



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1**

CERTIFICATION TEST REPORT

FOR

Overhead Door and Gate Operator

MODEL NUMBER: HVIN: 1D8389 PMN: HCTDCU

**FCC ID: HBW8389
IC: 2666A-8389**

REPORT NUMBER: 11311836

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NVLAP Lab code: 100414-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--		Initial Issue	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Chamberlain Group Inc.
845 Larch Av.
Elmhurst, IL 60126

EUT DESCRIPTION: Commercial 24VDC High Traffic Overhead Door and Gate Operator with low power FHSS transceiver and digital device/receiver.

MODEL: HVIN: 1D8389 PMN: HCTDCU

SERIAL NUMBER: non serialized

DATE TESTED: June 28, 2016 to July 05, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-Gen Issue 4	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. 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.

Approved & Released For
UL LLC By:

Tested By:



Michael Ferrer
WiSE Program Manager
UL LLC

Bartlomiej Mucha
WiSE Staff Engineer
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

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)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	3.65dB
Radiated Emissions	9k-30MHz	H-Field Loop	3.15dB
Radiated Emissions	30-200MHz	Bicon 3m Horz	3.64dB
Radiated Emissions	30-200MHz	Bicon 3m Vert	5.10dB
Radiated Emissions	200-1000MHz	LogP 3m Horz	4.00dB
Radiated Emissions	200-1000MHz	LogP 3m Vert	5.36dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.48dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.49dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.79dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.84dB
Radiated Emissions	1-18GHz	Horn	4.32dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Commercial 24VDC High Traffic Overhead Door and Gate Operator with low power FHSS transceiver and digital device/receiver, HVIN: 1D8389 PMN: HCTDCU.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
902.25 - 926.75	FHSS	8.49	7.06

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an wire antenna, with a maximum gain of 0.5dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware/software installed in the EUT during testing was 3.9.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT can only be installed in a single configuration on the ceiling. All testing was conducted with the EUT in similar orientation.

5.6. DESCRIPTION OF TEST SETUP

EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Type	FCC ID
Door and Gate Operator	Chamberlain Group Inc.	1D8389	EUT	HBW8389
Photo Eyes		Generic	Accessories	-
Push Button Control		Generic	Accessories	-

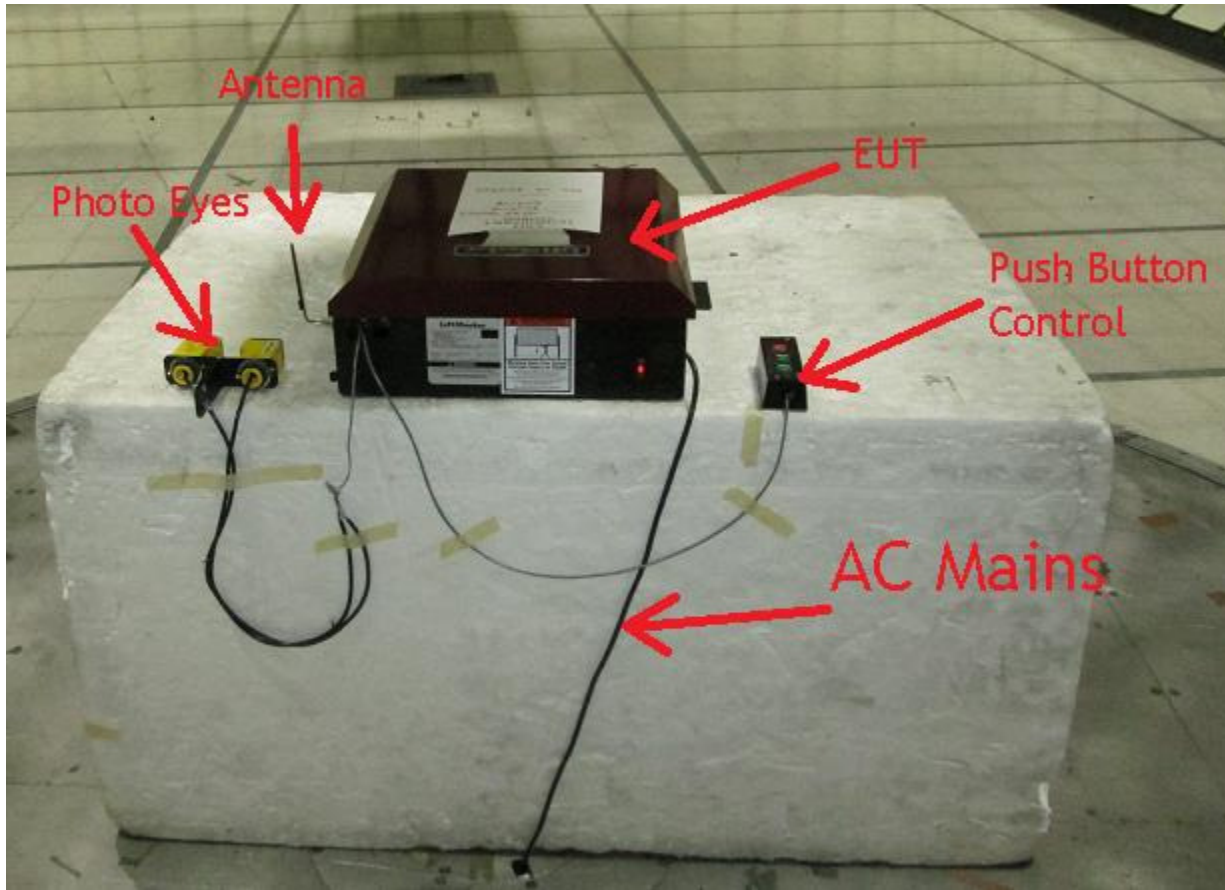
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Standard 120	3 wire	1.5m	none
2	Photo Eyes	2	none	2 wire	1m	none
3	Push button control	1	none	4 wire	1m	none

TEST SETUP

The transmitter is part of the door and gate operator built into a control board and assembled as end product.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20160102	20170131
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20151118	20161118
Bicon Antenna	Chase	VBA6106A	EMC4078	20151228	20161231
Log-P Antenna	Chase	UPA6109	EMC4313	20160122	20170131
Loop Antenna	EMCO	6502/1	EMC4026	20150420	20160430
Antenna Array	UL	BOMS	EMC4276	20151115	20161115
Spectrum Analyzer	Agilent	N9030A	EMC4360	20160108	20170131
EMI Test Receiver	Rohde & Schwarz	ESR	EMC4377	April 26, 2016	April 26, 2017
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	Feb 16, 2016	Feb 28, 2017
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Fen 16, 2016	Feb 28, 2017

