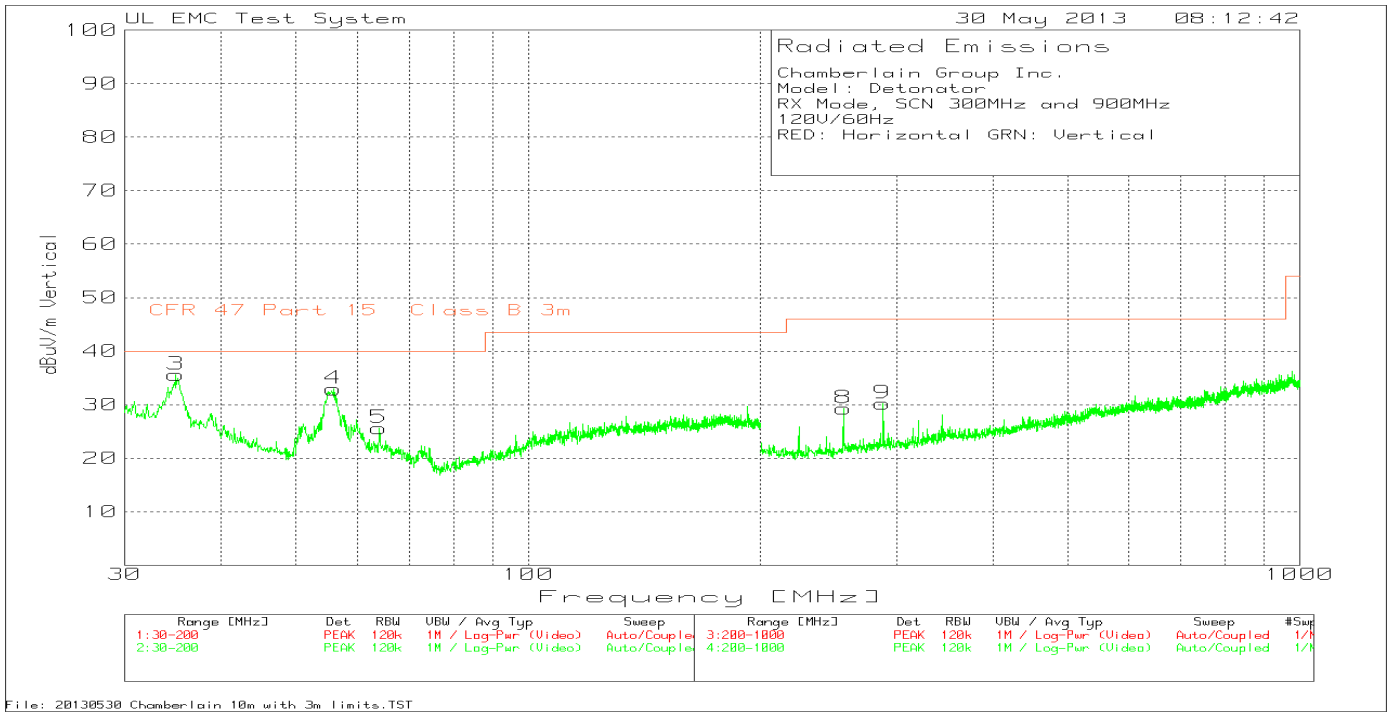


Table 4 Receive Mode 30MHz-1GHz Radiated Emissions Data Points

Chamberlain Group Inc.
Model: Detonator
RX Mode, SCN 300MHz and 900MHz
120V/60Hz
RED: Horizontal GRN: Vertical

No.	Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
1	34.5027	37.18 PK	16.2	-19	34.38	40	-	-	-	-	-
		Height:249 Horz		Margin [dB]		-5.62	-	-	-	-	-
2	55.4873	34.66 PK	7.4	-19	23.06	40	-	-	-	-	-
		Height:400 Horz		Margin [dB]		-16.94	-	-	-	-	-
3	34.9275	38.47 PK	16.1	-19	35.57	40	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-4.43	-	-	-	-	-
4	55.997	44.73 PK	7.2	-19	32.93	40	-	-	-	-	-
		Height:249 Vert		Margin [dB]		-7.07	-	-	-	-	-
5	64.068	38.34 PK	6.2	-18.9	25.64	40	-	-	-	-	-
		Height:400 Vert		Margin [dB]		-14.36	-	-	-	-	-
6	256.2292	39.05 PK	12.4	-21.3	30.15	46	-	-	-	-	-
		Height:399 Horz		Margin [dB]		-15.85	-	-	-	-	-
7	288.4744	37.24 PK	13.2	-21.1	29.34	46	-	-	-	-	-
		Height:399 Horz		Margin [dB]		-16.66	-	-	-	-	-
8	256.2292	38.24 PK	12.4	-21.3	29.34	46	-	-	-	-	-
		Height:199 Vert		Margin [dB]		-16.66	-	-	-	-	-
9	288.4744	38.11 PK	13.2	-21.1	30.21	46	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-15.79	-	-	-	-	-

Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
34.6314	25.49 PK	16.2	-19	22.69	40	-	-	-	-	-
Azimuth: 348	Height:178 Horz		Margin [dB]:		-17.31	-	-	-	-	-
35.0635	33.07 PK	16.1	-18.9	30.27	40	-	-	-	-	-
Azimuth: 327	Height:101 Vert		Margin [dB]:		-9.73	-	-	-	-	-

LIMIT 1: CFR 47 Part 15 Class B 3m

PK - Peak detector
QP - Quasi-Peak detector

***There were no emissions recorded above noise floor above 1GHz**

4.3 Test Conditions and Results – SPURIOUS 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)).

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.

Limits (Radiated – Restricted Bands Only)

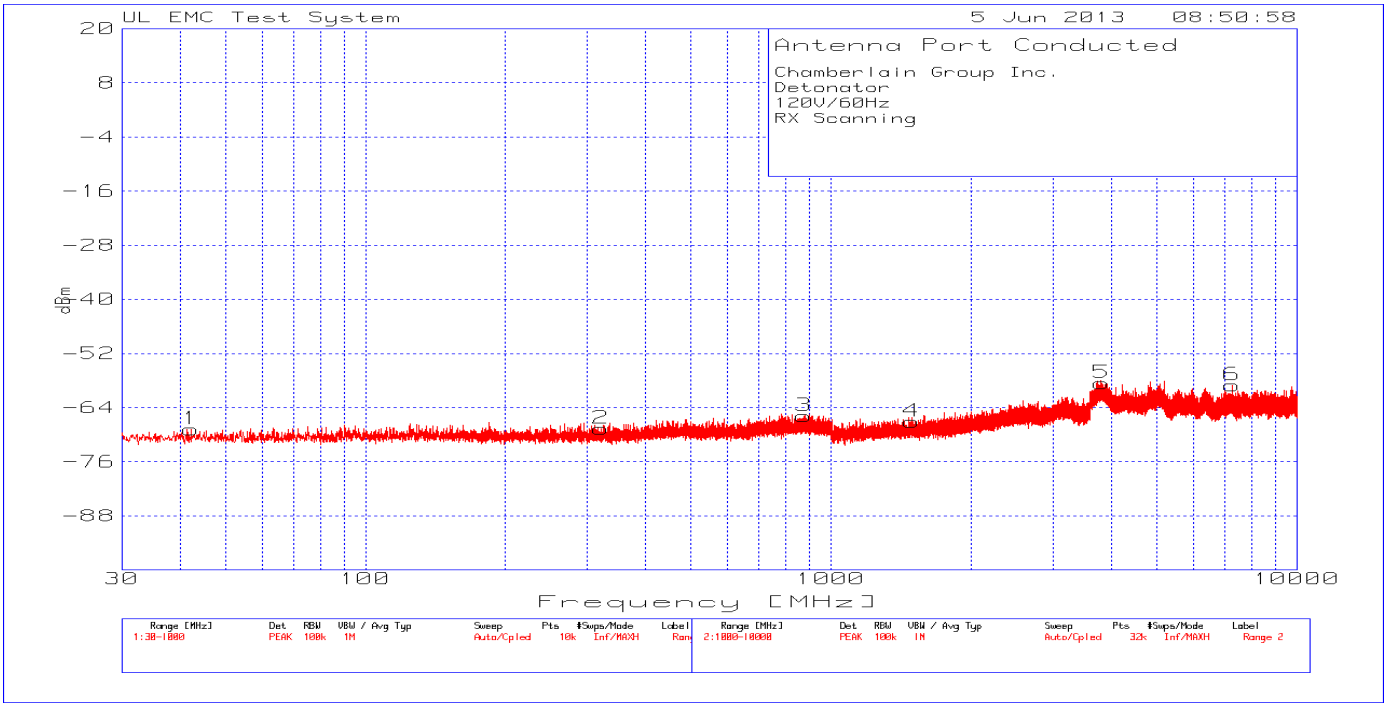
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
	General Emissions	Fundamental	Spurious
30 – 88	29.54	-	-
88 – 216	33.06	-	-
216-960	35.56	-	-
960-1000	43.52	-	-
1,000-25,000	-	-	54

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).

Table 5 SPURIOUS EMISSIONS EUT Configuration Settings

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

Figure 3 30MHz-10GHz Antenna Port Spurious Emissions Plot RX Mode.



* No emissions recorded.

Figure 4 30MHz-10GHz Antenna Port Spurious Emissions Plot TX Mode, Low Channel.

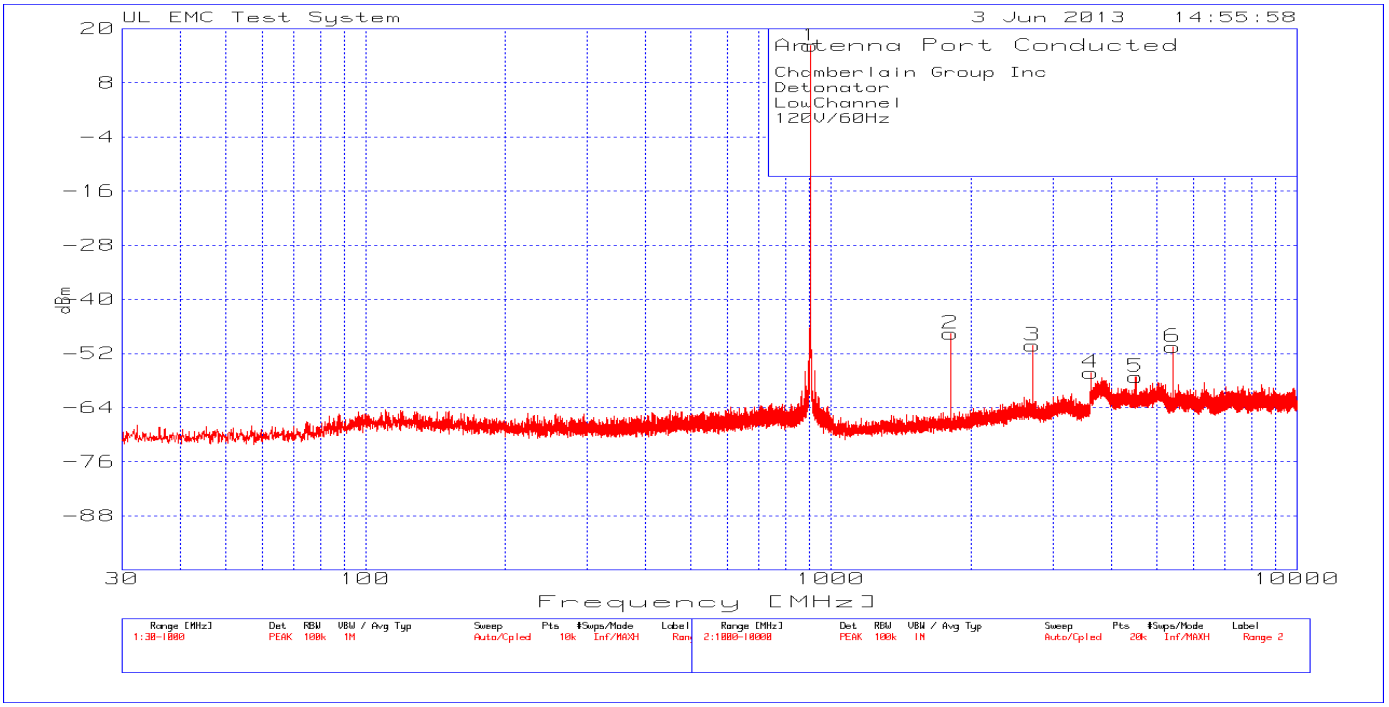


Table 6 Spurious Emissions Tabular Data Low Channel

Chamberlain Group Inc Detonator Low Channel 120V/60Hz						
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Path Factor dB	Level dBm
1	902.224	113	PK	-107	10.3	16.3
2	1804.56	48.9	PK	-107	10.5	-47.6
3	2706.315	46.23	PK	-107	10.5	-50.27
4	3608.52	40.14	PK	-107	10.6	-56.26
5	4511.174	39.13	PK	-107	10.7	-57.17
6	5412.929	45.64	PK	-107	10.8	-50.56
PK - Peak detector						

Figure 5 30MHz-10GHz Antenna Port Spurious Emissions Plot TX Mode, Middle Channel.

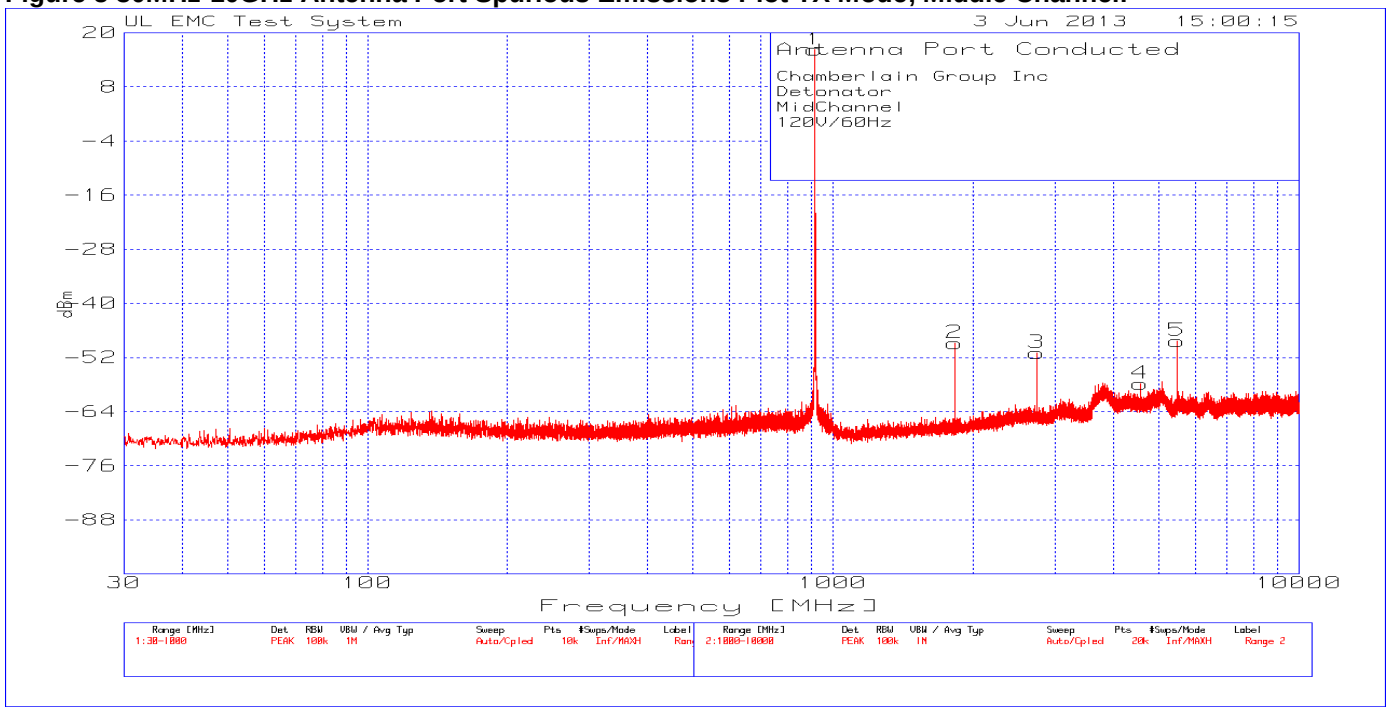


Table 7 Spurious Emissions Tabular Data Middle Channel

Chamberlain Group Inc Detonator Mid Channel 120V/60Hz						
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Path Factor dB	Level dBm
1	914.737	112.9	PK	-107	10.3	16.2
2	1829.309	47.75	PK	-107	10.5	-48.75
3	2744.113	45.45	PK	-107	10.6	-50.95
4	4573.721	38.37	PK	-107	10.8	-57.83
5	5488.526	47.92	PK	-107	10.8	-48.28
PK - Peak detector						

Figure 6 30MHz-10GHz Antenna Port Spurious Emissions Plot TX Mode, High Channel.