7. ANTENNA PORT TEST RESULTS

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

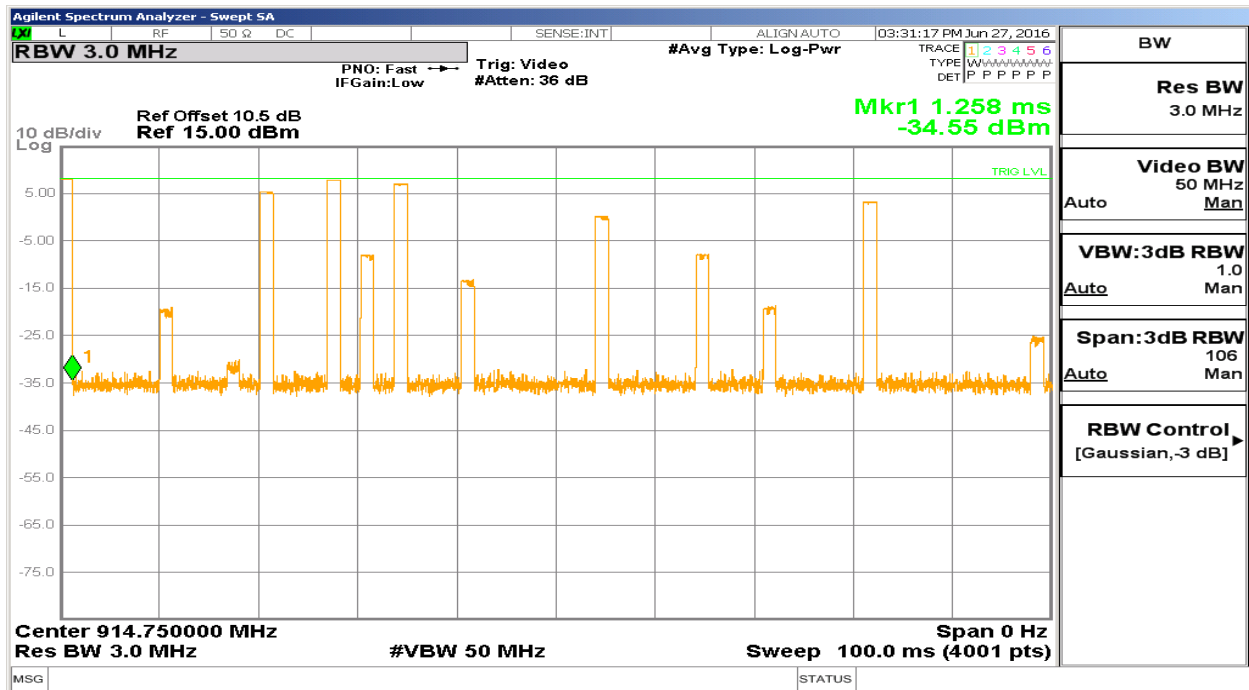
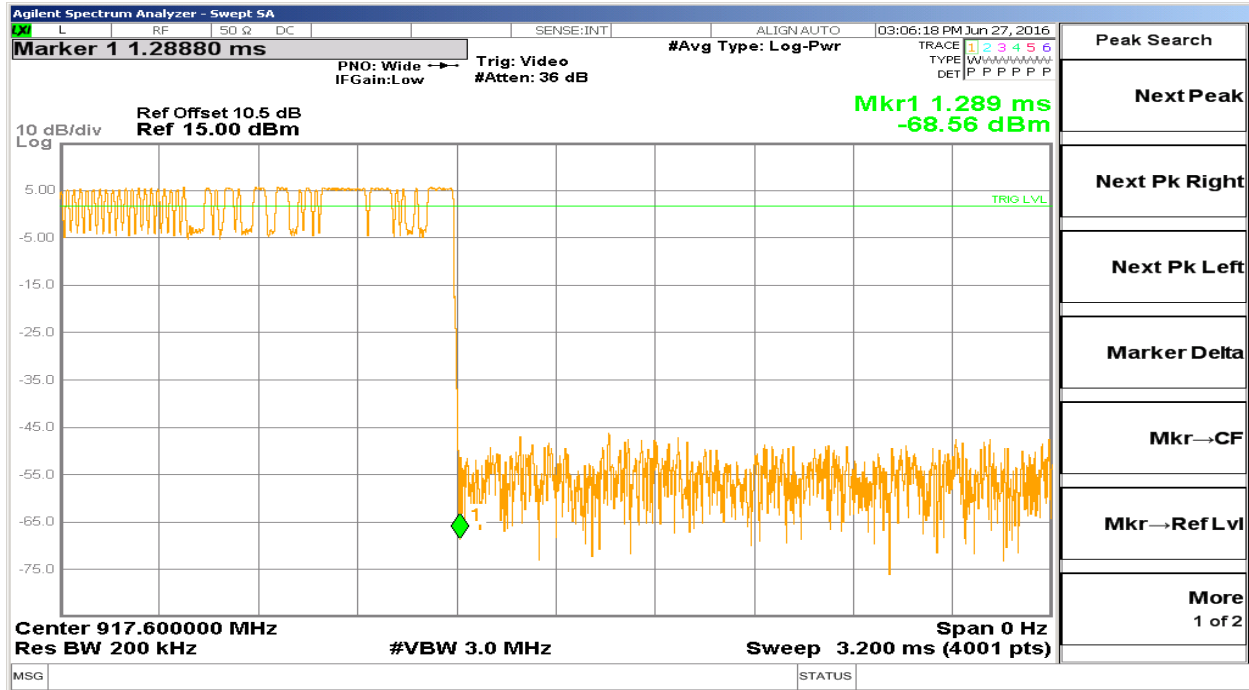
KDB 558074 Zero-Span Spectrum Analyzer Method.

8.1. ON TIME AND DUTY CYCLE RESULTS

	B (msec)	(msec)	x (linear)	Cycle (%)	Correction Factor (dB)	Minimum VBW (kHz)
900 MHz band (Hopping ON)						
FHSS	1.289	100	0.013	1.29%	-37.79	N/A

8.2. DUTY CYCLE PLOTS

HOPPING ON



8.3. GFSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

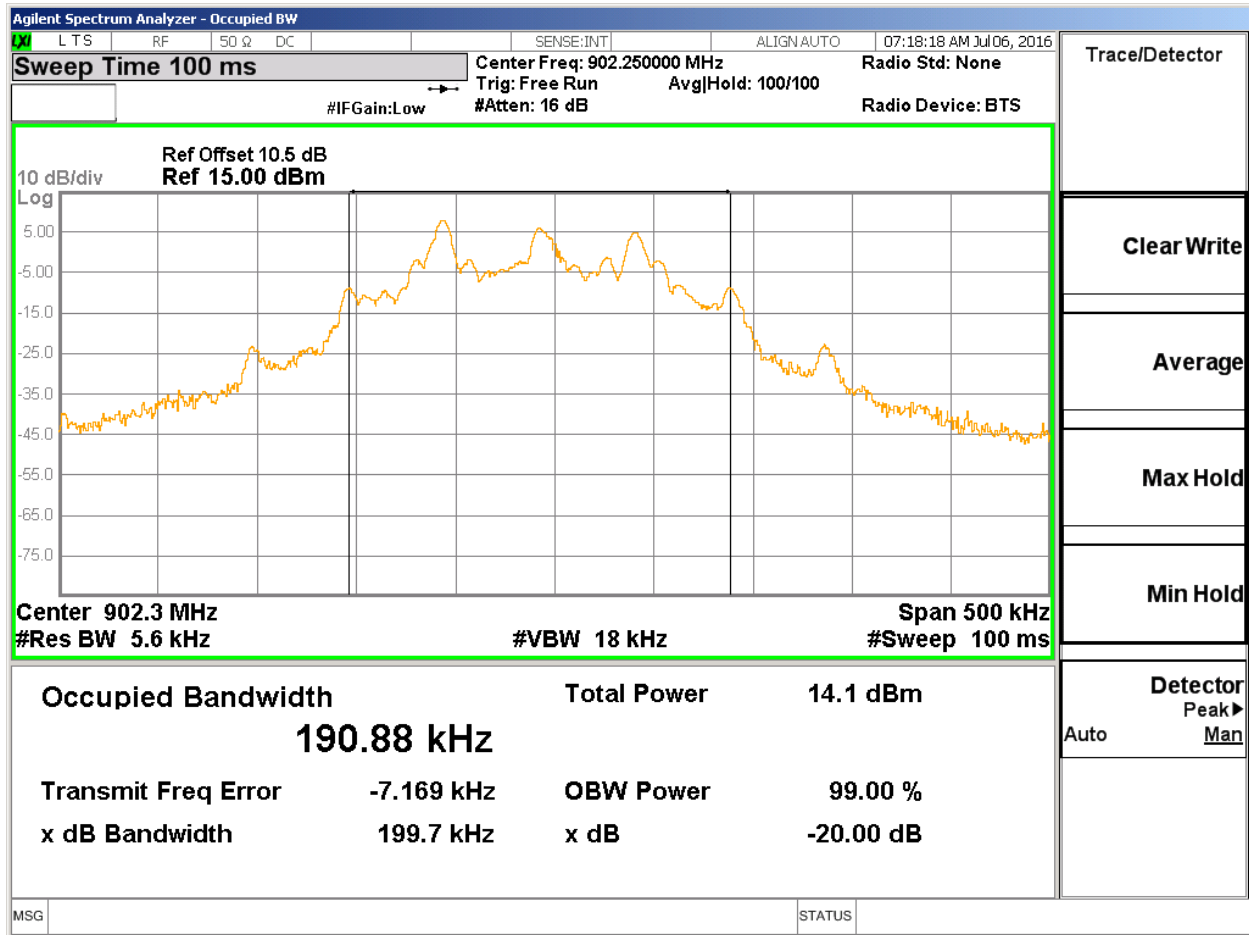
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

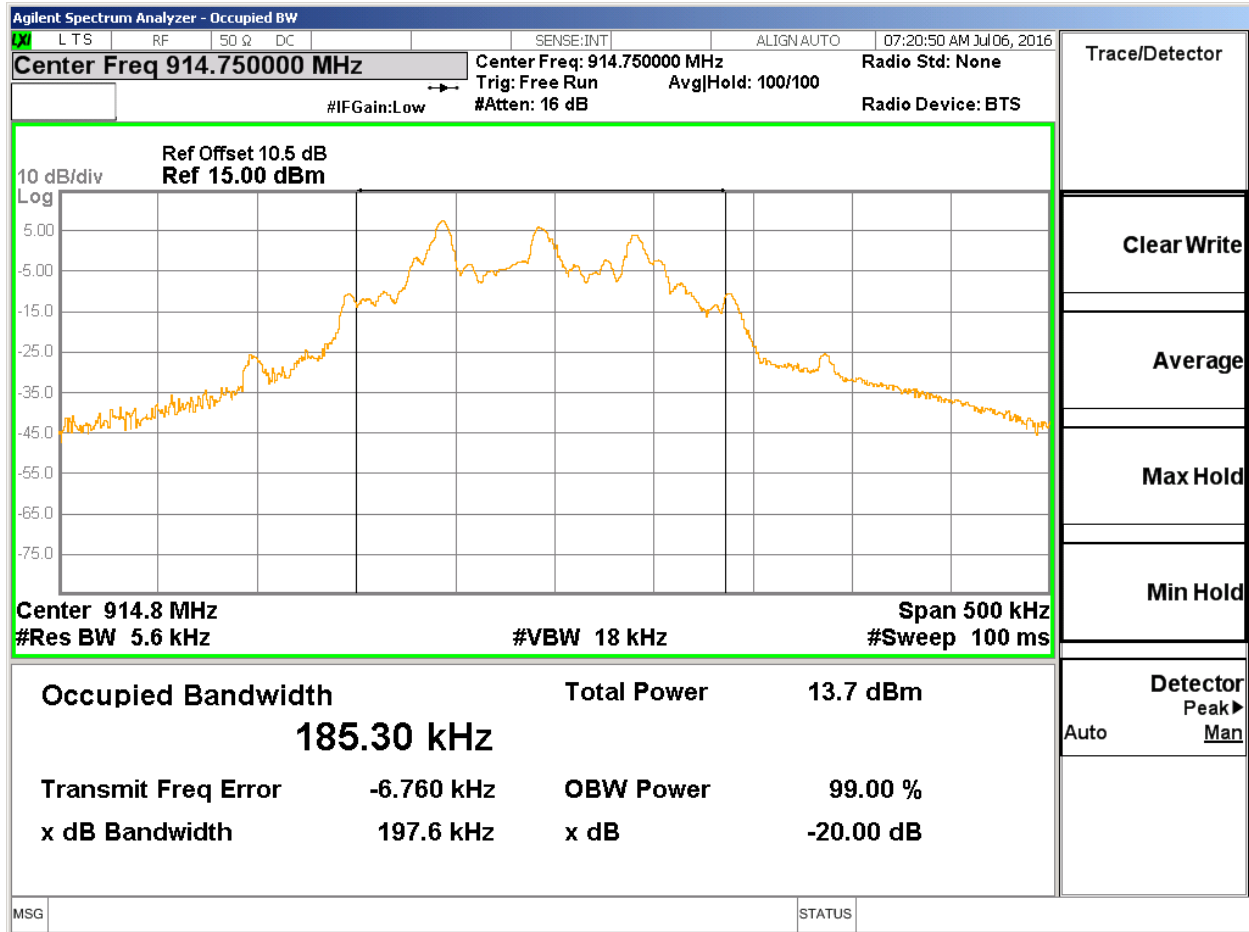
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	902.25	199.7	191.04
Middle	914.75	197.6	184.86
High	926.75	199.2	190.84