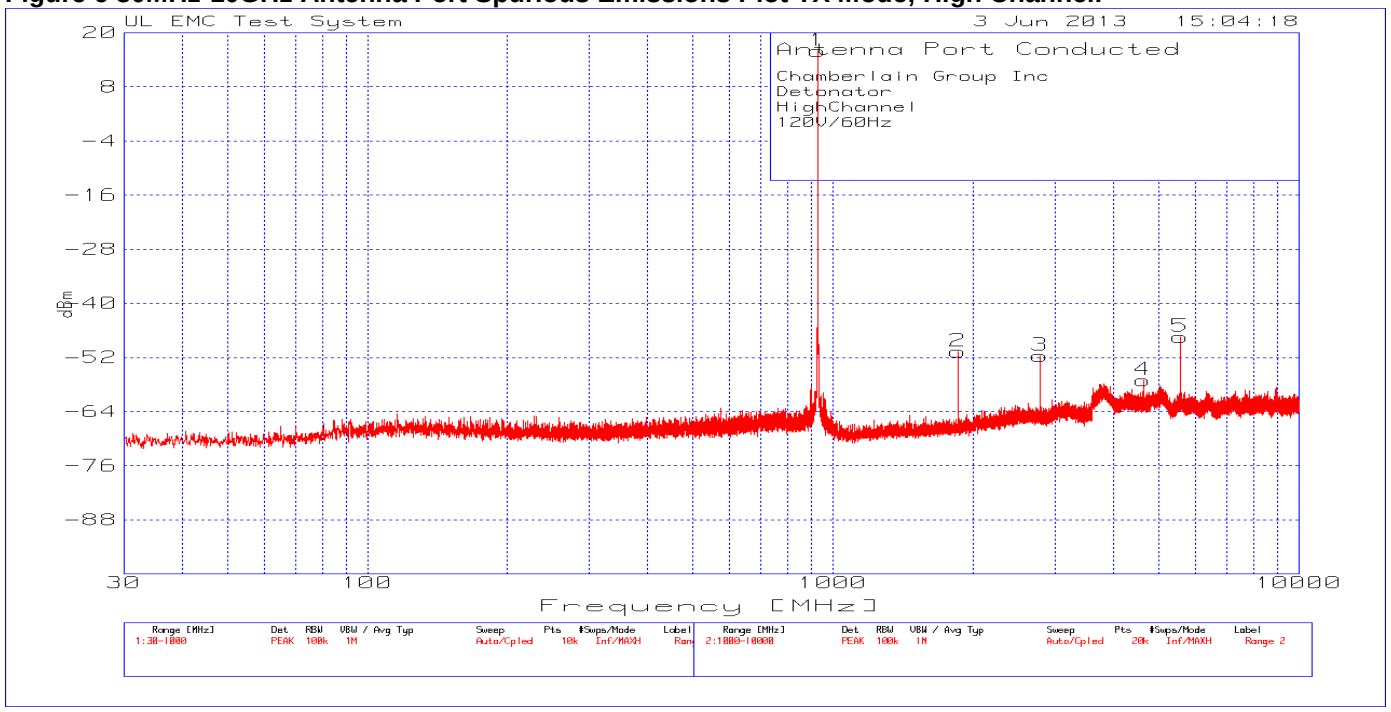


Table 8 Spurious Emissions Tabular Data High Channel

Chamberlain Group Inc Detonator High Channel 120V/60Hz						
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Path Factor dB	Level dBm
1	926.765	112.66	PK	-107	10.3	15.96
2	1853.157	46	PK	-107	10.4	-50.6
3	2780.111	44.86	PK	-107	10.6	-51.54
4	4633.118	39.32	PK	-107	10.7	-56.98
5	5560.522	48.82	PK	-107	10.8	-47.38
PK - Peak detector						

Figure 7 Band Edge Antenna Port Spurious Emissions Plot TX Mode, Low Channel, not hopping, plot 1

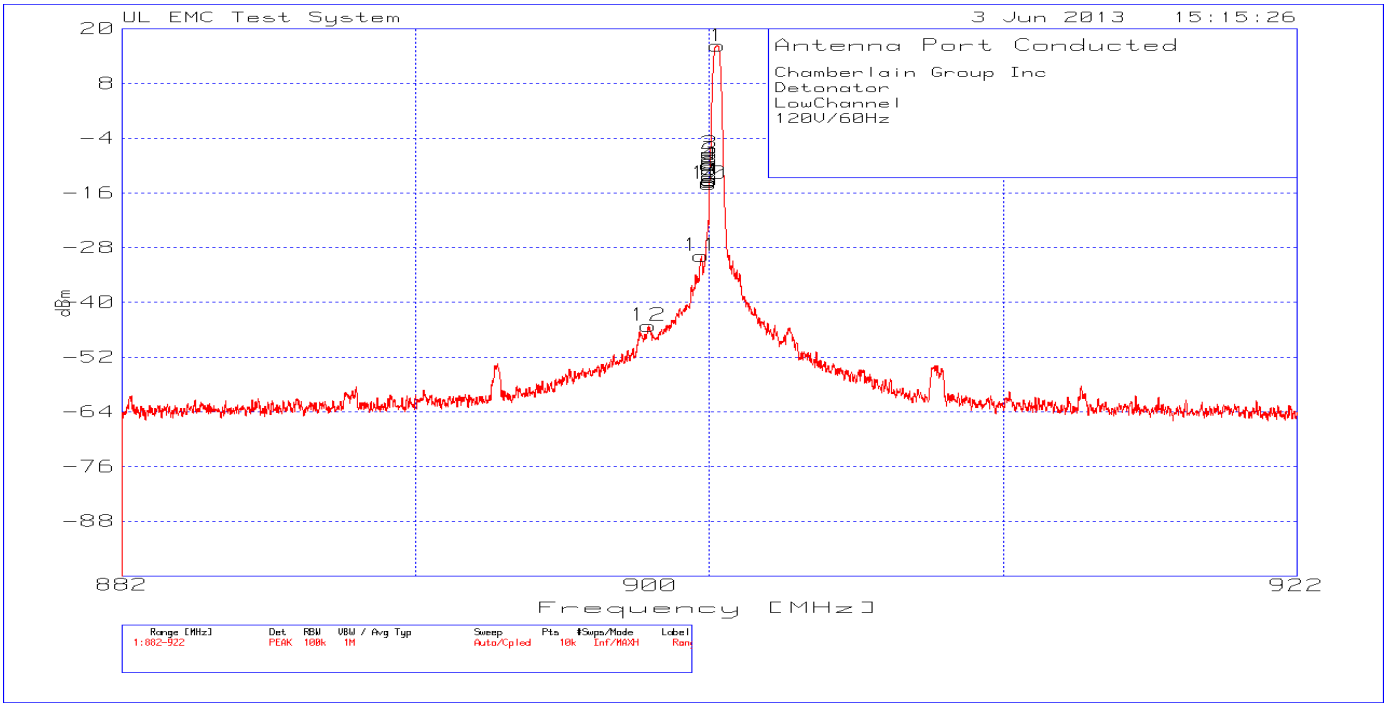


Figure 8 Band Edge Antenna Port Spurious Emissions Plot TX Mode, Low Channel, not hopping, plot 2

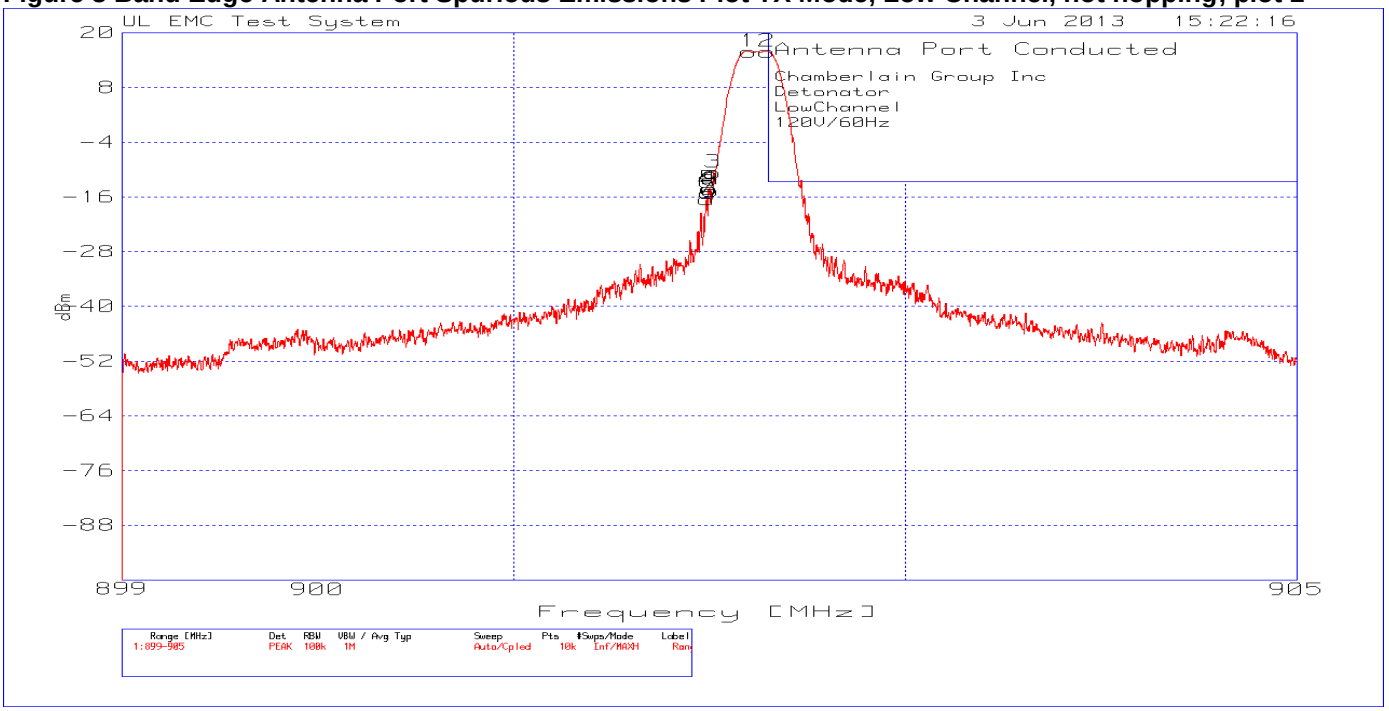


Table 9 Band Edge Antenna Port Spurious Emissions Data TX Mode, Low Channel, not hopping, plot 1

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	902.278	112.94	PK	-107	10.3	16.24
2	902.036	89.23	PK	-107	10.3	-7.47
3	902.032	88.07	PK	-107	10.3	-8.63
4	902.028	86.82	PK	-107	10.3	-9.88
5	902.024	85.58	PK	-107	10.3	-11.12
6	902.02	84.36	PK	-107	10.3	-12.34
7	902.012	83.53	PK	-107	10.3	-13.17
8	902.008	83.47	PK	-107	10.3	-13.23
9	902.004	83.2	PK	-107	10.3	-13.5
10	902	82.71	PK	-107	10.3	-13.99
11	901.734	66.93	PK	-107	10.3	-29.77
12	899.93	51.53	PK	-107	10.3	-45.17

Table 10 Band Edge Antenna Port Spurious Emissions Data TX Mode, Low Channel, not hopping, plot 2

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	902.2019	112.56	PK	-107	10.3	15.86
2	902.2979	112.58	PK	-107	10.3	15.88
3	902.0225	86	PK	-107	10.3	-10.7
4	901.9964	82.57	PK	-107	10.3	-14.13
5	902.0024	82.47	PK	-107	10.3	-14.23
6	901.994	81.52	PK	-107	10.3	-15.18
7	901.9862	80.26	PK	-107	10.3	-16.44
8	902.0105	82.1	PK	-107	10.3	-14.6

Figure 9 Band Edge Antenna Port Spurious Emissions Plot TX Mode, Low Channel, hopping, plot 1

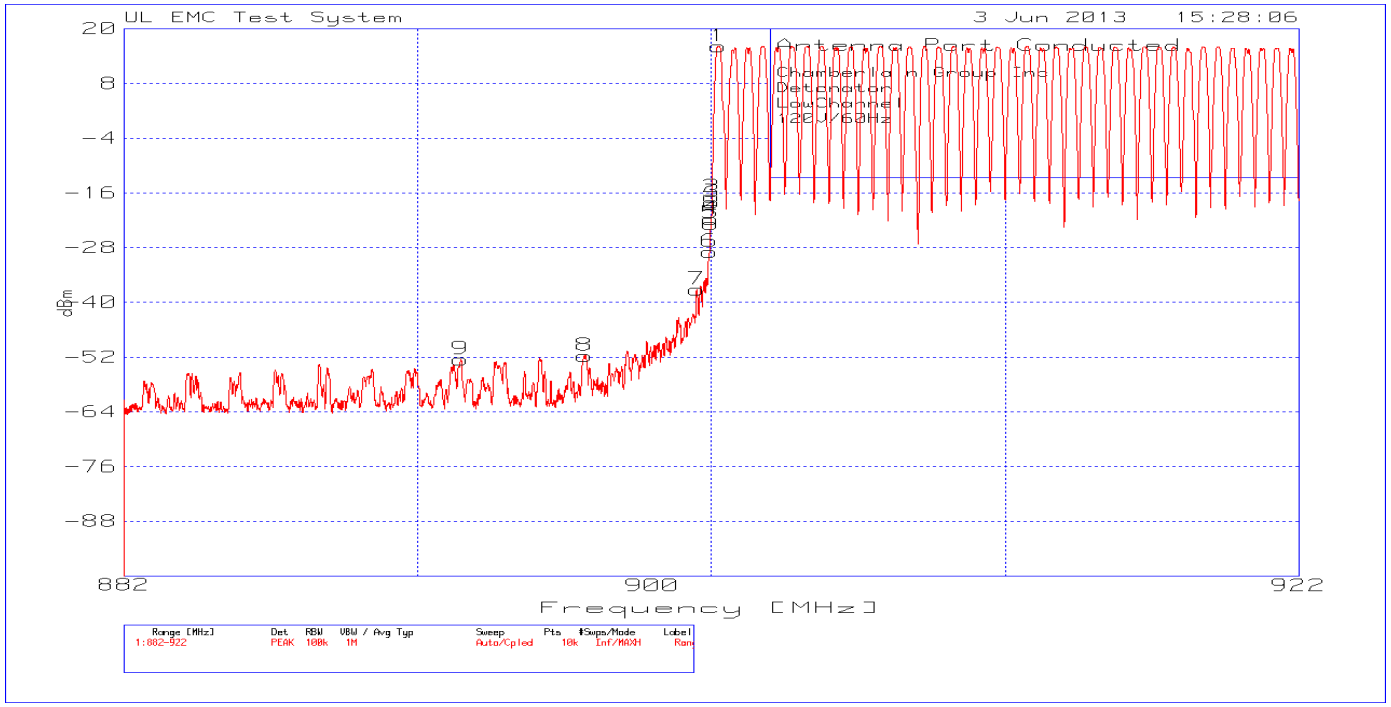


Figure 10 Band Edge Antenna Port Spurious Emissions Plot TX Mode, Low Channel, hopping, plot 2

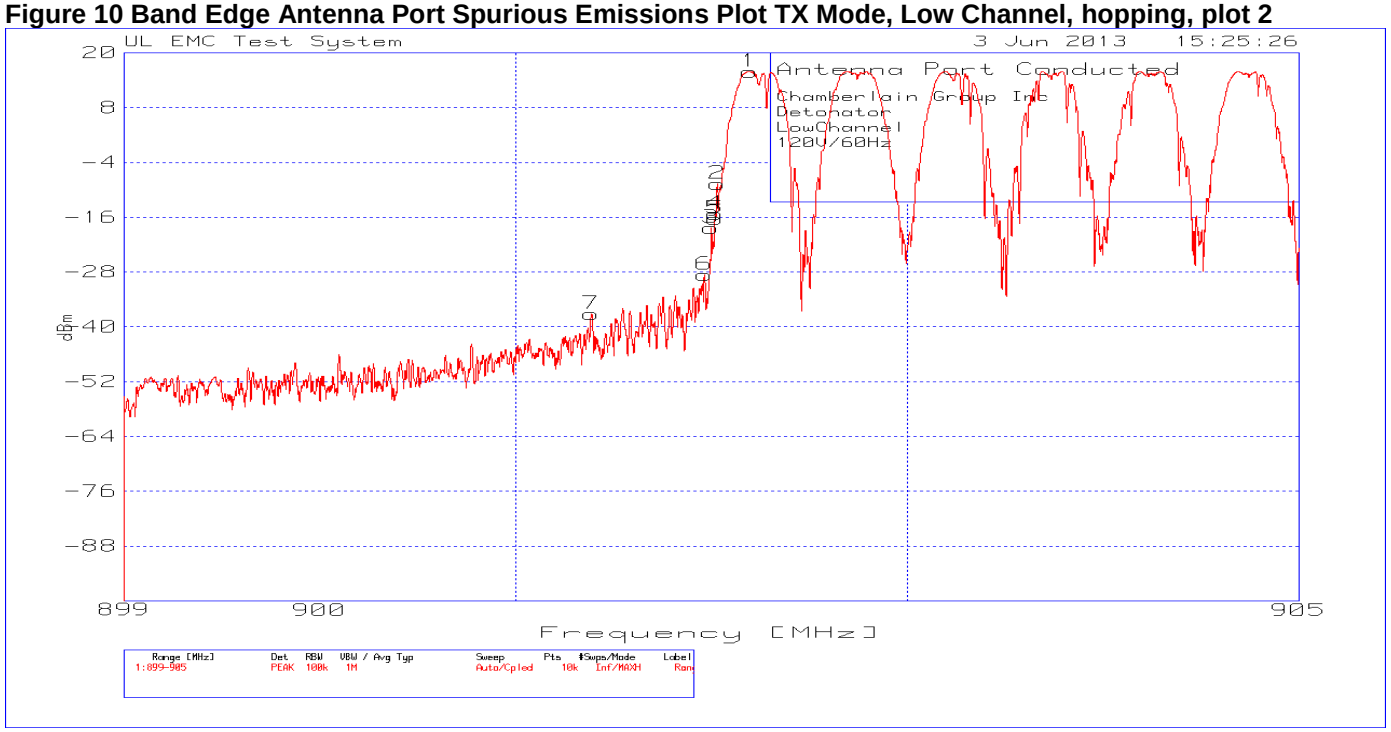


Table 11 Band Edge Antenna Port Spurious Emissions Data TX Mode, Low Channel, hopping, plot 1