20 dB AND 99% BANDWIDTH

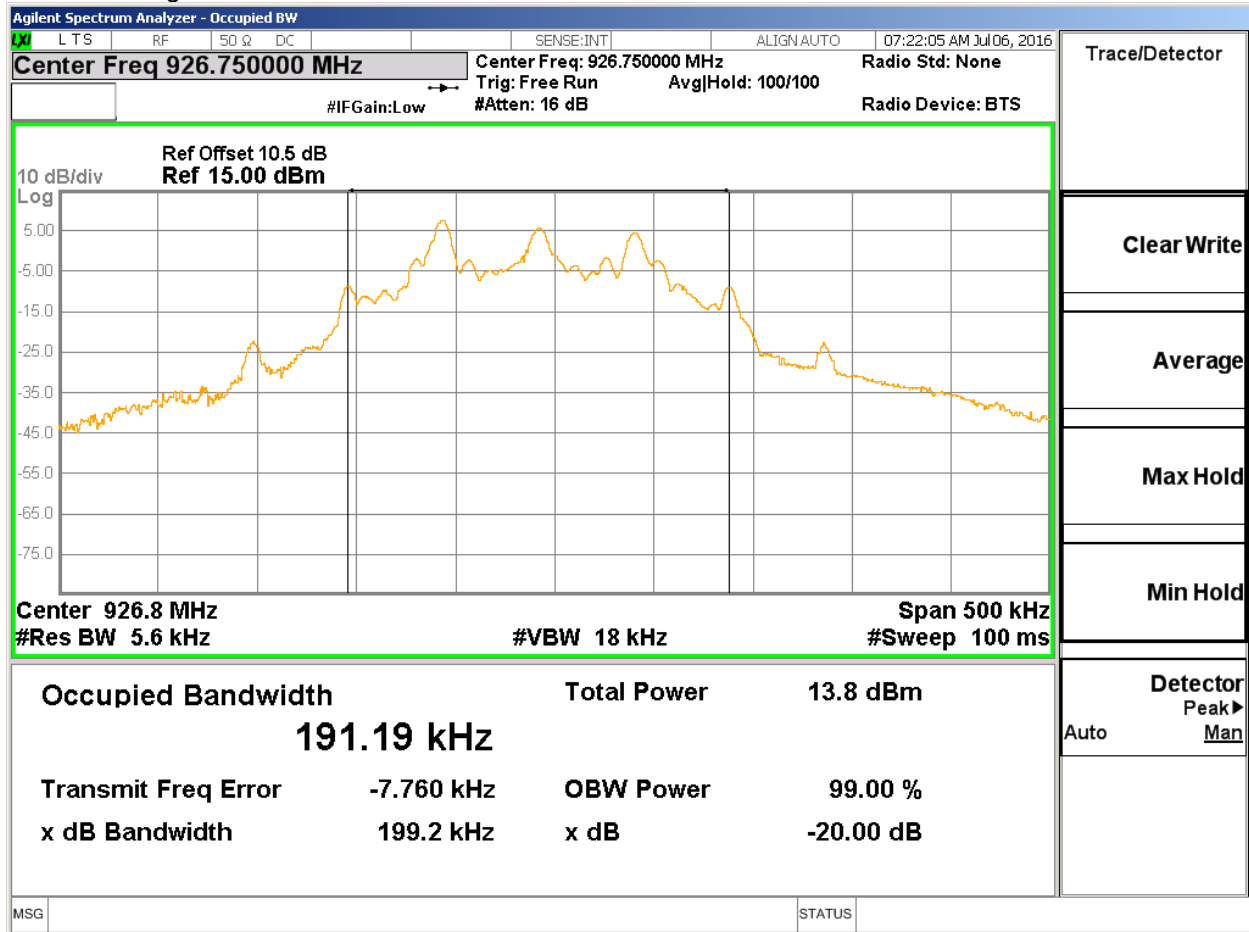
20dB BW Low Channel



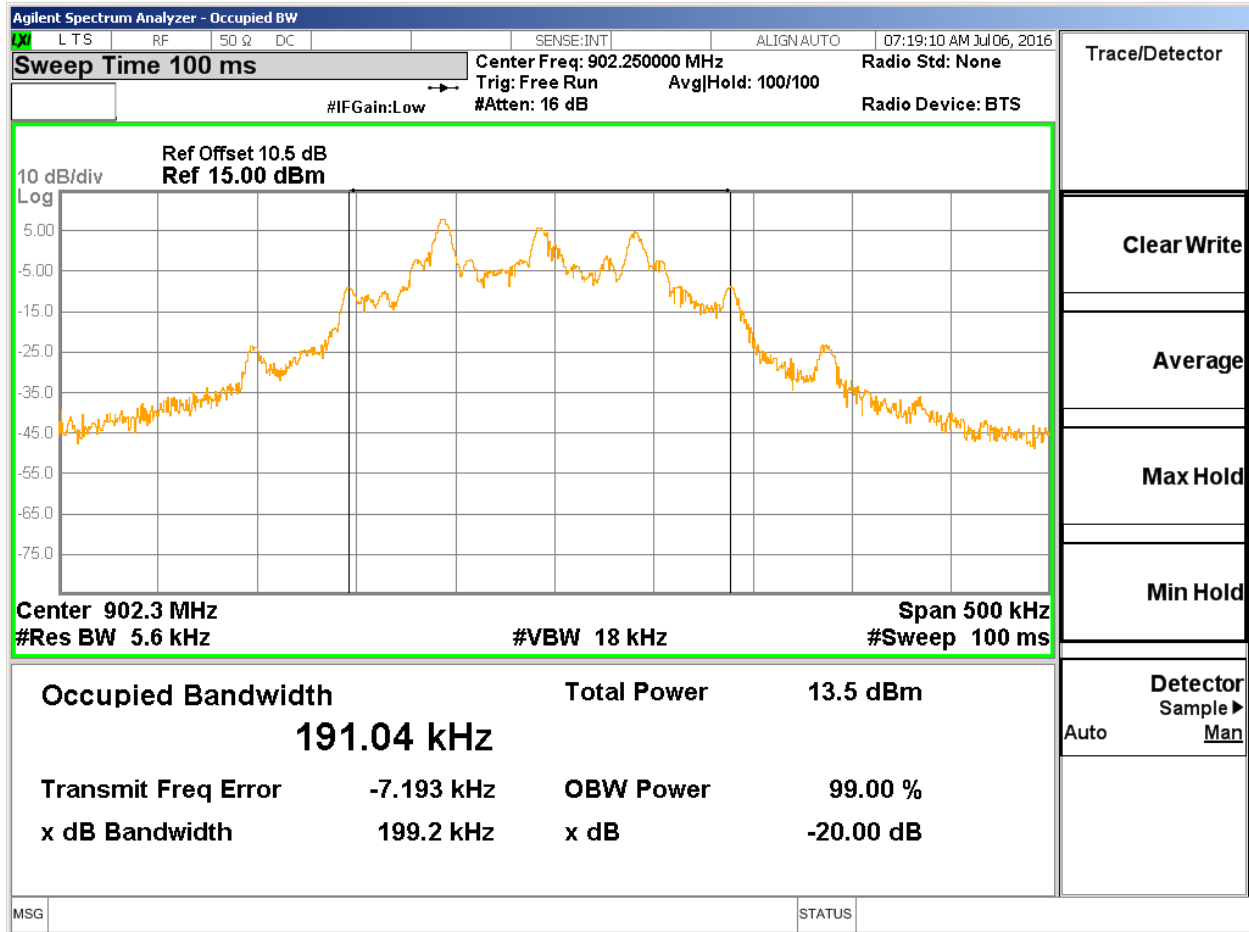
20dB BW Middle Channel



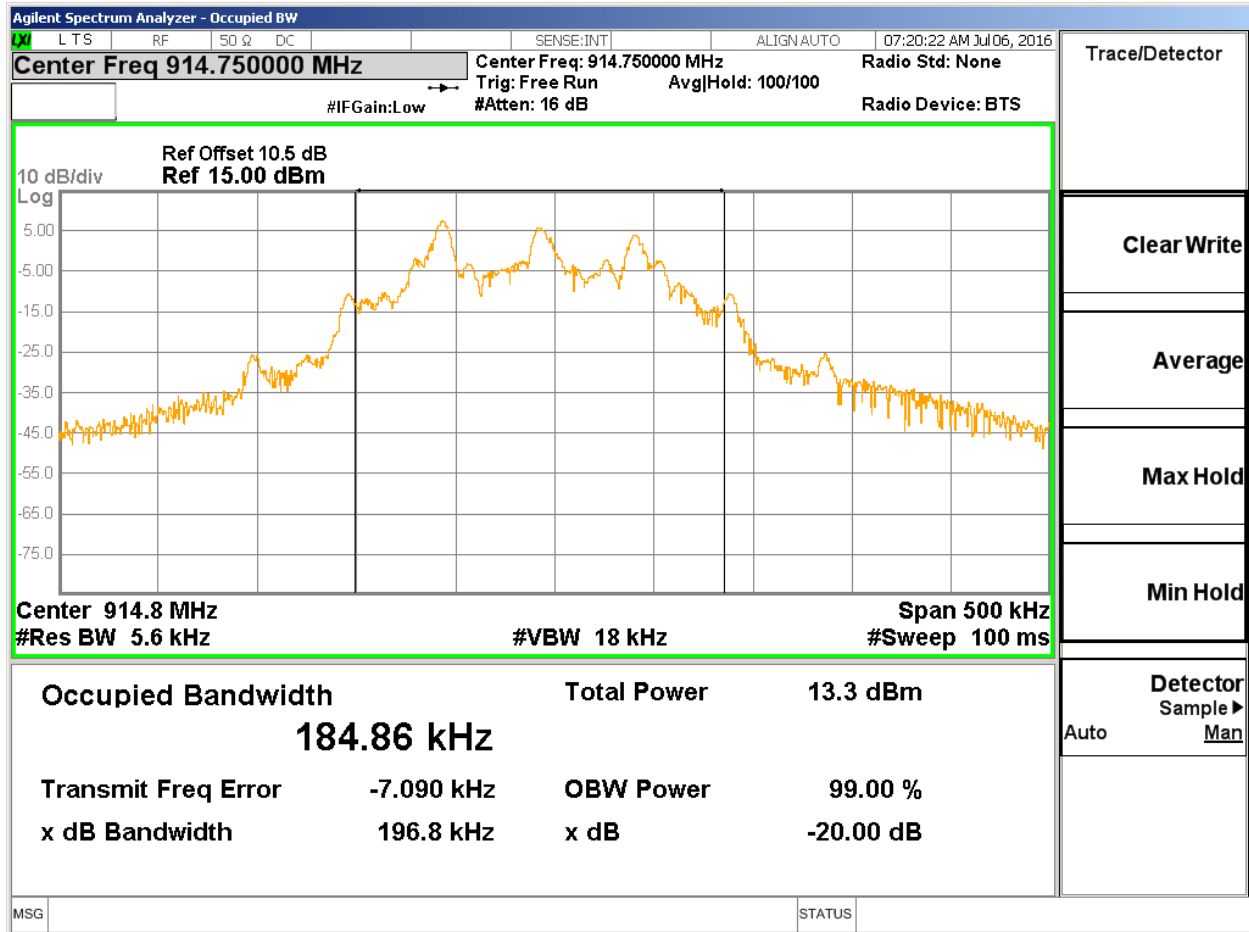
20dB BW High Channel



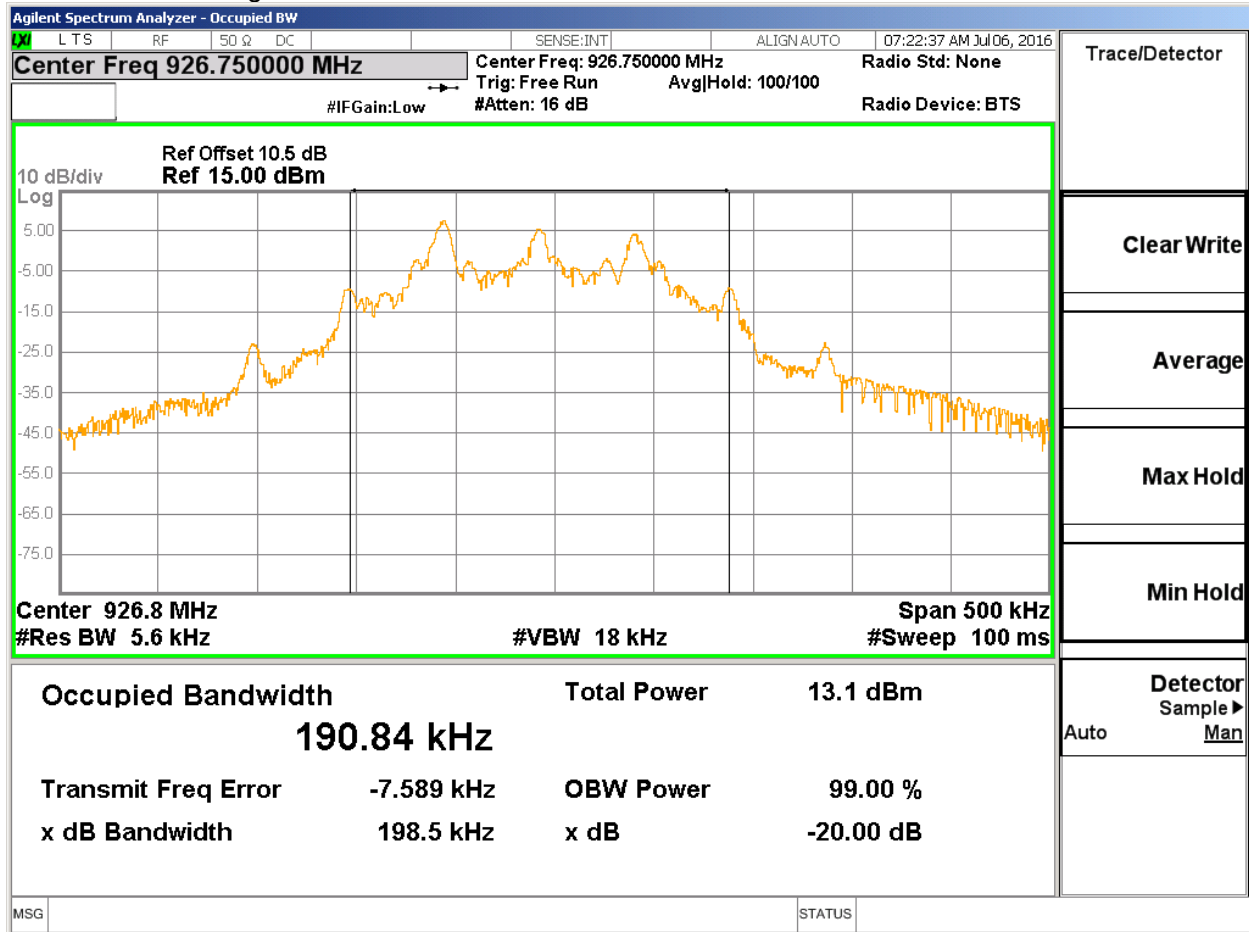
99% Power BW Low Channel



99% Power BW Middle Channel



99% Power BW High Channel



8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 5.1 (2)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (i)

IC RSS-247 5.1 (3)

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.

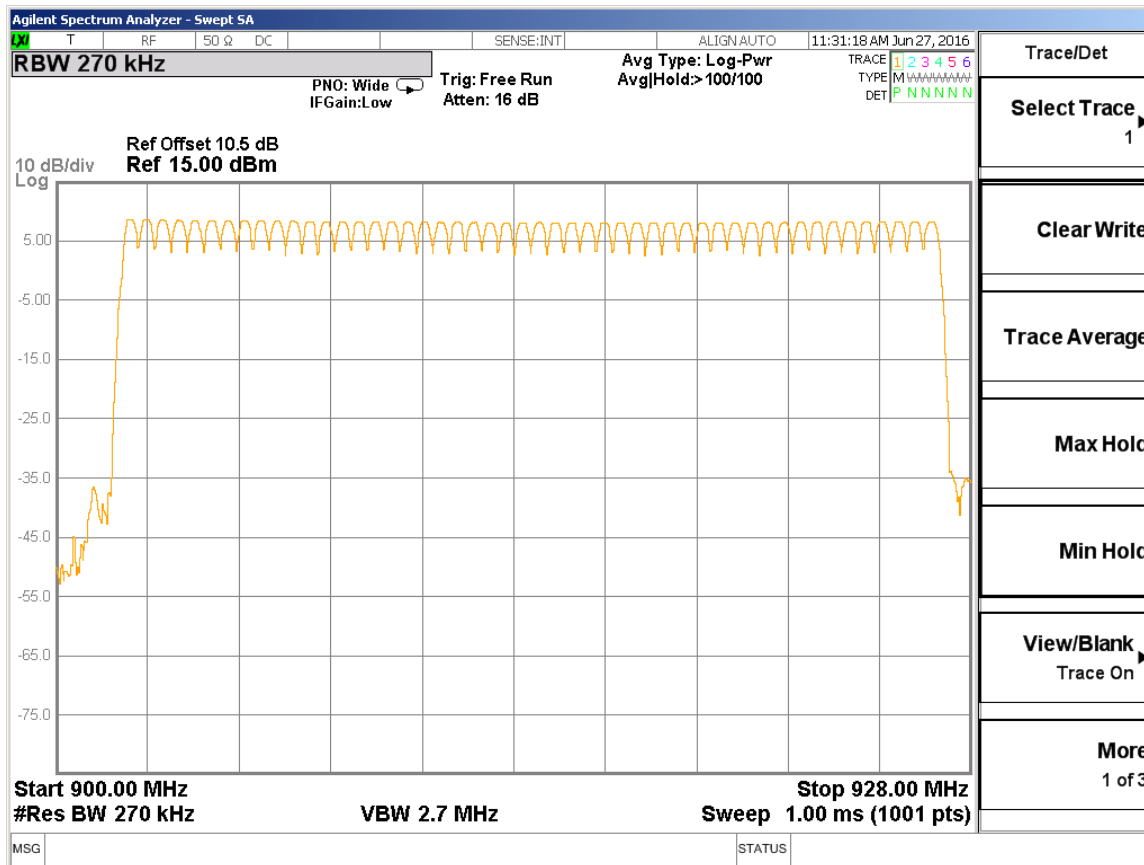
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 50 Channels Observed