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	902.258	112.87	PK	-107	10.3	16.17
2	902.02	79.83	PK	-107	10.3	-16.87
3	902.016	78.68	PK	-107	10.3	-18.02
4	902.004	75.05	PK	-107	10.3	-21.65
5	901.988	73.86	PK	-107	10.3	-22.84
6	901.952	67.86	PK	-107	10.3	-28.84
7	901.504	59.49	PK	-107	10.3	-37.21
8	897.696	44.97	PK	-107	10.3	-51.73
9	893.47	44.19	PK	-107	10.3	-52.51

Table 12 Band Edge Antenna Port Spurious Emissions Data TX Mode, Low Channel, hopping, plot 2

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	902.1971	112.56	PK	-107	10.3	15.86
2	902.0306	88.03	PK	-107	10.3	-8.67
3	902	78.39	PK	-107	10.3	-18.31
4	902.0222	81.39	PK	-107	10.3	-15.31
5	902.018	80.3	PK	-107	10.3	-16.4
6	901.9646	68.1	PK	-107	10.3	-28.6
7	901.3877	59.59	PK	-107	10.3	-37.11

Figure 11 Band Edge Antenna Port Spurious Emissions Plot TX Mode, High Channel, not hopping

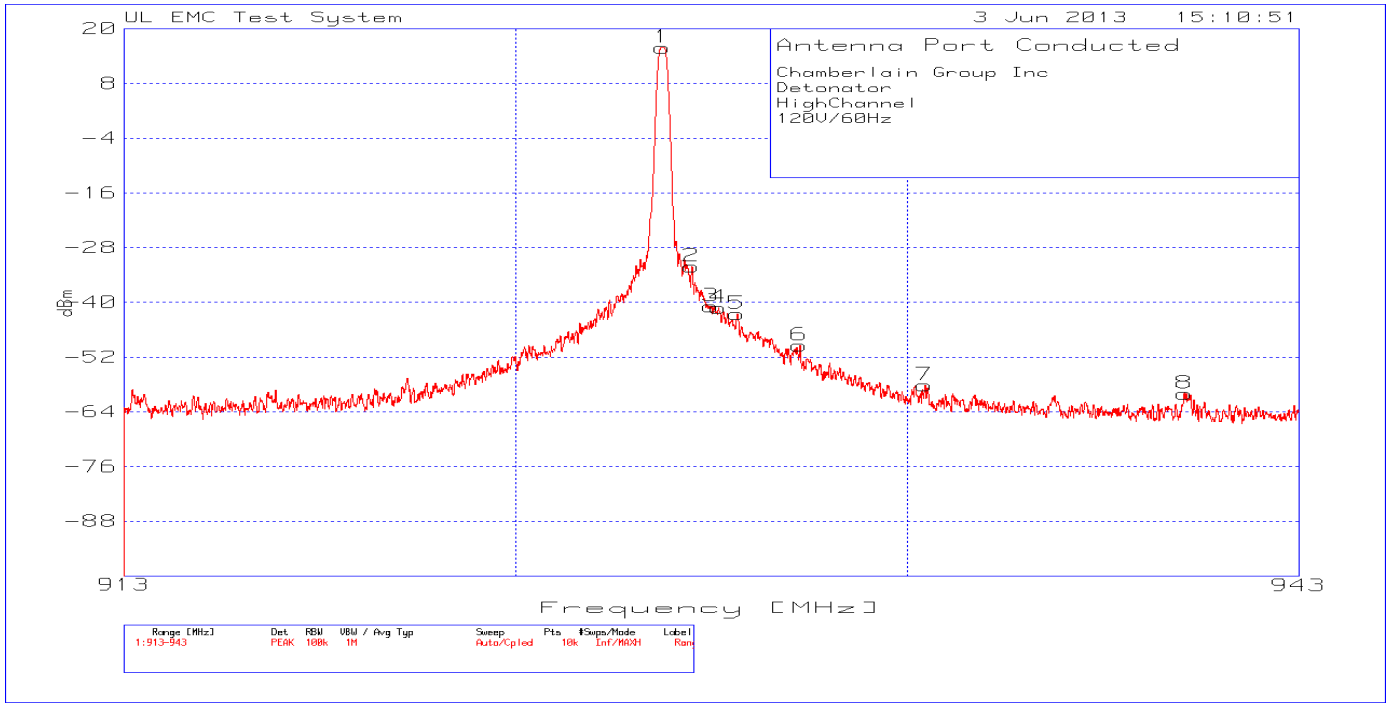


Table 13 Band Edge Antenna Port Spurious Emissions Data TX Mode, High Channel, not hopping

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	926.7385	112.55	PK	-107	10.3	15.85
2	927.505	64.56	PK	-107	10.3	-32.14
3	928.0015	55.88	PK	-107	10.3	-40.82
4	928.1845	55.51	PK	-107	10.3	-41.19
5	928.6645	54.21	PK	-107	10.3	-42.49
6	930.2605	47.26	PK	-107	10.3	-49.44
7	933.46	38.5	PK	-107	10.3	-58.2
8	940.084	36.75	PK	-107	10.3	-59.95

Figure 12 Band Edge Antenna Port Spurious Emissions Plot TX Mode, High Channel, hopping

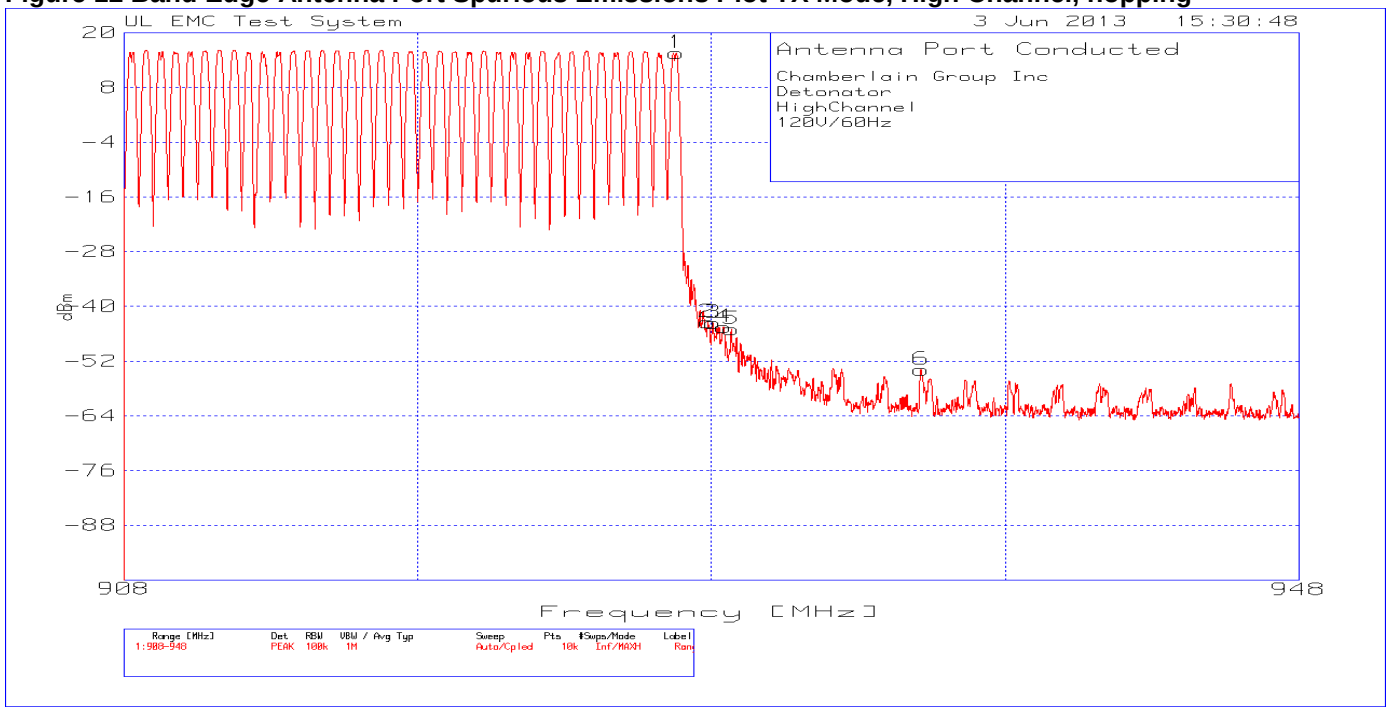
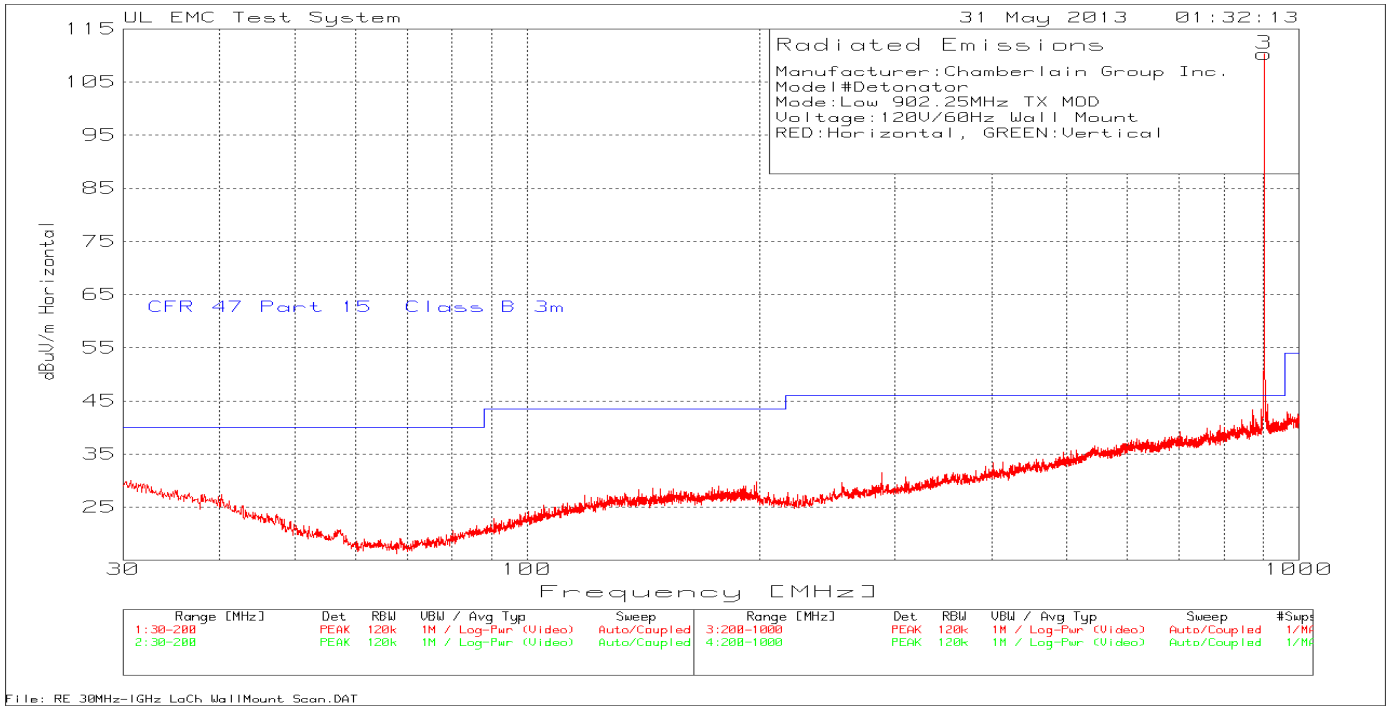


Table 14 Band Edge Antenna Port Spurious Emissions Data TX Mode, High Channel, hopping

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	dBuV to dBm	Cable Factor dB	Level dBm
1	926.804	112.27	PK	-107	10.3	15.57
2	927.884	53.24	PK	-107	10.3	-43.46
3	928.048	53.06	PK	-107	10.3	-43.64
4	928.418	52.2	PK	-107	10.3	-44.5
5	928.68	51.65	PK	-107	10.3	-45.05
6	935.138	42.8	PK	-107	10.3	-53.9

Figure 13 Low Channel 30MHz – 1GHz Radiated Emissions Graph



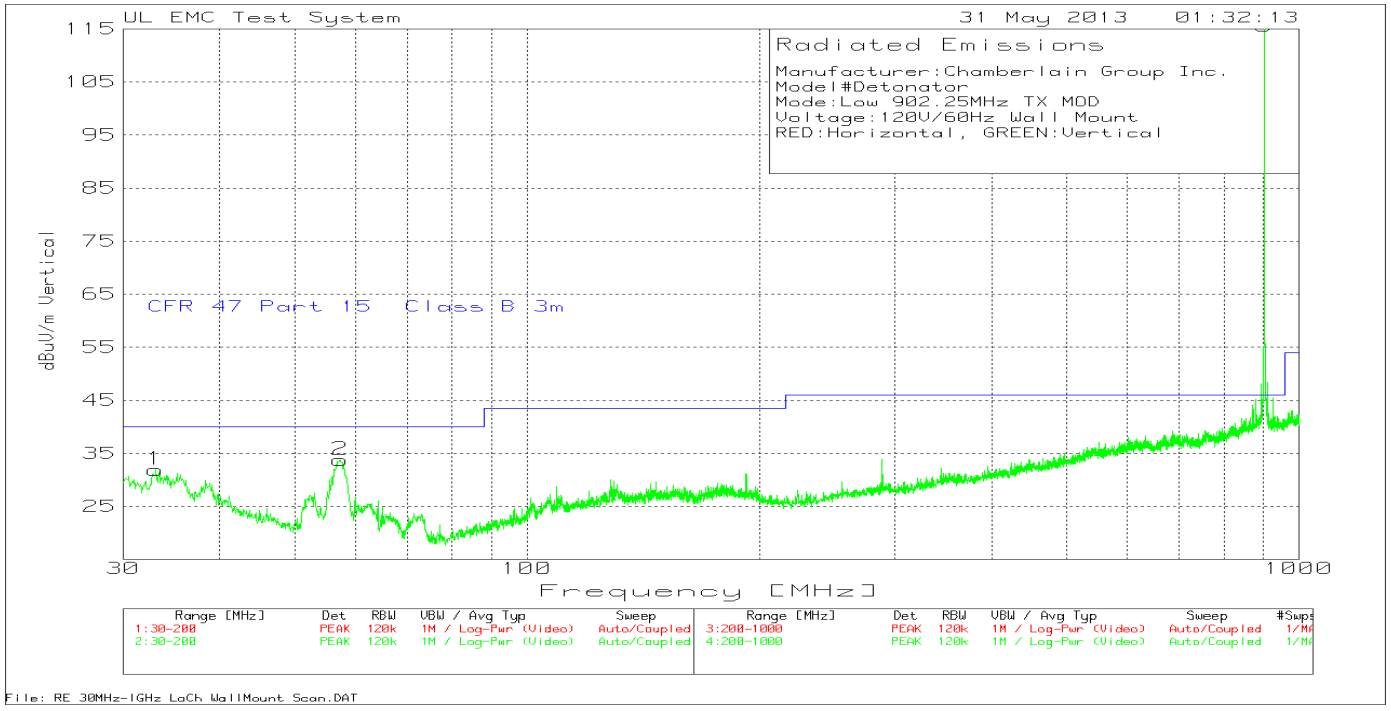


Table 15 Low Channel 30MHz – 1GHz Radiated Emissions Data Points

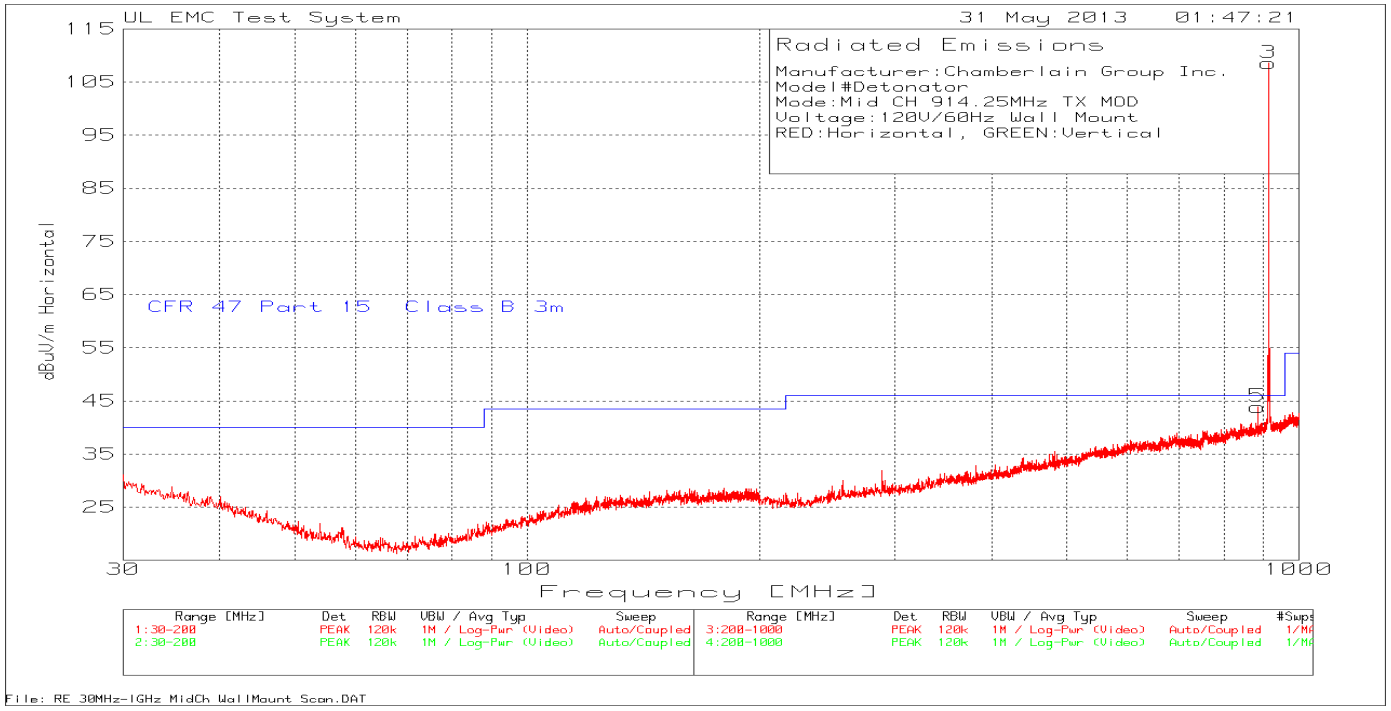
Manufacturer:Chamberlain Group Inc.
Model#Detonator
Mode:Low 902.25MHz TX MOD
Voltage:120V/60Hz Wall Mount
RED:Horizontal, GREEN:Vertical