NUMBER OF HOPPING CHANNELS



8.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (i)

IC RSS-247 5.1 (3)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. Resolution BW was decreased to 200kHz to filter out adjacent channels. Sweep was set to 20 seconds and number of pulses during the time was counted.

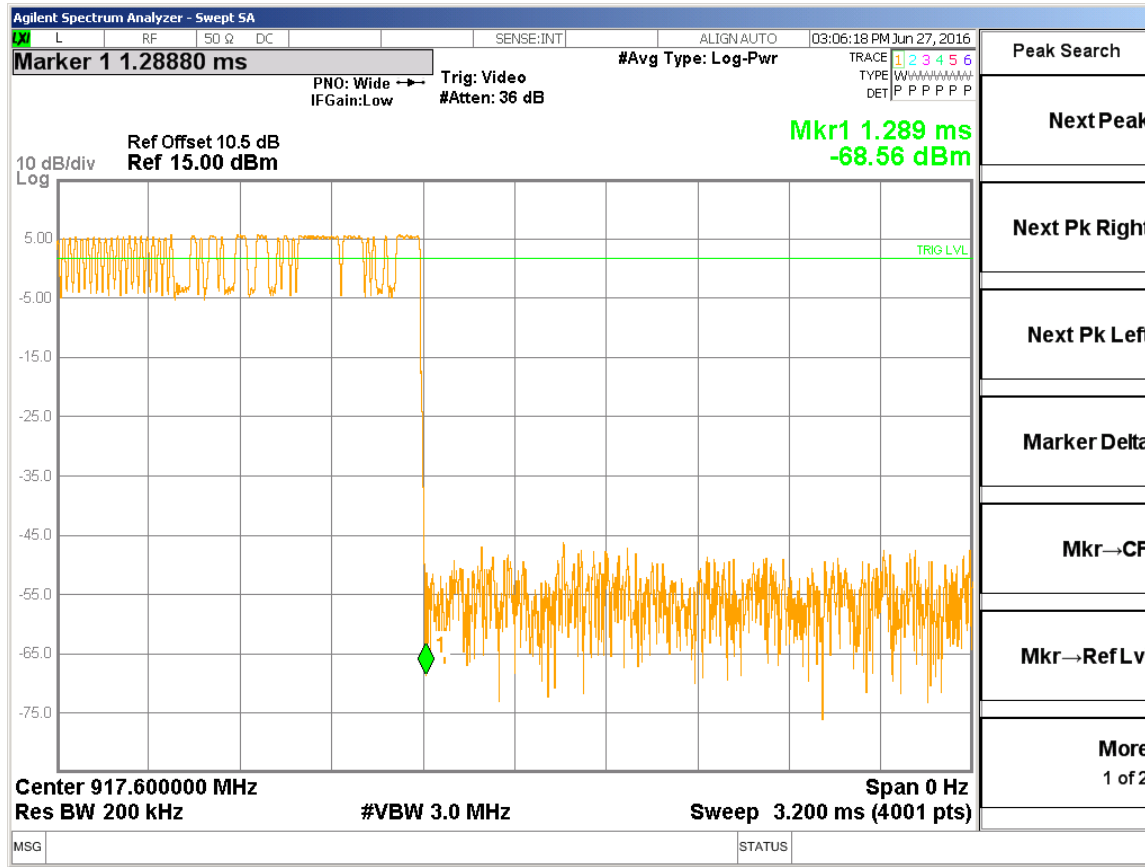
RESULTS

Single pulse width: 1.289mS

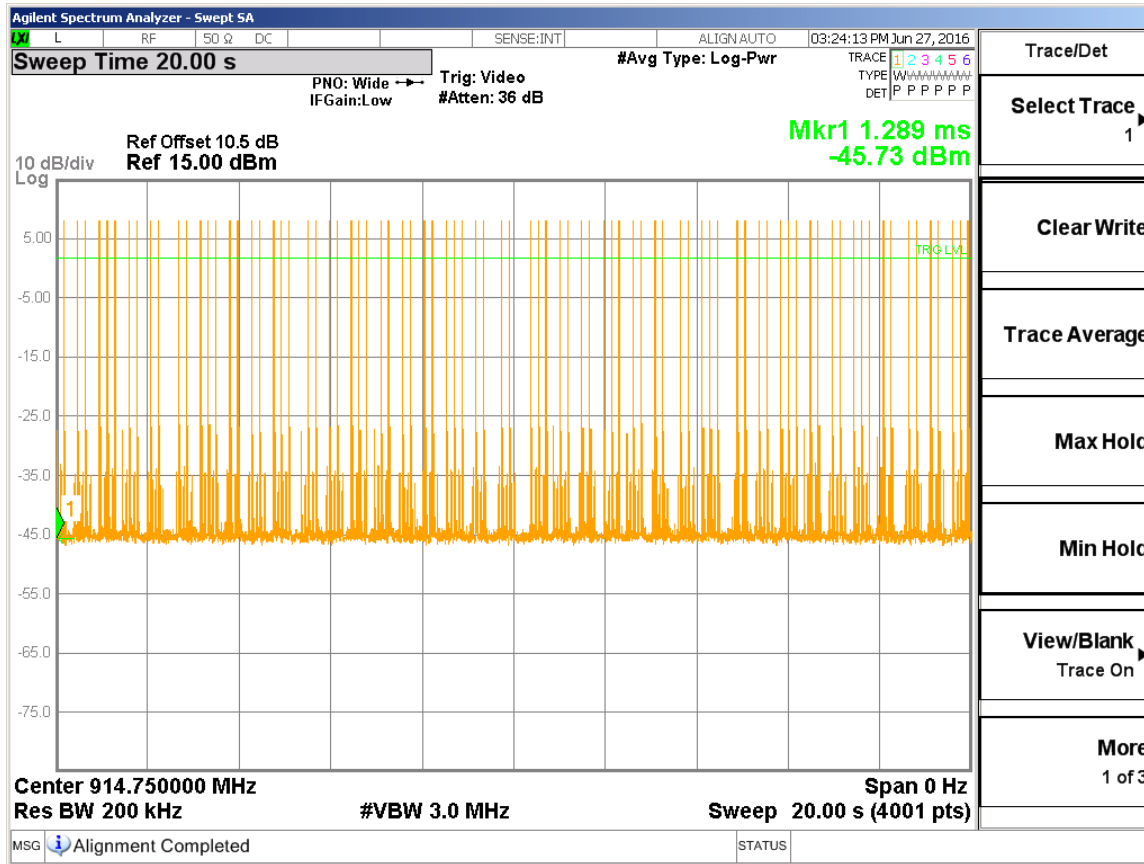
Number of Pulses in 20 seconds: 85

Total TX time in 20s: 110mS

PULSE WIDTH



NUMBER OF PULSES IN 20 SECONDS OBSERVATION PERIOD



8.3.5. OUTPUT POWER

LIMIT

§15.247 (b) (2)

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 15.247.

RSS-247 5.4 (1)

For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

TEST PROCEDURE

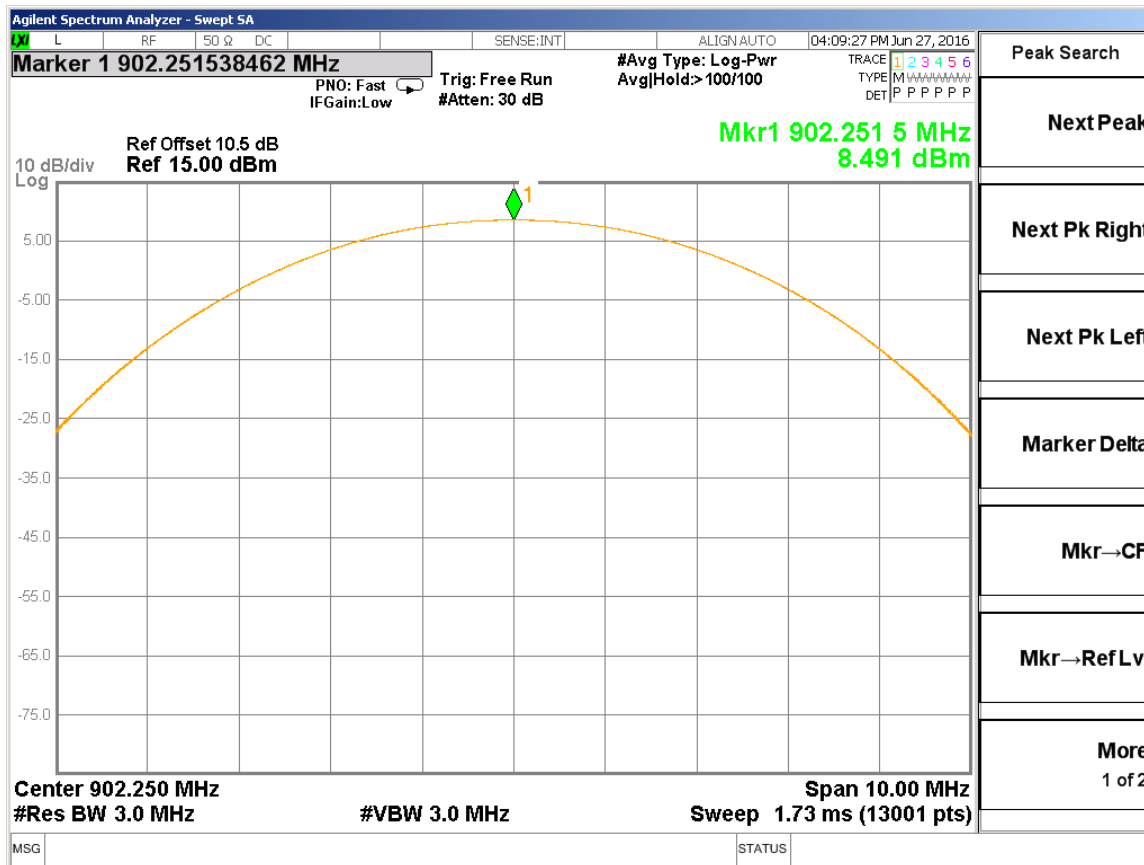
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

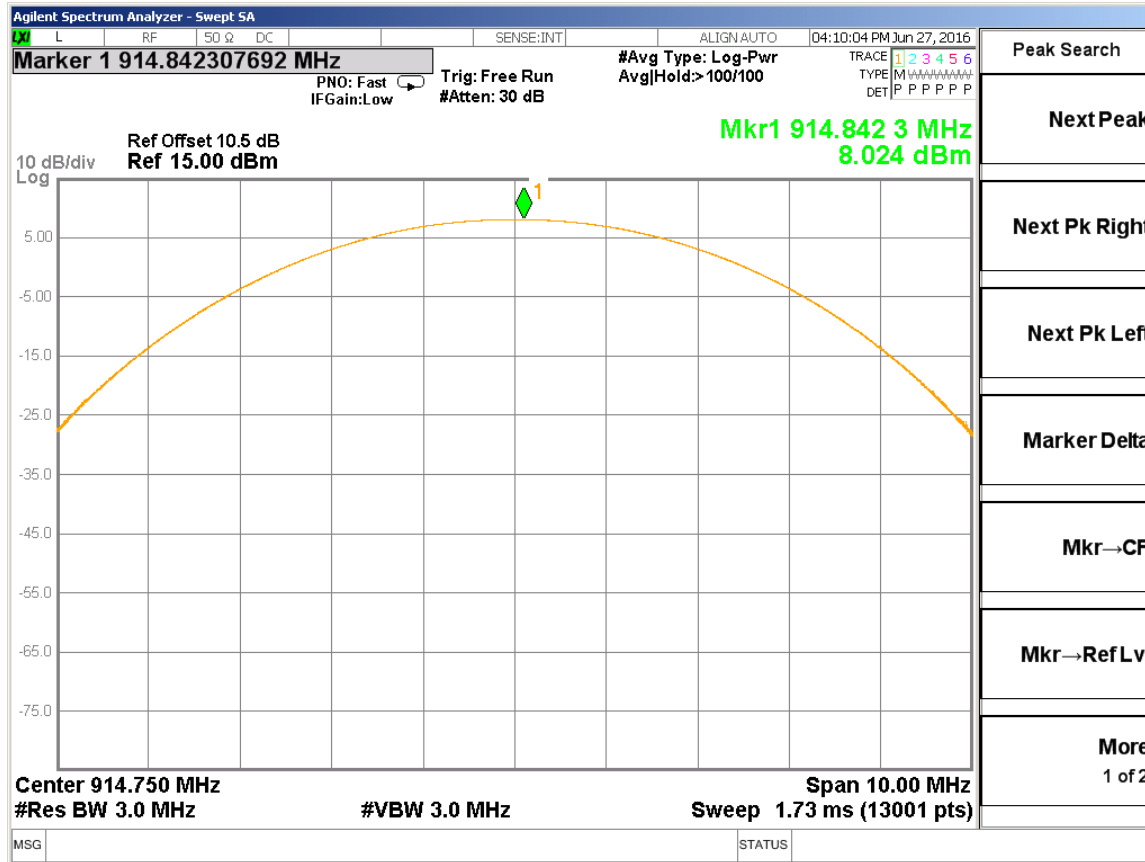
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.25	8.49	30	-21.51
Middle	914.75	8.02	30	-21.98
High	926.75	8.17	30	-21.83