No.	Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
1	33.0585	33.99 PK	16.9	-19	31.89	40	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-8.11	-	-	-	-	-
2	57.2714	45.95 PK	6.8	-19	33.75	40	-	-	-	-	-
		Height:250 Vert		Margin [dB]		-6.25	-	-	-	-	-
3	902.465	106.92 PK	22.9	-19.5	110.32	46	-	-	-	-	-
		Height:99 Horz		Margin [dB]		64.32	-	-	-	-	-
4	902.465	112.27 PK	22.9	-19.5	115.67	46	-	-	-	-	-
		Height:199 Vert		Margin [dB]		69.67	-	-	-	-	-

LIMIT 1: CFR 47 Part 15 Class B 3m

PK - Peak detector

Figure 14 Middle Channel 30MHz – 1GHz Radiated Emissions Graph



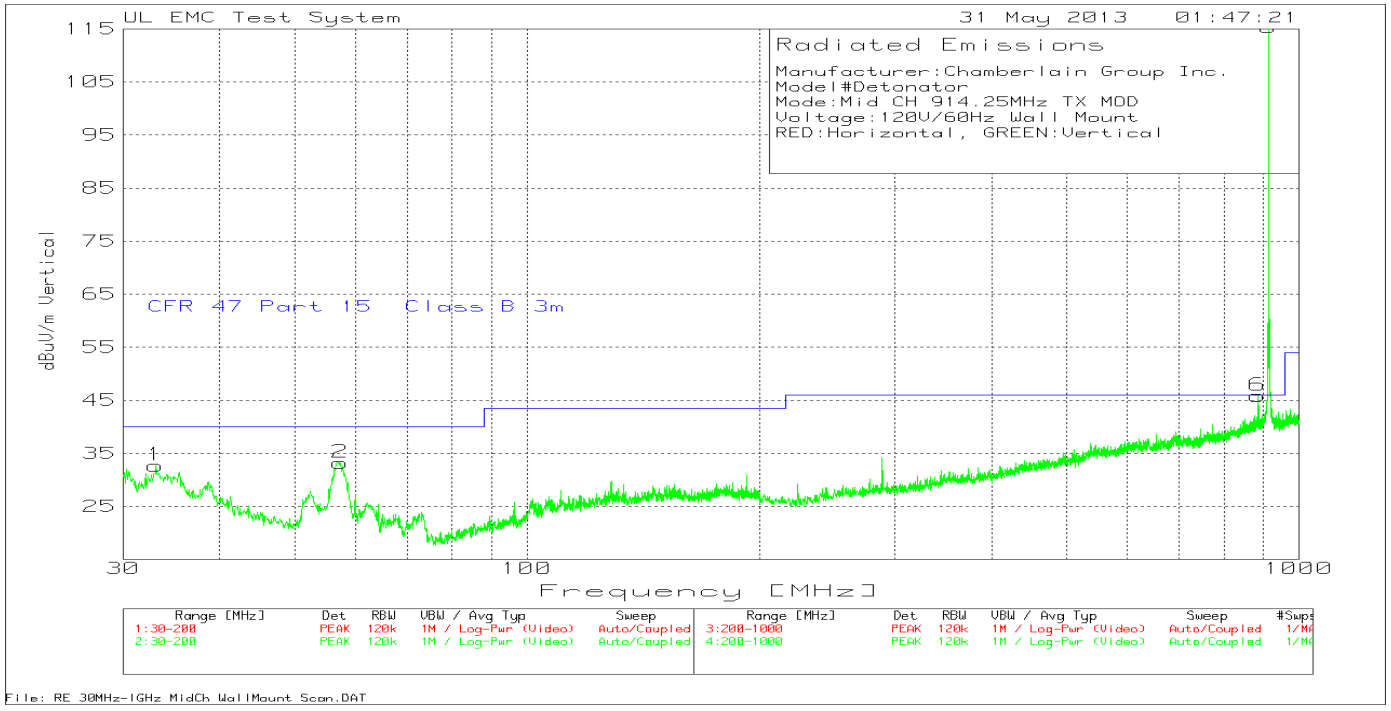


Table 16 Middle Channel 30MHz – 1GHz Radiated Emissions Data Points

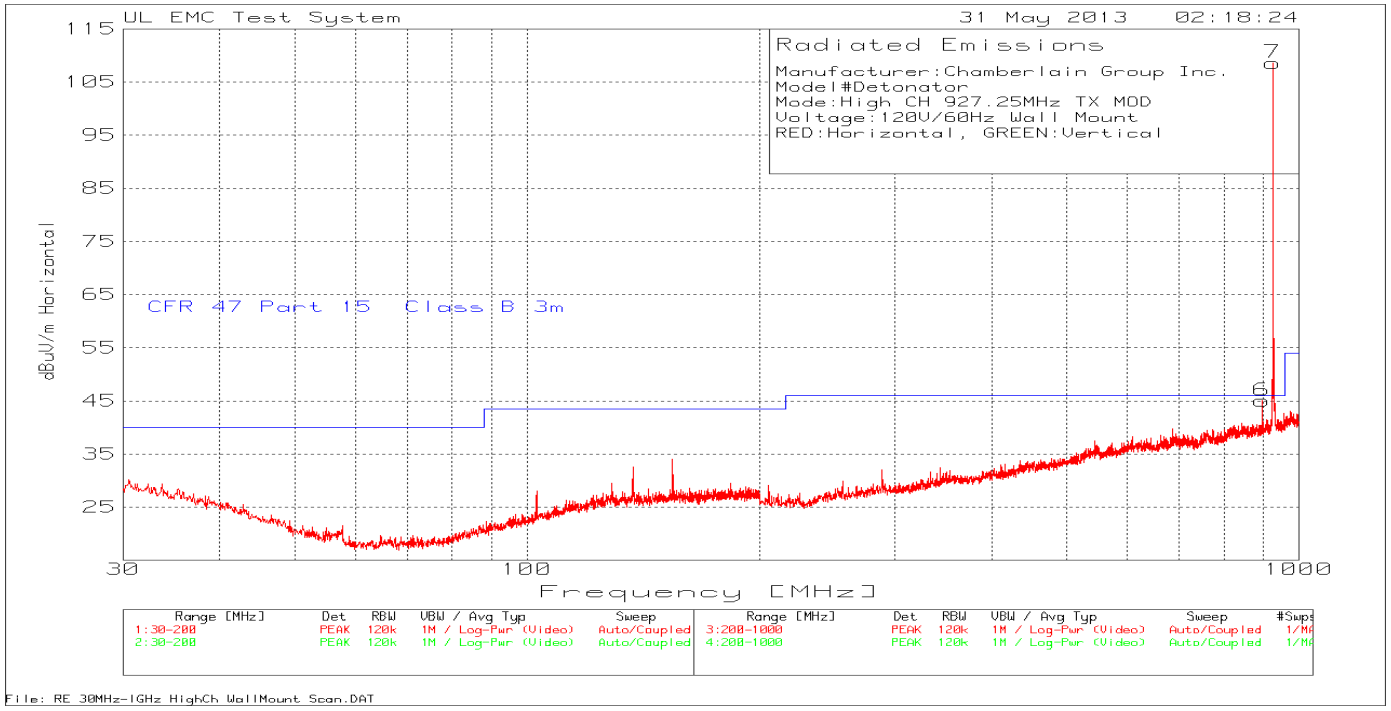
Manufacturer:Chamberlain Group Inc.
Model#Detonator
Mode:Mid CH 914.25MHz TX MOD
Voltage:120V/60Hz Wall Mount
RED:Horizontal, GREEN:Vertical

No.	Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
1	33.0585	34.79 PK	16.9	-19	32.69	40	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-7.31	-	-	-	-	-
2	57.2714	45.48 PK	6.8	-19	33.28	40	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-6.72	-	-	-	-	-
3	914.99	105.14 PK	22.9	-19.5	108.54	46	-	-	-	-	-
		Height:99 Horz		Margin [dB]		62.54	-	-	-	-	-
4	914.99	111.99 PK	22.9	-19.5	115.39	46	-	-	-	-	-
		Height:199 Vert		Margin [dB]		69.39	-	-	-	-	-

LIMIT 1: CFR 47 Part 15 Class B 3m

PK - Peak detector

Figure 15 High Channel 30MHz – 1GHz Radiated Emissions Graph



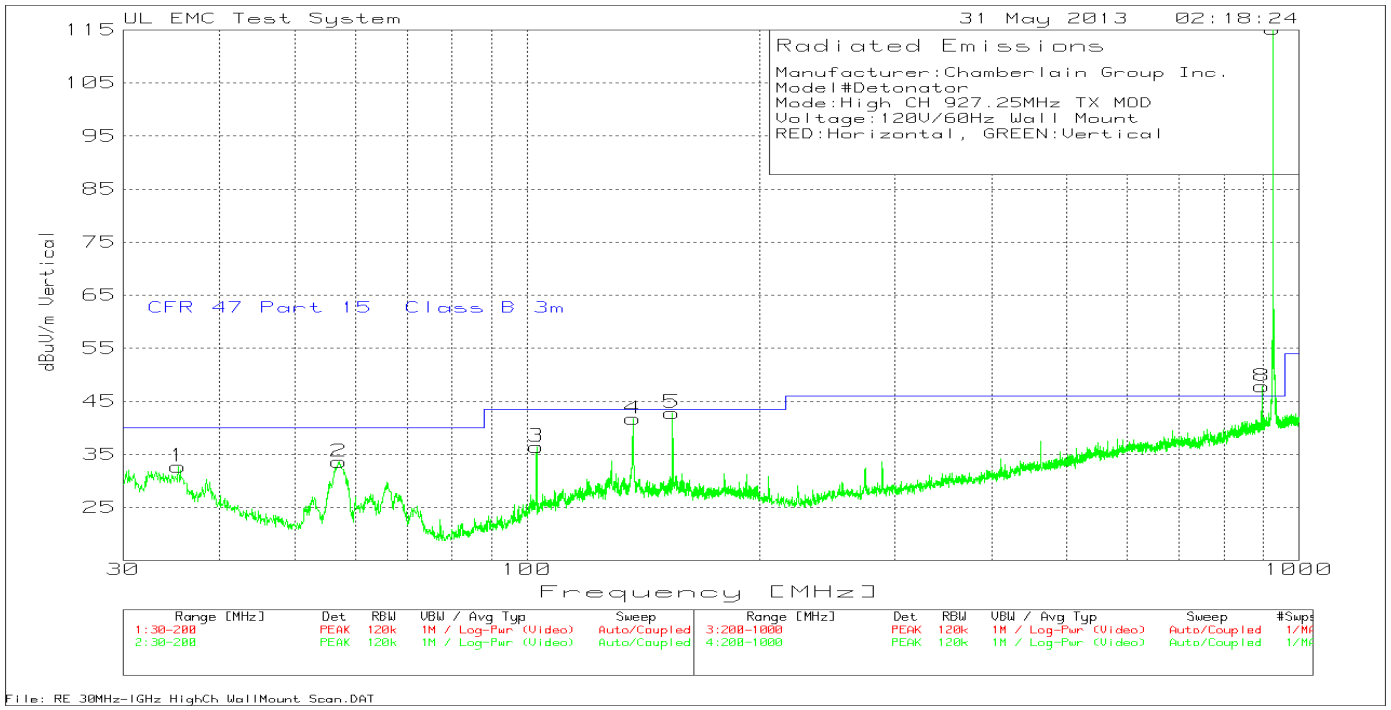


Table 17 High Channel 30MHz – 1GHz Radiated Emissions Data Points

Manufacturer:Chamberlain Group Inc.
Model#Detonator
Mode:High CH 927.25MHz TX MOD
Voltage:120V/60Hz Wall Mount
RED:Horizontal, GREEN:Vertical

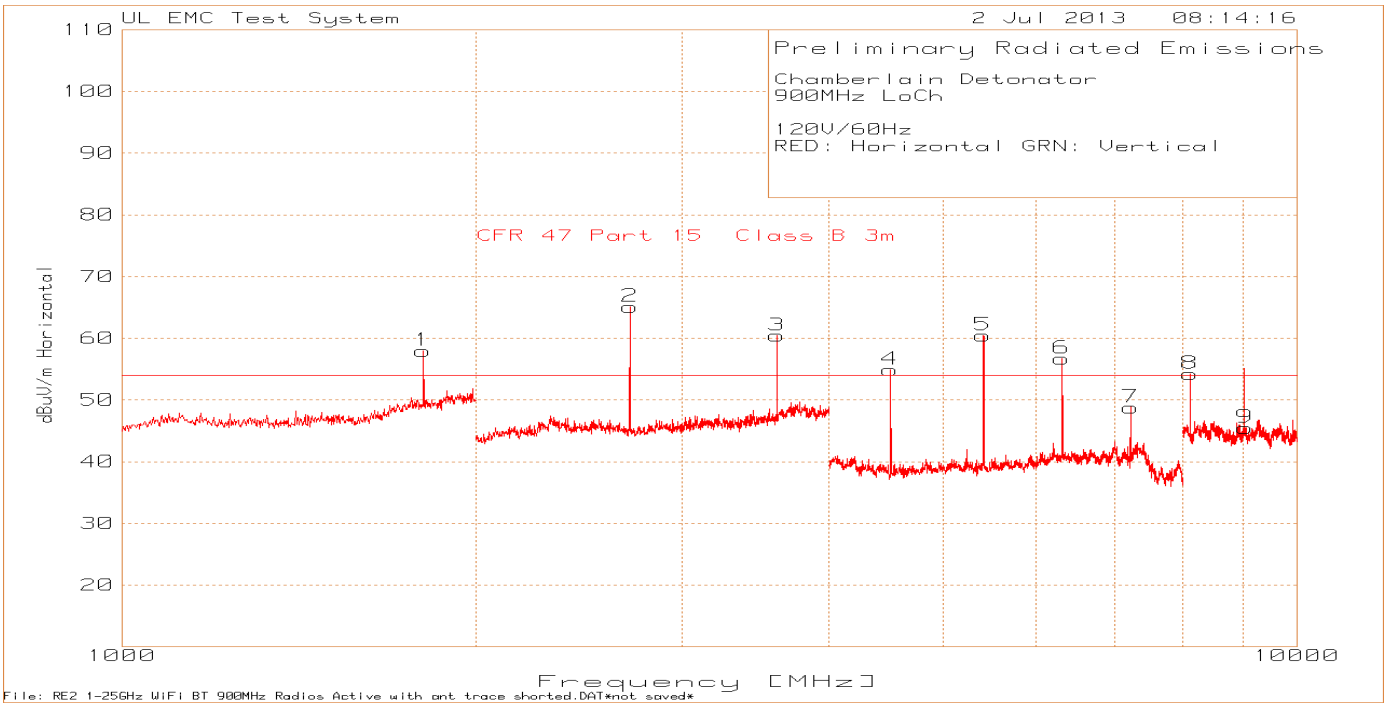
No.	Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
1	35.3523	35.71 PK	15.9	-18.9	32.71	40	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-7.29	-	-	-	-	-
2	57.1014	45.7 PK	6.9	-19	33.6	40	-	-	-	-	-
		Height:249 Vert		Margin [dB]		-6.4	-	-	-	-	-
3	102.8936	43.54 PK	11.8	-18.9	36.44	43.5	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-7.06	-	-	-	-	-
4	137.2164	45.8 PK	14.8	-18.9	41.7	43.5	-	-	-	-	-
		Height:400 Vert		Margin [dB]		-1.8	-	-	-	-	-
5	154.3778	46.28 PK	15.4	-18.9	42.78	43.5	-	-	-	-	-
		Height:99 Vert		Margin [dB]		-.72	-	-	-	-	-
6	896.8688	41.52 PK	22.7	-19.2	45.02	46	-	-	-	-	-
		Height:99 Horz		Margin [dB]		-.98	-	-	-	-	-
7	926.982	104.92 PK	23.1	-19.4	108.62	46	-	-	-	-	-
		Height:99 Horz		Margin [dB]		62.62	-	-	-	-	-
8	896.8688	44.31 PK	22.7	-19.2	47.81	46	-	-	-	-	-
		Height:400 Vert		Margin [dB]		1.81	-	-	-	-	-
9	926.982	111.57 PK	23.1	-19.4	115.27	46	-	-	-	-	-
		Height:199 Vert		Margin [dB]		69.27	-	-	-	-	-

Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level dBuV/m	Limit:1	2	3	4	5	6
Bicon Vertical 30 - 200MHz										
137.1411	35 QP	14.8	-18.9	30.9	43.5	-	-	-	-	-
Azimuth: 176	Height:310 Vert		Margin [dB]:		-12.6	-	-	-	-	-
154.3041	46.98 QP	15.4	-18.9	43.48	43.5	-	-	-	-	-
Azimuth: 41	Height:181 Vert		Margin [dB]:		-.02	-	-	-	-	-
LogP Horizontal 200 - 1000MHz										
896.7967	42.24 QP	22.7	-19.2	45.74	46	-	-	-	-	-
Azimuth: 322	Height:190 Vert		Margin [dB]:		-.26	-	-	-	-	-
896.7983	35.27 QP	22.7	-19.2	38.77	46	-	-	-	-	-
Azimuth: 145	Height:230 Horz		Margin [dB]:		-7.23	-	-	-	-	-

LIMIT 1: CFR 47 Part 15 Class B 3m

PK - Peak detector
QP - Quasi-Peak detector

Figure 16 Low Channel 1GHz – 10GHz Radiated Emissions Graph



* Marker #9 at 9022MHz was not measured, however because of large duty cycle correction it is considered in compliance.

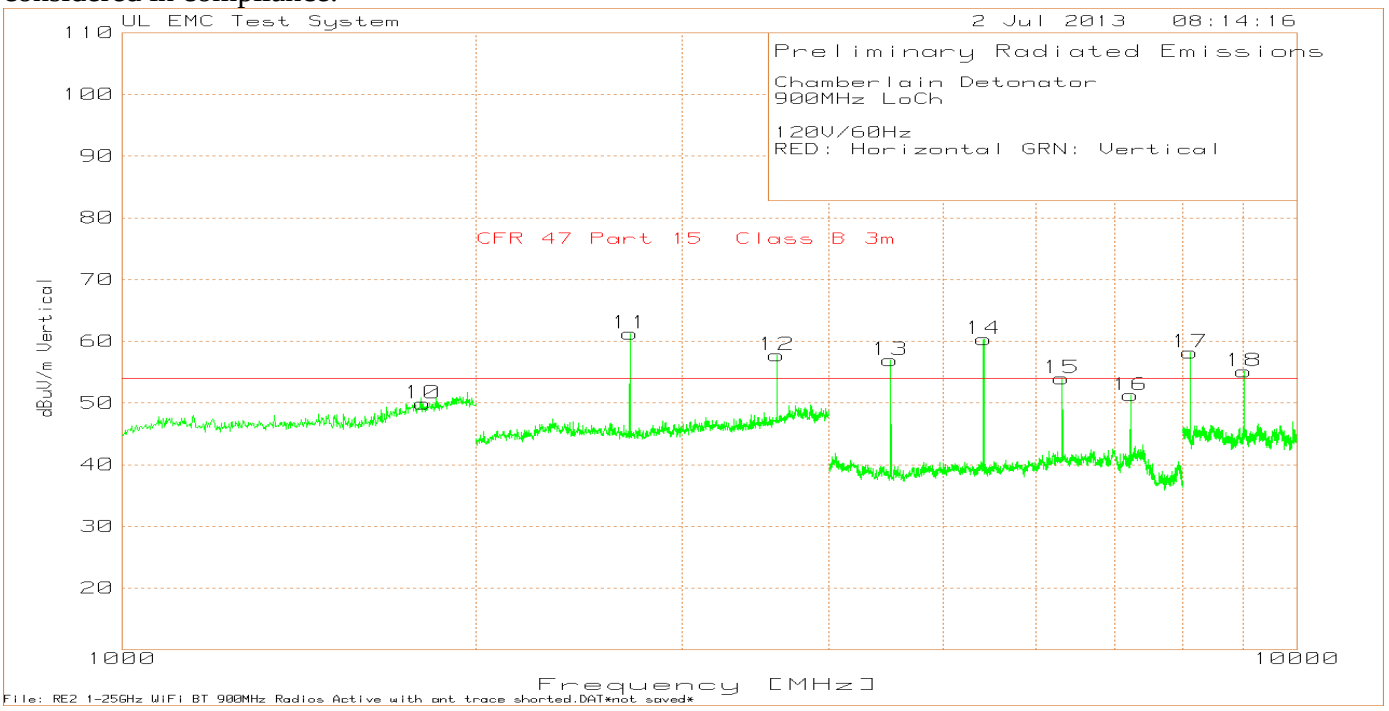


Table 18 Low Channel 1GHz – 10GHz Radiated Emissions Data Points

Marker Data

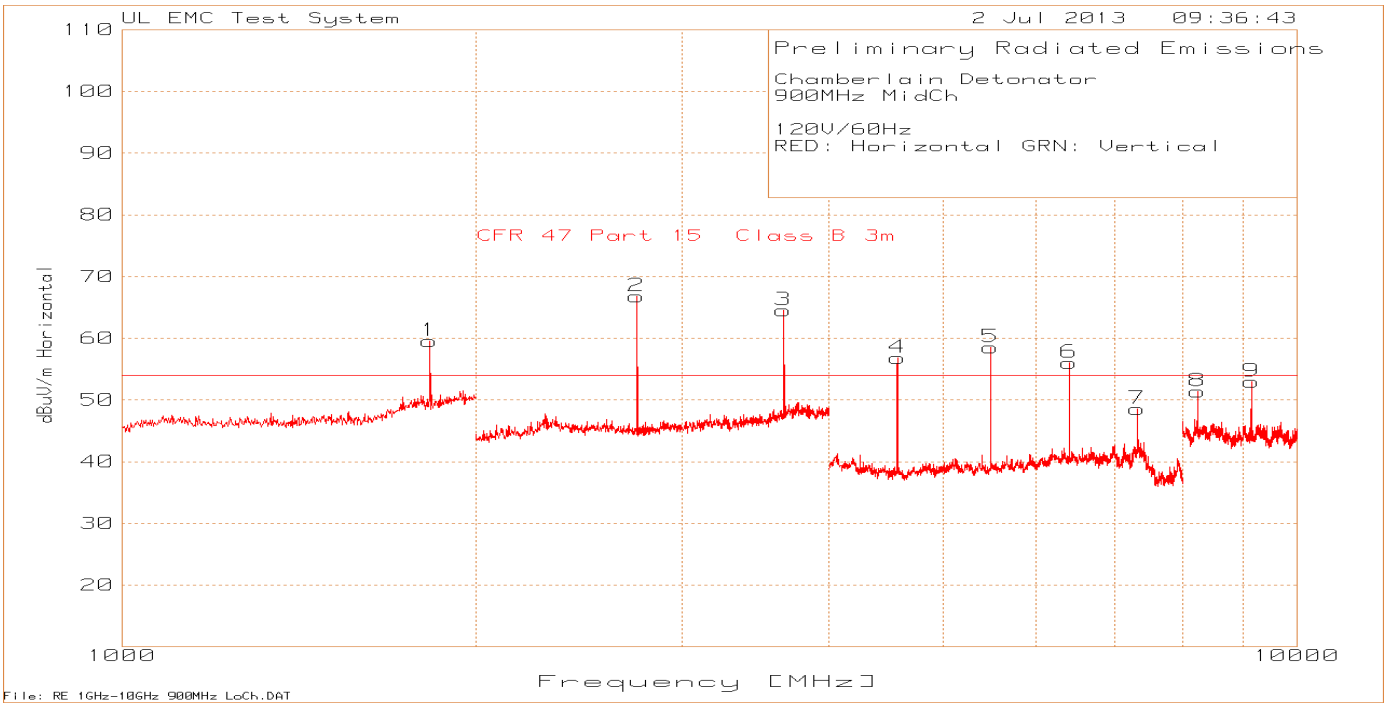
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Height [cm]	Polarity
1	1805.611	27.43	PK	26.8	3.73	57.96	54	3.96	125	Horz
2	2706.707	38.89	PK	22.1	4.11	65.1	54	11.1	100	Horz
3	3609.61	32.11	PK	23.2	5.1	60.41	54	6.41	100	Horz
4	4509.673	80.24	PK	27.8	-53.18	54.86	54	0.86	100	Horz
5	5411.608	82.71	PK	27.9	-50.19	60.42	54	6.42	100	Horz
6	6316.211	75.4	PK	29.2	-47.9	56.7	54	2.7	100	Horz
7	7220.814	66.44	PK	29.9	-47.52	48.82	54	-5.18	100	Horz
8	8118.118	68.33	PK	36.2	-50.3	54.23	54	0.23	100	Horz
9	9039.039	58.93	PK	36.1	-49.55	45.48	54	-8.52	125	Horz
10	1803.607	19.39	PK	26.8	3.74	49.93	54	-4.07	125	Vert
11	2706.707	35.07	PK	22.1	4.11	61.28	54	7.28	100	Vert
12	3609.61	29.4	PK	23.2	5.1	57.7	54	3.7	100	Vert
13	4509.673	82.32	PK	27.8	-53.18	56.94	54	2.94	100	Vert
14	5414.276	82.83	PK	27.9	-50.33	60.4	54	6.4	100	Vert
15	6316.211	72.66	PK	29.2	-47.9	53.96	54	-0.04	100	Vert
16	7218.145	69.11	PK	29.8	-47.68	51.23	54	-2.77	100	Vert
17	8120.12	72.37	PK	36.2	-50.37	58.2	54	4.2	125	Vert
18	9023.023	68.31	PK	36.1	-49.3	55.11	54	1.11	125	Vert

Maximized Peak and Average Measurements

Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	DC Factor dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1804.382	31.09	PK	26.8	3.74	0	61.63	74	-12.37	284	119	Horz
1804.538	21.02	LnAv	26.8	3.74	-37.5	14.06	54	-39.94	284	119	Horz
1804.43	26.39	PK	26.8	3.74	0	56.93	74	-17.07	38	113	Vert
1804.478	15.21	LnAv	26.8	3.74	-37.5	8.25	54	-45.75	38	113	Vert
2706.64	41.19	PK	22.1	4.11	0	67.4	74	-6.6	71	100	Horz
2706.743	32.93	LnAv	22.1	4.11	-37.5	21.64	54	-32.36	71	100	Horz
3608.781	37.71	PK	23.2	5.12	0	66.03	74	-7.97	56	100	Horz
3608.955	28.97	LnAv	23.2	5.11	-37.5	19.78	54	-34.22	56	100	Horz
3608.937	33.58	PK	23.2	5.11	0	61.89	74	-12.11	211	100	Vert
3609.033	23.99	LnAv	23.2	5.11	-37.5	14.8	54	-39.2	211	100	Vert
2706.589	40.01	PK	22.1	4.11	0	66.22	74	-7.78	303	110	Vert
2706.764	31.39	LnAv	22.1	4.11	-37.5	20.1	54	-33.9	303	110	Vert
4511.051	83.26	PK	27.8	-53.14	0	57.92	74	-16.08	76	102	Vert
4511.238	74.71	LnAv	27.8	-53.13	-37.5	11.88	54	-42.12	76	102	Vert
5413.146	83.46	PK	27.9	-50.27	0	61.09	74	-12.91	88	109	Vert
5413.447	74.83	LnAv	27.9	-50.29	-37.5	14.94	54	-39.06	88	109	Vert
6315.315	74.13	PK	29.2	-47.9	0	55.43	74	-18.57	6	111	Vert
6315.693	64.92	LnAv	29.2	-47.9	-37.5	8.72	54	-45.28	6	111	Vert
7218.49	71.56	PK	29.8	-47.66	0	53.7	74	-20.3	205	100	Vert
7217.889	62	LnAv	29.8	-47.69	-37.5	6.61	54	-47.39	205	100	Vert
7218.34	69.19	PK	29.8	-47.67	0	51.32	74	-22.68	246	100	Horz
7217.883	59.31	LnAv	29.8	-47.69	-37.5	3.92	54	-50.08	246	100	Horz
6315.363	76.51	PK	29.2	-47.9	0	57.81	74	-16.19	278	100	Horz
6315.687	67.48	LnAv	29.2	-47.9	-37.5	11.28	54	-42.72	278	100	Horz
5413.228	83.19	PK	27.9	-50.28	0	60.81	74	-13.19	209	100	Horz
5413.456	74.46	LnAv	27.9	-50.29	-37.5	14.57	54	-39.43	209	100	Horz
4511.282	81.4	PK	27.8	-53.13	0	56.07	74	-17.93	3	101	Horz
4511.234	72.94	LnAv	27.8	-53.13	-37.5	10.11	54	-43.89	3	101	Horz
8119.706	69.76	PK	36.2	-50.37	0	55.59	74	-18.41	203	100	Horz
8120.175	59.52	LnAv	36.2	-50.37	-37.5	7.85	54	-46.15	203	100	Horz
8119.654	73.66	PK	36.2	-50.37	0	59.49	74	-14.51	234	106	Vert
8120.081	63.82	LnAv	36.2	-50.37	-37.5	12.15	54	-41.85	234	106	Vert
9022.597	70.14	PK	36.1	-49.29	0	56.95	74	-17.05	221	146	Vert
9022.363	59.45	LnAv	36.1	-49.28	-37.5	8.77	54	-45.23	221	146	Vert

PK - Peak detector
LnAv - Linear Average detector

Figure 17 Middle Channel 1GHz – 10GHz Radiated Emissions Graph



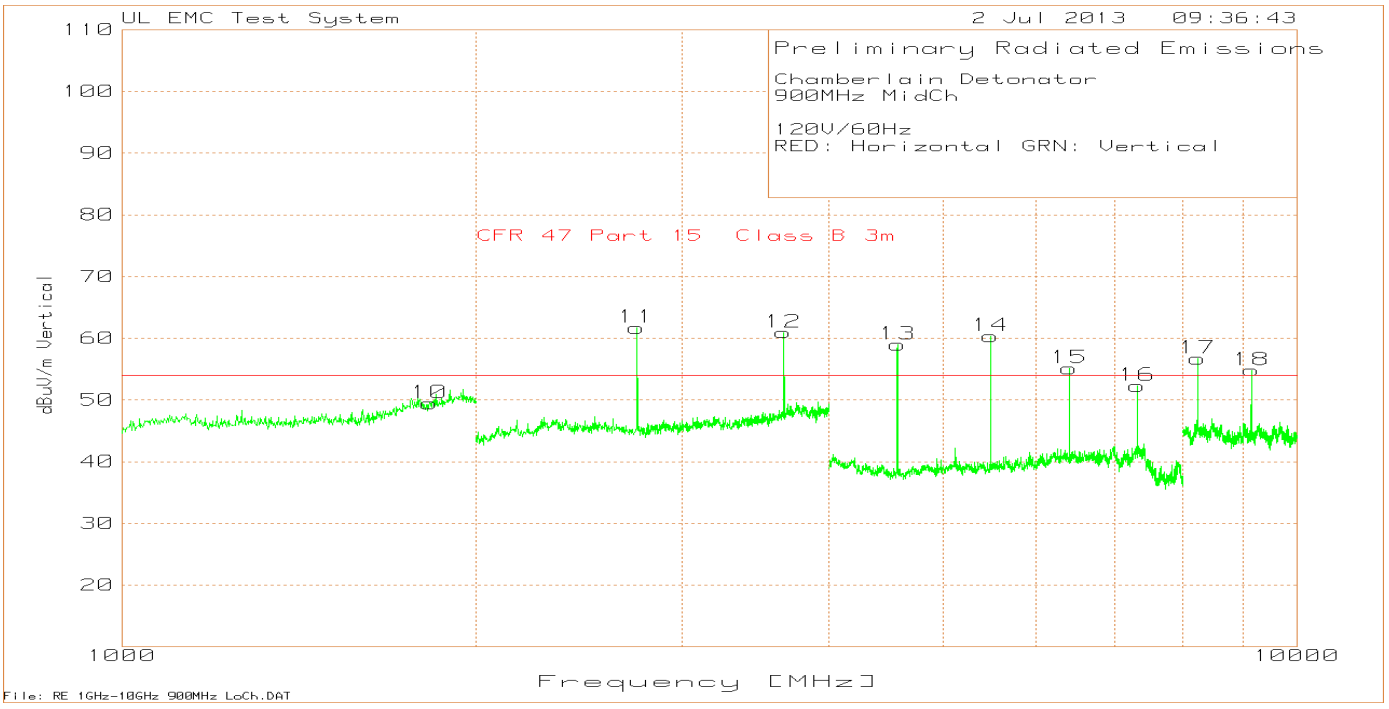


Table 19 Middle Channel 1GHz – 10GHz Radiated Emissions Data Points

Marker Data

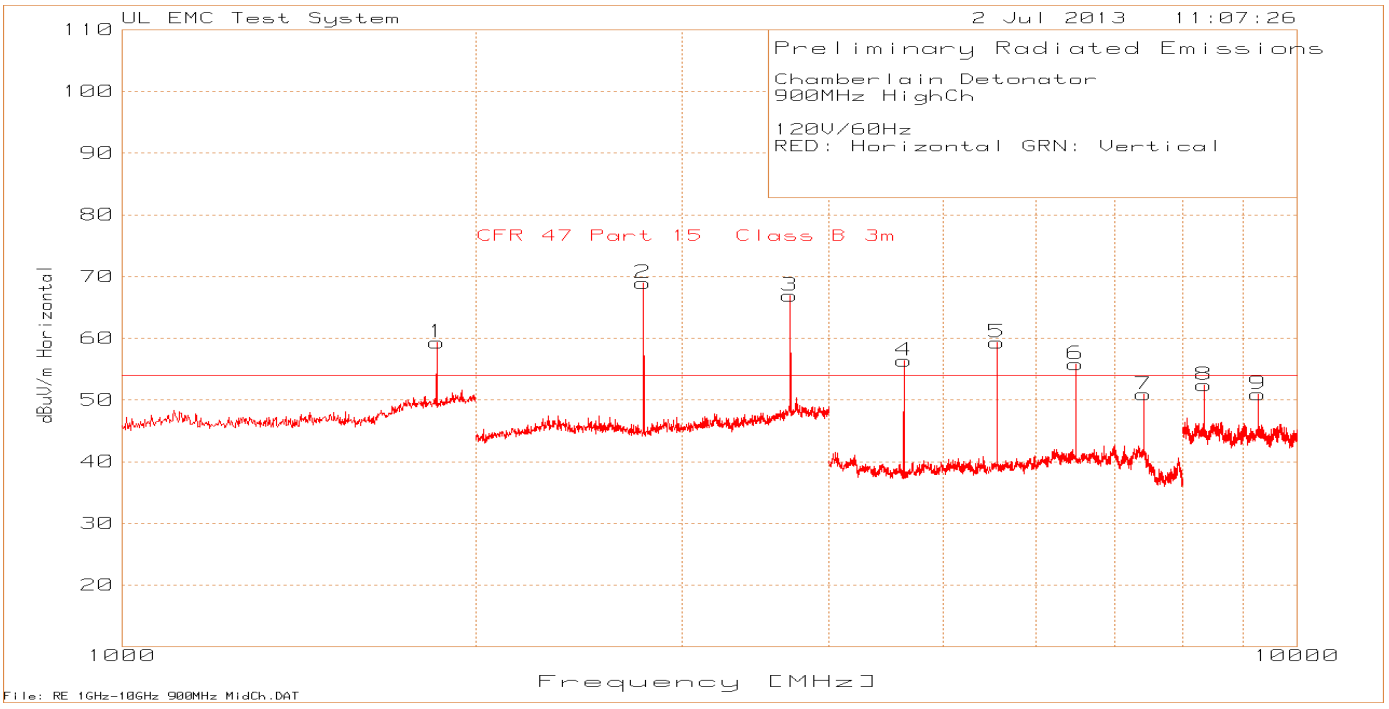
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Height [cm]	Polarity
1	1829.659	28.87	PK	26.9	3.76	59.53	54	5.53	125	Horz
2	2744.745	40.65	PK	22.1	4.01	66.76	54	12.76	100	Horz
3	3659.66	35.94	PK	23.4	5.24	64.58	54	10.58	100	Horz
4	4573.716	81.58	PK	27.7	-52.41	56.87	54	2.87	100	Horz
5	5488.993	80.78	PK	28.1	-50.34	58.54	54	4.54	100	Horz
6	6404.27	74.94	PK	29.2	-48.11	56.03	54	2.03	100	Horz
7	7319.546	64.2	PK	30.6	-46.25	48.55	54	-5.45	100	Horz
8	8232.232	63.35	PK	36.4	-48.32	51.43	54	-2.57	125	Horz
9	9147.147	66.87	PK	36.3	-50.14	53.03	54	-0.97	125	Horz
10	1827.655	18.86	PK	26.9	3.74	49.5	54	-4.5	125	Vert
11	2744.745	35.58	PK	22.1	4.01	61.69	54	7.69	125	Vert
12	3659.66	32.33	PK	23.4	5.24	60.97	54	6.97	125	Vert
13	4573.716	83.65	PK	27.7	-52.41	58.94	54	4.94	100	Vert
14	5488.993	82.64	PK	28.1	-50.34	60.4	54	6.4	100	Vert
15	6404.27	74.09	PK	29.2	-48.11	55.18	54	1.18	100	Vert
16	7319.546	67.98	PK	30.6	-46.25	52.33	54	-1.67	100	Vert
17	8232.232	68.64	PK	36.4	-48.32	56.72	54	2.72	100	Vert
18	9149.149	68.62	PK	36.3	-50.07	54.85	54	0.85	125	Vert

Maximized Peak and Average Measurements

Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	DC Factor dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1829.581	31.86	PK	26.9	3.76	0	62.52	74	-11.48	292	118	Horz
1829.545	22.21	LnAv	26.9	3.76	-37.5	15.37	54	-38.63	292	118	Horz
1829.497	27.03	PK	26.9	3.76	0	57.69	74	-16.31	280	113	Vert
1829.527	15.36	LnAv	26.9	3.76	-37.5	8.52	54	-45.48	280	113	Vert
2744.426	43.13	PK	22.1	4.01	0	69.24	74	-4.76	79	112	Horz
2744.306	34.93	LnAv	22.1	4.01	-37.5	23.54	54	-30.46	79	112	Horz
3658.967	38.17	PK	23.4	5.26	0	66.83	74	-7.17	58	100	Horz
3658.967	29.48	LnAv	23.4	5.26	-37.5	20.64	54	-33.36	58	100	Horz
3659.099	34.97	PK	23.4	5.25	0	63.62	74	-10.38	213	100	Vert
3659.057	26.06	LnAv	23.4	5.26	-37.5	17.22	54	-36.78	213	100	Vert
2744.186	38.38	PK	22.1	4	0	64.48	74	-9.52	300	110	Vert
2744.235	29.66	LnAv	22.1	4.01	-37.5	18.27	54	-35.73	300	110	Vert
4573.877	84.83	PK	27.7	-52.4	0	60.13	74	-13.87	76	114	Vert
4573.739	76.44	LnAv	27.7	-52.41	-37.5	14.23	54	-39.77	76	114	Vert
5488.204	83.93	PK	28.1	-50.36	0	61.67	74	-12.33	83	108	Vert
5488.451	75.22	LnAv	28.1	-50.36	-37.5	15.46	54	-38.54	83	108	Vert
6403.663	74.82	PK	29.2	-48.14	0	55.88	74	-18.12	360	100	Vert
6403.206	65.5	LnAv	29.2	-48.15	-37.5	9.05	54	-44.95	360	100	Vert
7317.617	70.36	PK	30.6	-46.27	0	54.69	74	-19.31	207	100	Vert
7317.906	60.35	LnAv	30.6	-46.27	-37.5	7.18	54	-46.82	207	100	Vert
4573.986	81.95	PK	27.7	-52.4	0	57.25	74	-16.75	1	100	Horz
4573.734	73.47	LnAv	27.7	-52.41	-37.5	11.26	54	-42.74	1	100	Horz
5488.253	81.32	PK	28.1	-50.36	0	59.06	74	-14.94	122	100	Horz
5488.481	72.74	LnAv	28.1	-50.35	-37.5	12.99	54	-41.01	122	100	Horz
6402.792	75.56	PK	29.2	-48.16	0	56.6	74	-17.4	178	100	Horz
7317.518	67.68	PK	30.6	-46.27	0	52.01	74	-21.99	25	102	Horz
7317.957	57.75	LnAv	30.6	-46.27	-37.5	4.58	54	-49.42	25	102	Horz
8233.215	72.24	PK	36.4	-48.34	0	60.3	74	-13.7	226	104	Vert
8232.632	62.24	LnAv	36.4	-48.33	-37.5	12.81	54	-41.19	226	104	Vert
9147.052	71.81	PK	36.3	-50.14	0	57.97	74	-16.03	242	144	Vert
9147.371	61.39	LnAv	36.3	-50.13	-37.5	10.06	54	-43.94	242	144	Vert
9147.223	69.96	PK	36.3	-50.14	0	56.12	74	-17.88	302	135	Horz
9147.332	59.42	LnAv	36.3	-50.13	-37.5	8.09	54	-45.91	302	135	Horz
8232.902	66.54	PK	36.4	-48.33	0	54.61	74	-19.39	175	100	Horz
8232.613	55.97	LnAv	36.4	-48.33	-37.5	6.54	54	-47.46	175	100	Horz

PK - Peak detector
LnAv - Linear Average detector

Figure 18 High Channel 1GHz – 10GHz Radiated Emissions Graph



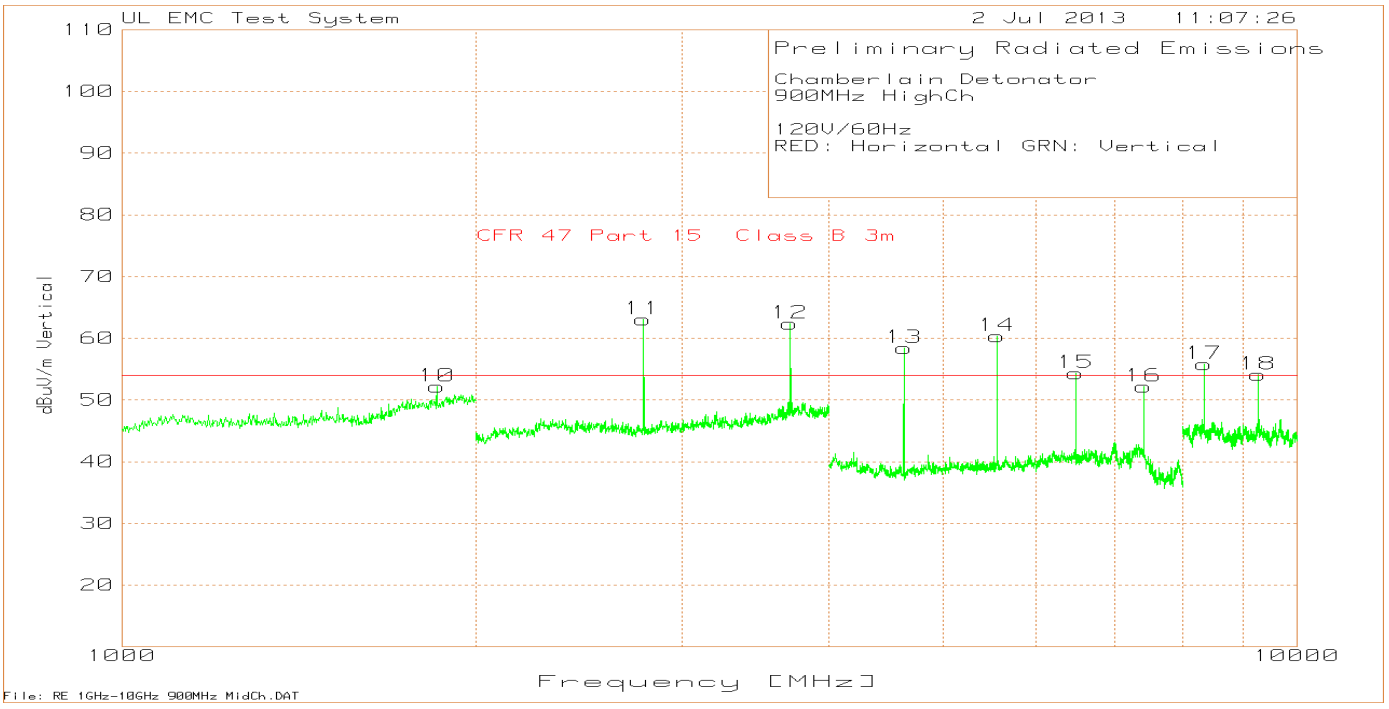


Table 20 High Channel 1GHz – 10GHz Radiated Emissions Data Points

Marker Data

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Height [cm]	Polarity
1	1853.707	28.41	PK	27.1	3.83	59.34	54	5.34	125	Horz
2	2780.781	42.75	PK	22.2	4.04	68.99	54	14.99	100	Horz
3	3707.708	37.77	PK	23.5	5.62	66.89	54	12.89	100	Horz
4	4632.422	81.96	PK	27.7	-53.24	56.42	54	2.42	100	Horz
5	5561.041	81.78	PK	28.3	-50.79	59.29	54	5.29	100	Horz
6	6486.991	75.06	PK	29.1	-48.32	55.84	54	1.84	100	Horz
7	7415.61	66.99	PK	31	-47.1	50.89	54	-3.11	100	Horz
8	8340.34	65.63	PK	36.5	-49.68	52.45	54	-1.55	100	Horz
9	9267.267	63.37	PK	36.4	-48.85	50.92	54	-3.08	125	Horz
10	1853.707	21.22	PK	27.1	3.83	52.15	54	-1.85	100	Vert
11	2780.781	36.78	PK	22.2	4.04	63.02	54	9.02	99	Vert
12	3707.708	33.31	PK	23.5	5.62	62.43	54	8.43	125	Vert
13	4632.422	83.93	PK	27.7	-53.24	58.39	54	4.39	100	Vert
14	5561.041	82.87	PK	28.3	-50.79	60.38	54	6.38	100	Vert
15	6486.991	73.55	PK	29.1	-48.32	54.33	54	0.33	100	Vert
16	7415.61	68.25	PK	31	-47.1	52.15	54	-1.85	100	Vert
17	8340.34	69.01	PK	36.5	-49.68	55.83	54	1.83	100	Vert
18	9267.267	66.59	PK	36.4	-48.85	54.14	54	0.14	125	Vert

Maximized Peak and Average Measurements

Test Frequency MHz	Meter Reading dBuV	Detector	AF dB/m	PF dB	DC Factor dB	Level dBuV/m	47 CFR 15.209 Limit 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1853.404	32.03	PK	27.1	3.83	0	62.96	74	-11.04	303	120	Horz
1853.518	22.45	LnAv	27.1	3.83	-37.5	15.88	54	-38.12	303	120	Horz
2780.089	43.84	PK	22.2	4.05	0	70.09	74	-3.91	81	109	Horz
2780.221	35.61	LnAv	22.2	4.05	-37.5	24.36	54	-29.64	81	109	Horz
3707.207	39.15	PK	23.5	5.63	0	68.28	74	-5.72	49	100	Horz
3706.997	30.32	LnAv	23.5	5.63	-37.5	21.95	54	-32.05	49	100	Horz
3707.099	36.06	PK	23.5	5.63	0	65.19	74	-8.81	213	110	Vert
3706.979	27.23	LnAv	23.5	5.63	-37.5	18.86	54	-35.14	213	110	Vert
2779.997	40.1	PK	22.2	4.05	0	66.35	74	-7.65	297	110	Vert
2780.238	31.82	LnAv	22.2	4.05	-37.5	20.57	54	-33.43	297	110	Vert
4633.777	84.19	PK	27.7	-53.28	0	58.61	74	-15.39	76	100	Vert
4633.735	75.75	LnAv	27.7	-53.28	-37.5	12.67	54	-41.33	76	100	Vert
5560.79	84.42	PK	28.3	-50.79	0	61.93	74	-12.07	78	107	Vert
5560.471	75.88	LnAv	28.3	-50.79	-37.5	15.89	54	-38.11	78	107	Vert
6486.914	74.47	PK	29.1	-48.31	0	55.26	74	-18.74	360	107	Vert
6487.184	65.09	LnAv	29.1	-48.33	-37.5	8.36	54	-45.64	360	107	Vert
4633.449	82.15	PK	27.7	-53.27	0	56.58	74	-17.42	0	100	Horz
4633.701	73.72	LnAv	27.7	-53.28	-37.5	10.64	54	-43.36	0	100	Horz
5560.438	82.05	PK	28.3	-50.79	0	59.56	74	-14.44	119	100	Horz
5560.444	73.5	LnAv	28.3	-50.79	-37.5	13.51	54	-40.49	119	100	Horz
6486.824	75.58	PK	29.1	-48.31	0	56.37	74	-17.63	184	100	Horz
6487.184	66.5	LnAv	29.1	-48.33	-37.5	9.77	54	-44.23	184	100	Horz
8340.59	72.65	PK	36.5	-49.69	0	59.46	74	-14.54	215	119	Vert
8340.638	62.57	LnAv	36.5	-49.69	-37.5	11.88	54	-42.12	215	119	Vert
9266.979	70.42	PK	36.4	-48.86	0	57.96	74	-16.04	236	130	Vert
9267.37	59.09	LnAv	36.4	-48.85	-37.5	9.14	54	-44.86	236	130	Vert

PK - Peak detector
LnAv - Linear Average detector

4.4 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: Adjust power if less then 50 ch or less then 75 ch are used		

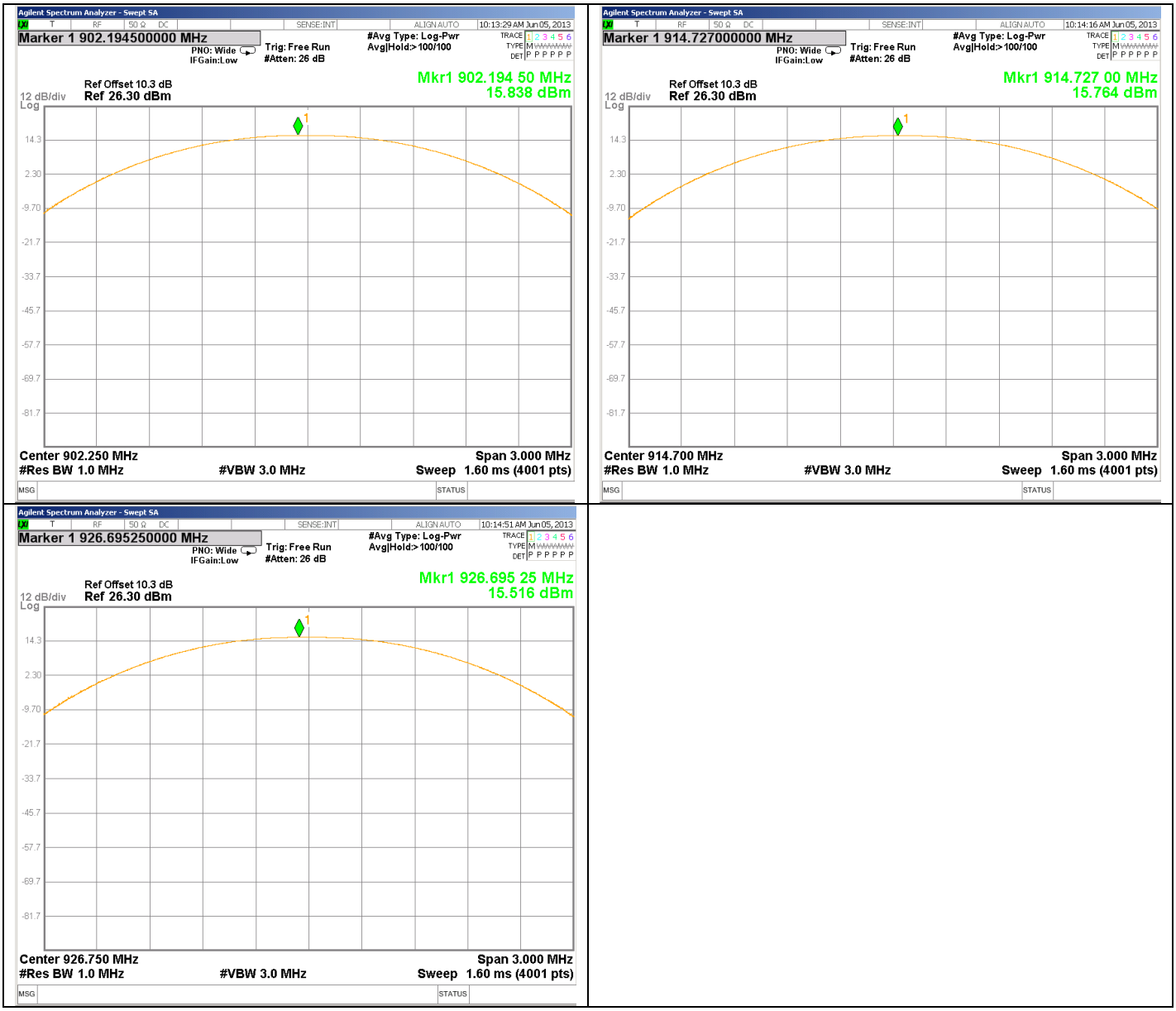
Table 21 Maximum Peak Output Power EUT Configuration Settings

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

Table 22 Maximum Peak Output Power Results

Channel	Declared Antenna Gain (dBi)	Limit (dBm)	Power dBm	Power W
Low Channel	-	30	15.84	0.0384
Middle Channel	-	30	15.76	0.0377
High Channel	-	30	15.52	0.0356

Figure 19 Maximum Peak Output Power Graph



4.5 Test Conditions and Results – Dwell Time 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 23 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 24 Dwell Time Results

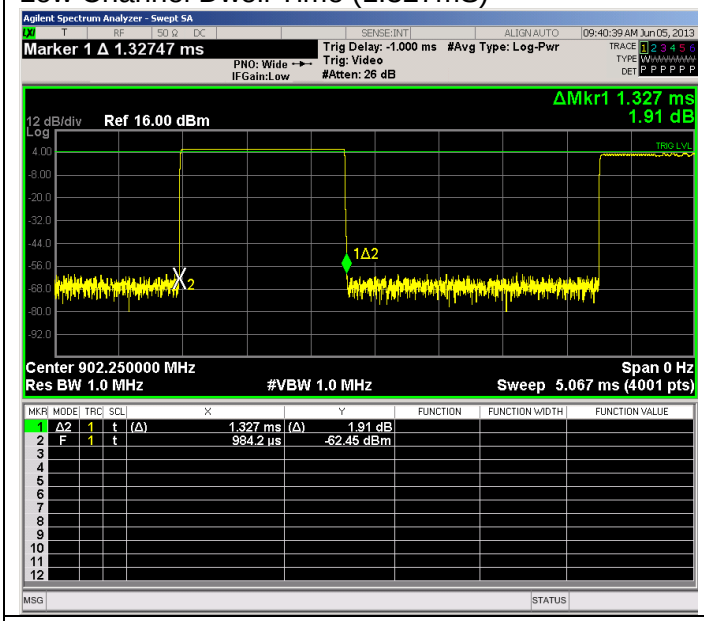
Mode	Number of Channels	Maximum Time Allowed in 20s.	Measured Dwell Time in 20s.
TX Hopping	50	0.4	118.1

Table 25 Duty Cycle Correction Factor

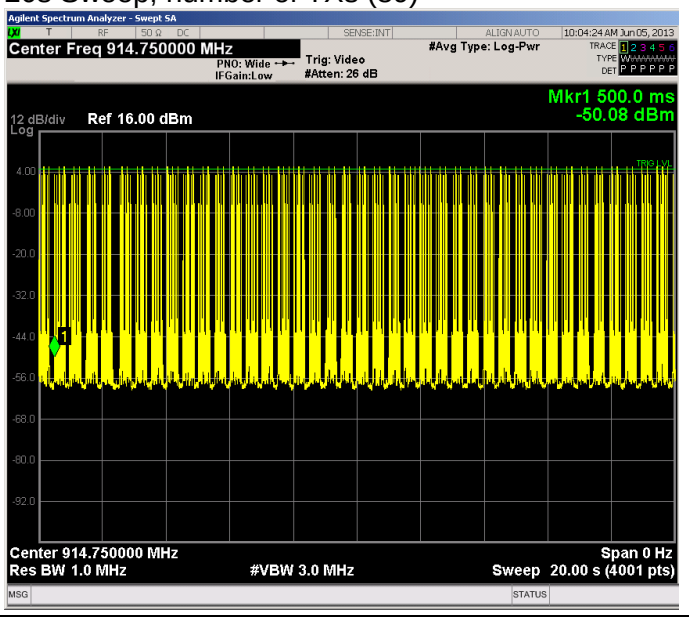
Mode	Number of TX in 100mS	TX Duration in 100mS	Duty Cycle Correction (dB) $20\times\log(\frac{TX(ms)}{100ms})$
TX Hopping Middle Channel	1	1.327	-37.54

Figure 20 Dwell Time Graphs

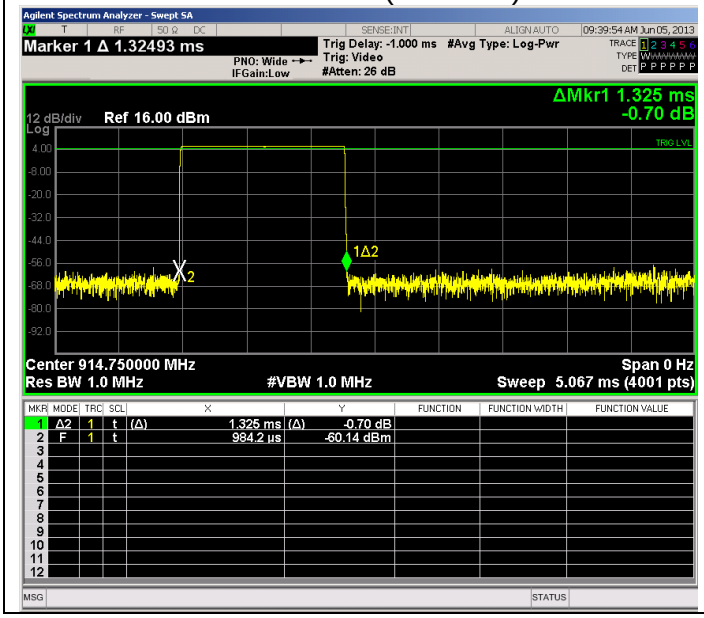
Low Channel Dwell Time (1.327mS)



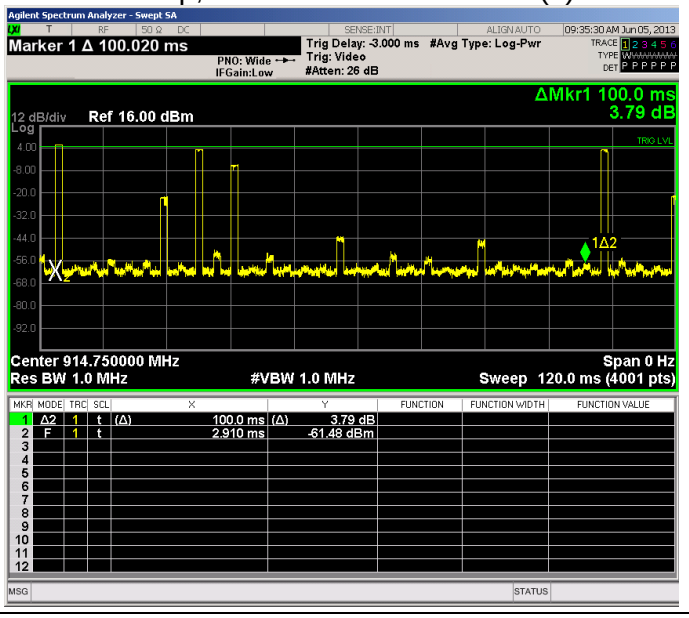
20s Sweep, number of TXs (89)



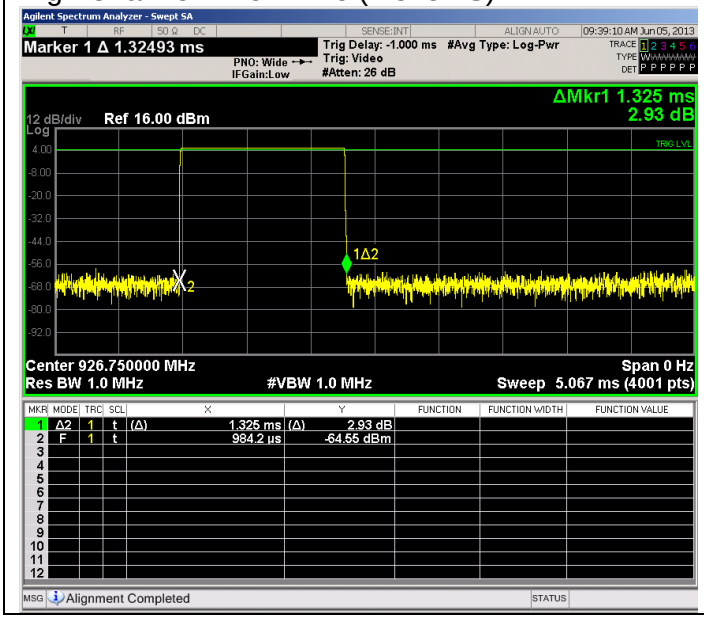
Middle Channel Dwell Time (1.325mS)



120mS Sweep, number of TXs in 100ms (1)



High Channel Dwell Time (1.325mS)



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 transitions counted in 20s is: 89. Total maximum transmit time: 118.1mS within 20s.

4.6 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)

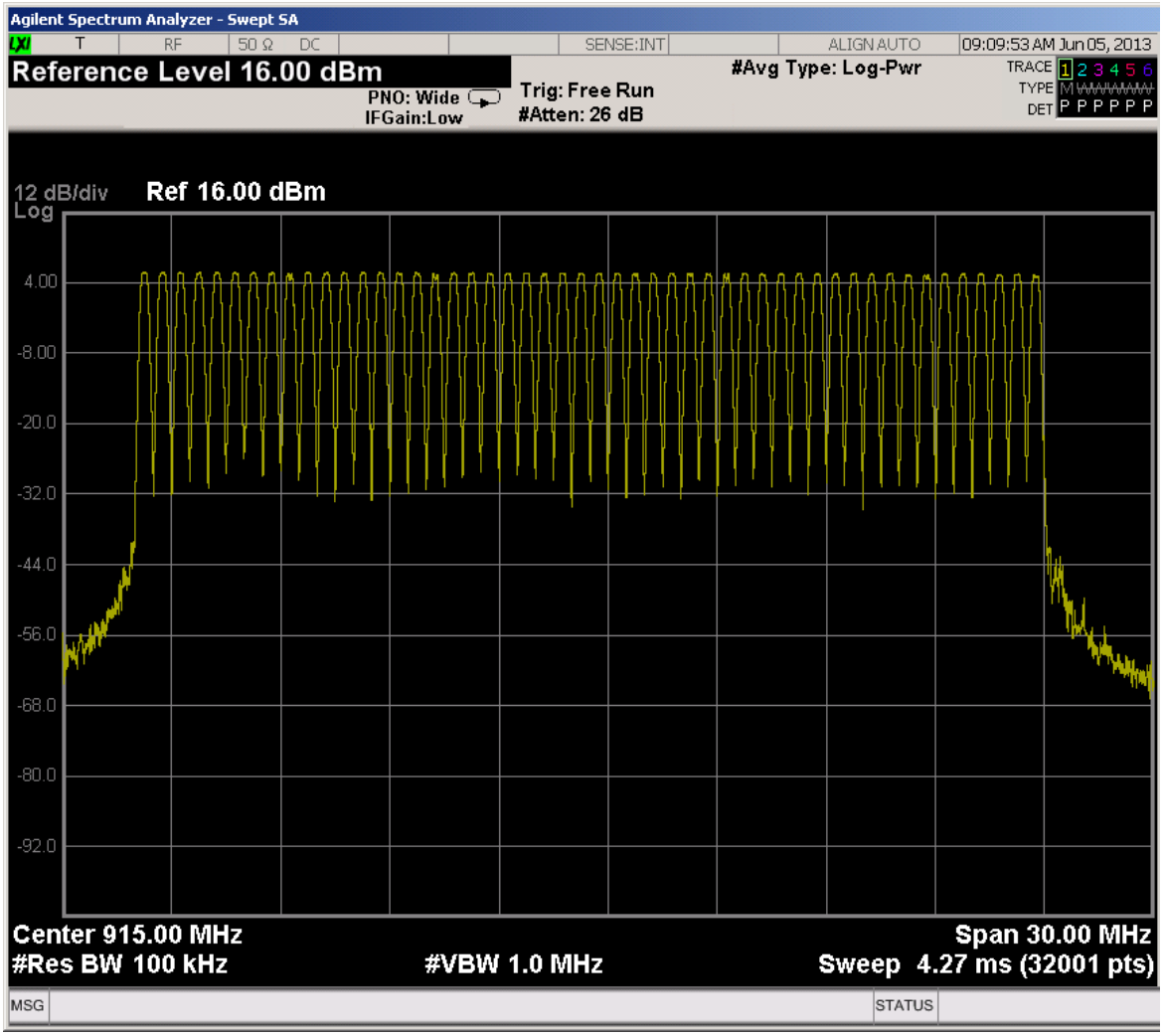
Table 26 Number of Hopping Frequencies Configuration Settings

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

Table 27 Number of Hopping Frequencies Results

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

Figure 21 Number of Hopping Frequencies Graphs



4.7 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 28 20dB Bandwidth Configuration Settings

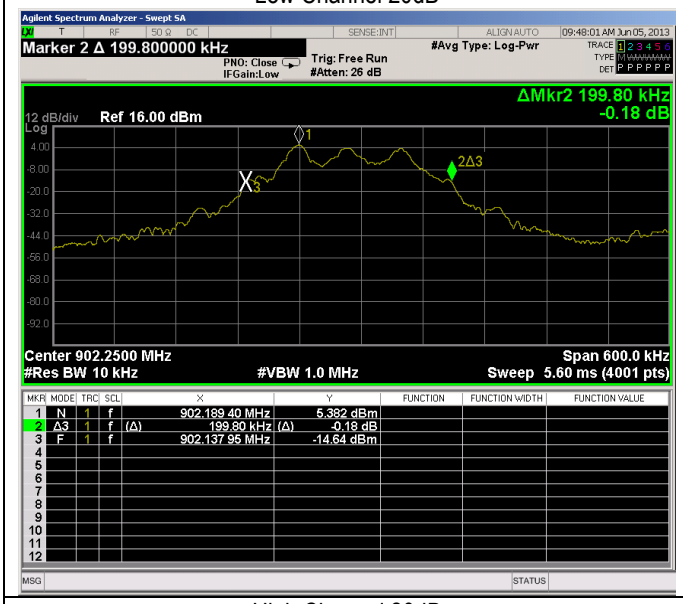
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

Table 29 20dB Bandwidth Results

Mode	Channel	20dB Bandwidth	99% Bandwidth
TX	Low	199.8kHz	177.62kHz
	Middle	200.4kHz	188.34kHz
	High	205.2kHz	190.87kHz

Figure 22 20dB Bandwidth Graphs & 99% Power Bandwidth Graphs

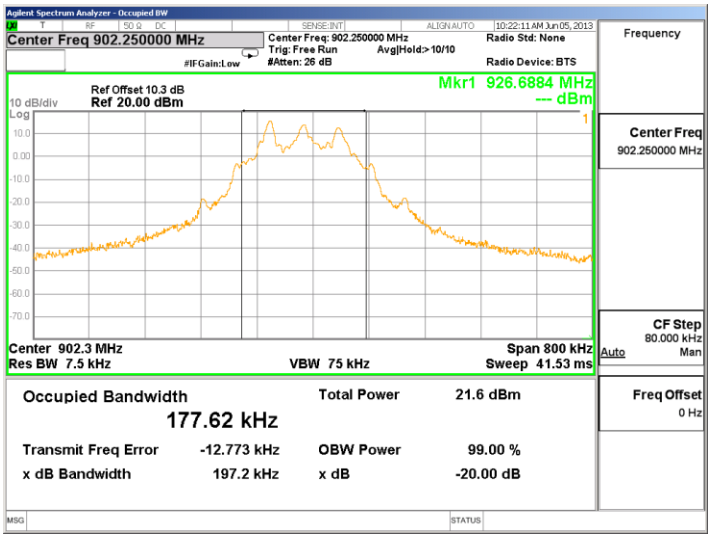
Low Channel 20dB



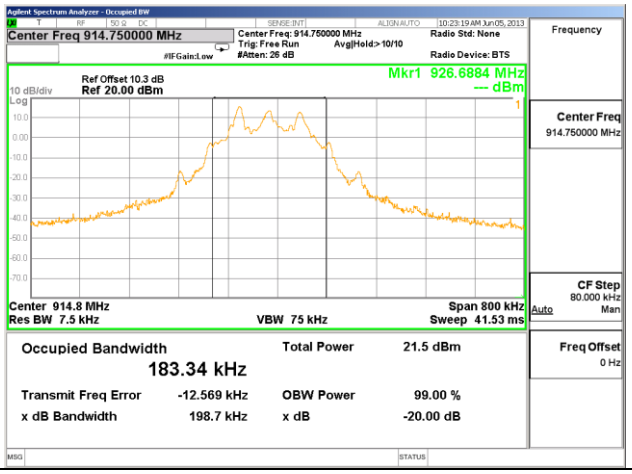
Middle Channel 20dB

High Channel 20dB

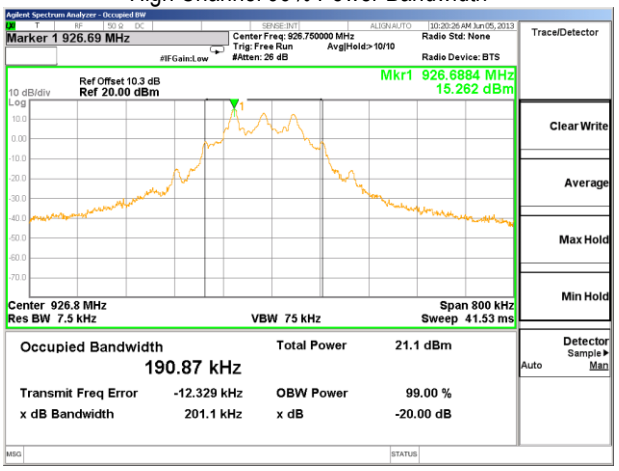
Low Channel 99% Power Bandwidth



Middle Channel 99% Power Bandwidth



High Channel 99% Power Bandwidth



4.8 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 30 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 31 Carrier Frequency Separation Results

Mode	Channel	Carrier Frequency Separation Limit	Channel Separation
TX Hopping	Low Side	> 20dB Bandwidth (aprx. 200kHz)	0.5062MHz
	Middle		0.4980MHz
	High Side		0.5145MHz

Figure 23 Carrier Frequency Separation Graph Low Channel

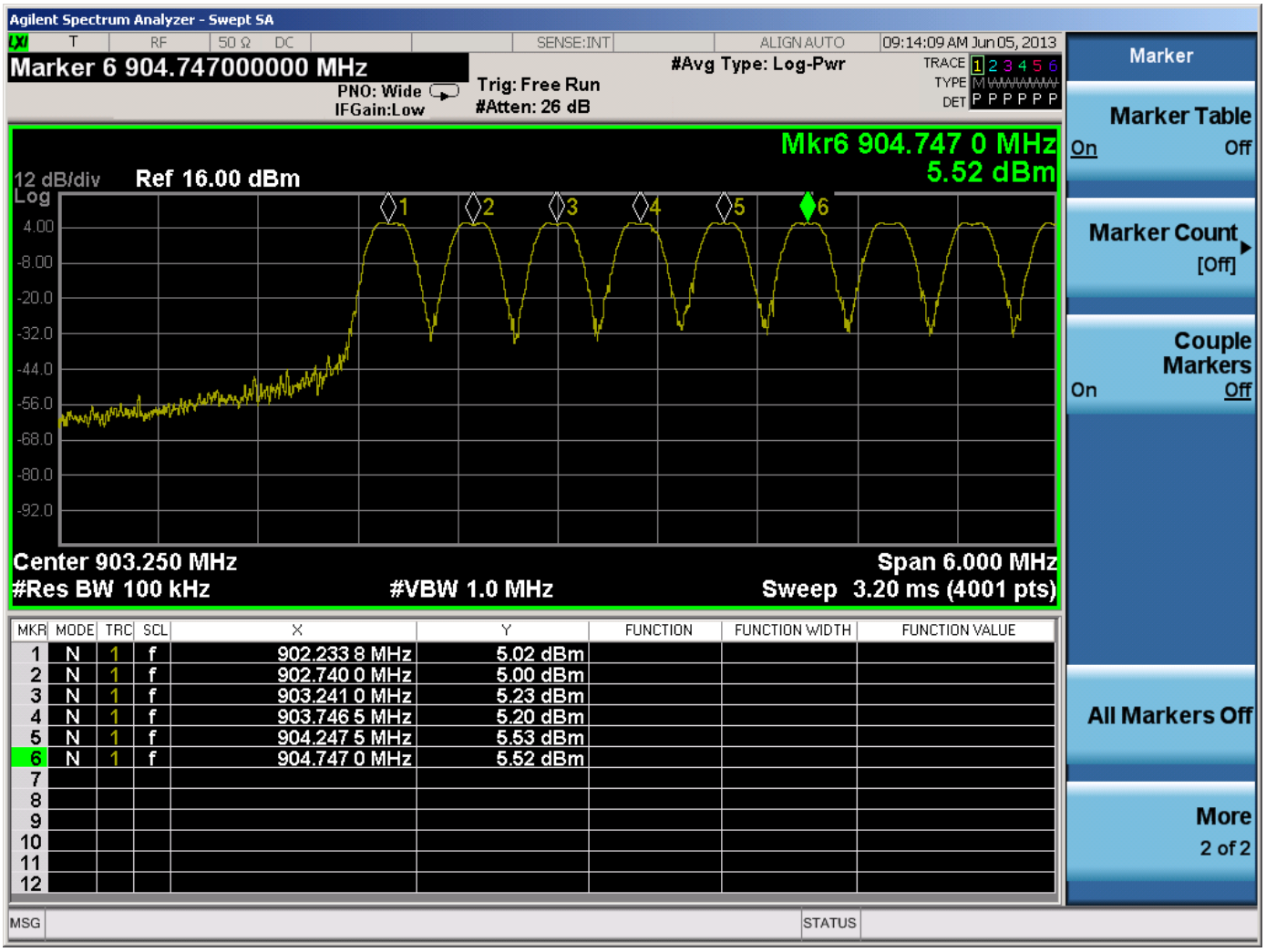


Figure 24 Carrier Frequency Separation Graph Middle Channel

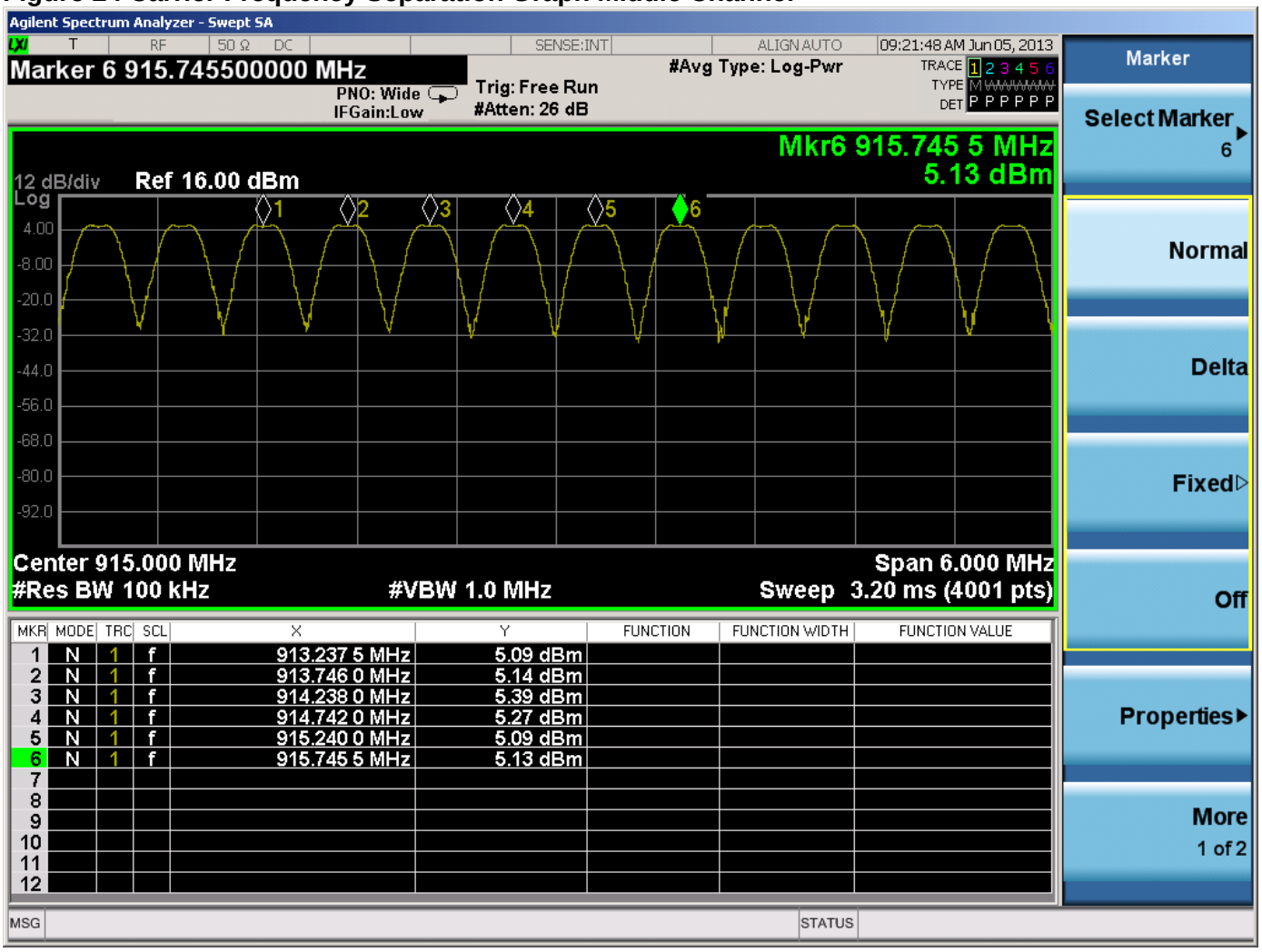
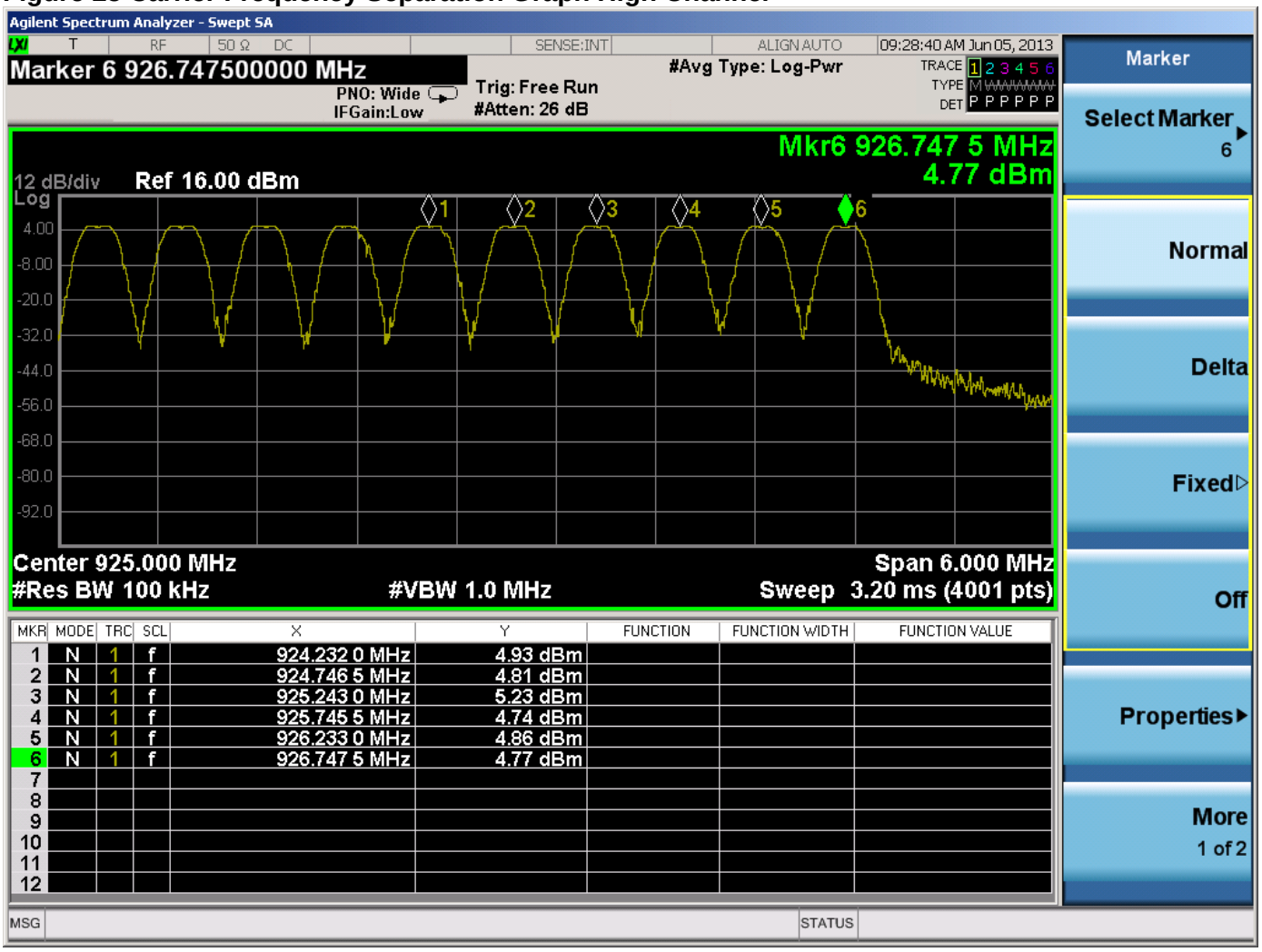


Figure 25 Carrier Frequency Separation Graph High Channel

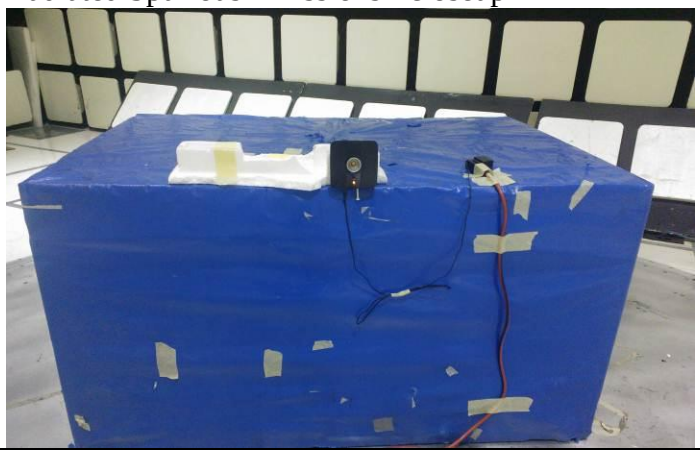


Appendix A

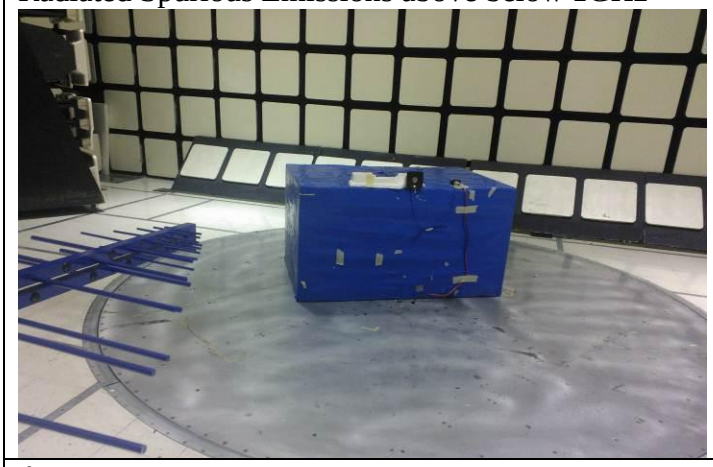
Test Setup Photos

Line Conducted Emissions

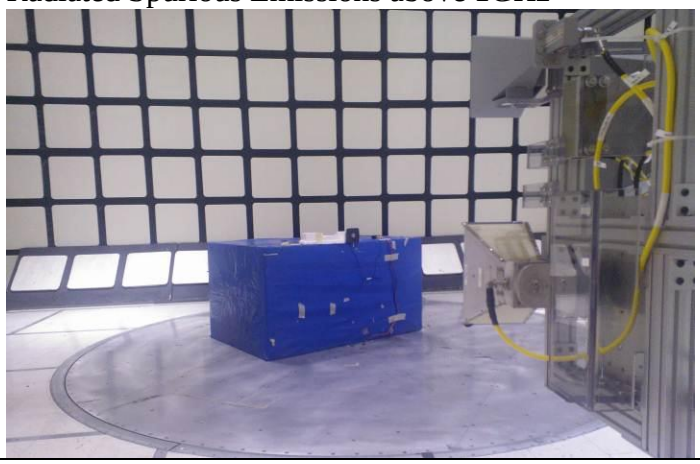
Radiated Spurious Emissions - closeup



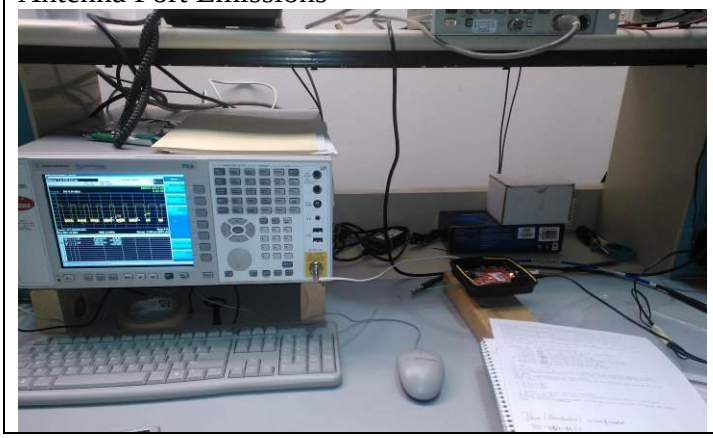
Radiated Spurious Emissions above below 1GHz



Radiated Spurious Emissions above 1GHz



Antenna Port Emissions



Appendix B

Test Equipment

Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 30, 2012	Dec 30, 2013
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	Jan 15, 2013	Jan 16, 2014
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 15, 2013	Jan 16, 2014

Radiated Emissions – 10-Meter Chamber

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20121227	20131231
Bicon Antenna	Electro-Metrics	EM6912A	EMC4070	20120806	20130830
Log-P Antenna	Chase	UPA6109	EMC4313	20120807	20130831
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20121226	20131231
Antenna Array	UL	BOMS 1GHz-40GHz	EMC4276	20111227	20131231

Antenna Port Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Spectrum analyzer	Agilent	PXA	EMC4360	20121226	20131226
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