OUTPUT POWER

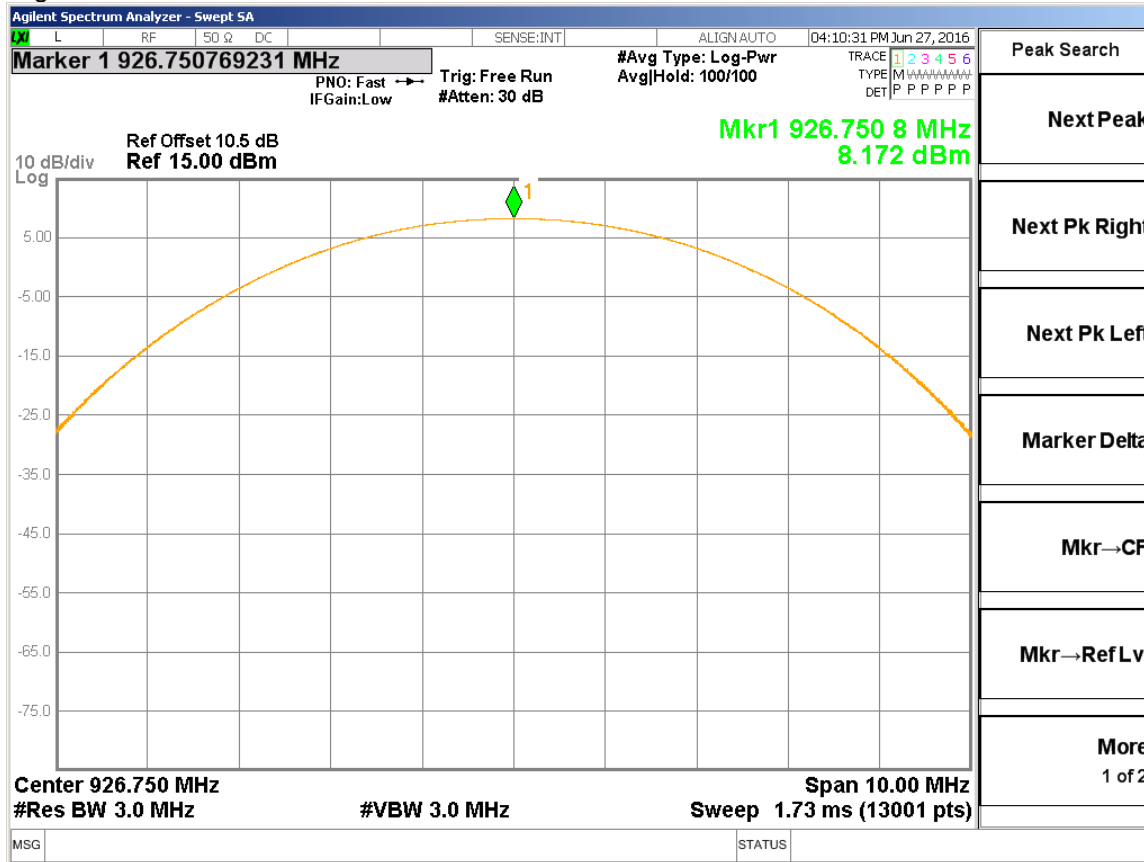
Low Channel



Middle Channel



High Channel



8.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

TEST PROCEDURE

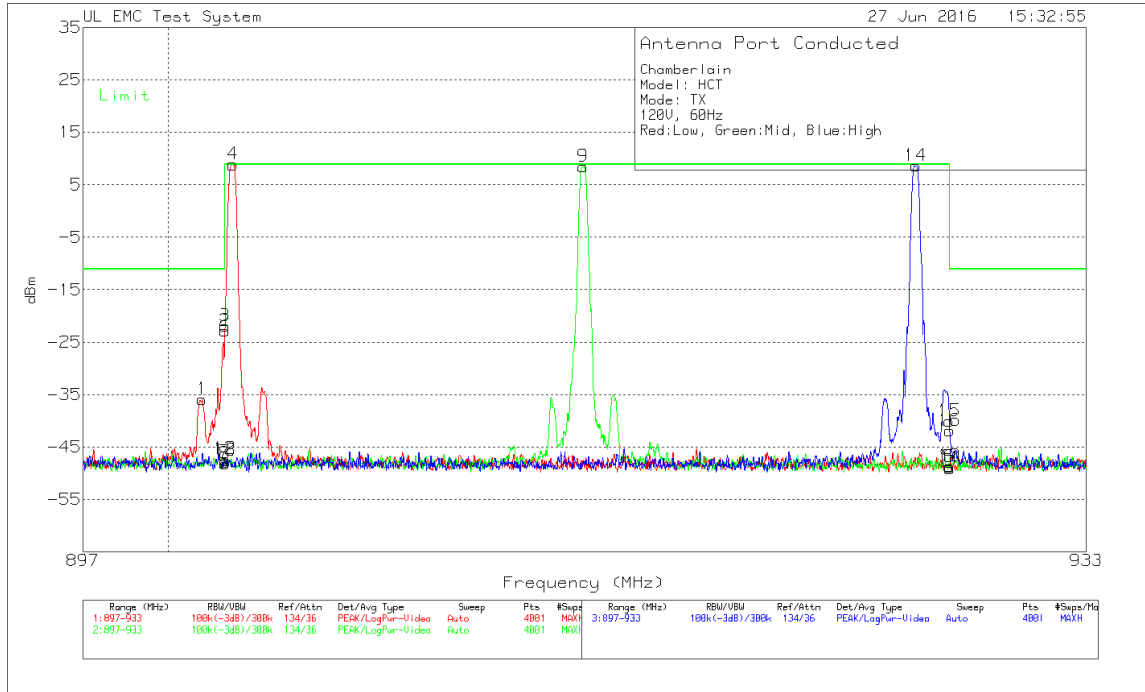
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 902 and 928 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

Low and High Bandedge Spurious



Chamberlain
 Model: HCT
 Mode: TX
 120V, 60Hz
 Red:Low, Green:Mid, Blue:High

Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading	Limit:1 dBm
=====						
Range 1: Low CH						
1	901.194	60.59dBuV Pk	-107	10.5	-35.91	-11.13
					Margin (dB)	-24.78
2	901.995	73.65dBuV Pk	-107	10.5	-22.85	-11.13
					Margin (dB)	-11.72
3	902.004	74.56dBuV Pk	-107	10.5	-21.94	8.87
					Margin (dB)	-30.81
4	902.2785	105.39dBuV Pk	-107	10.5	8.89	8.87
					Margin (dB)	.02
5	927.996	47.71dBuV Pk	-107	10.5	-48.79	8.87
					Margin (dB)	-57.66
6	928.005	47.69dBuV Pk	-107	10.5	-48.81	-11.13
					Margin (dB)	-37.68
Range 2: Mid CH						
7	901.995	48.56dBuV Pk	-107	10.5	-47.94	-11.13
					Margin (dB)	-36.81
8	902.004	48.28dBuV Pk	-107	10.5	-48.22	8.87
					Margin (dB)	-57.09
9	914.7705	104.97dBuV Pk	-107	10.5	8.47	8.87
					Margin (dB)	-.4
10	927.996	47.82dBuV Pk	-107	10.5	-48.68	8.87
					Margin (dB)	-57.55
11	928.005	47.38dBuV Pk	-107	10.5	-49.12	-11.13
					Margin (dB)	-37.99
Range 3: High CH						
12	901.995	49.25dBuV Pk	-107	10.5	-47.25	-11.13
					Margin (dB)	-36.12
13	902.004	48.91dBuV Pk	-107	10.5	-47.59	8.87
					Margin (dB)	-56.46
14	926.7765	105.11dBuV Pk	-107	10.5	8.61	8.87
					Margin (dB)	-.26
15	927.996	56.41dBuV Pk	-107	10.5	-40.09	8.87
					Margin (dB)	-48.96
16	928.005	54.63dBuV Pk	-107	10.5	-41.87	-11.13
					Margin (dB)	-30.74

LIMIT 1: Limit
 Pk - Peak detector

Hopping Band Edge Spurious

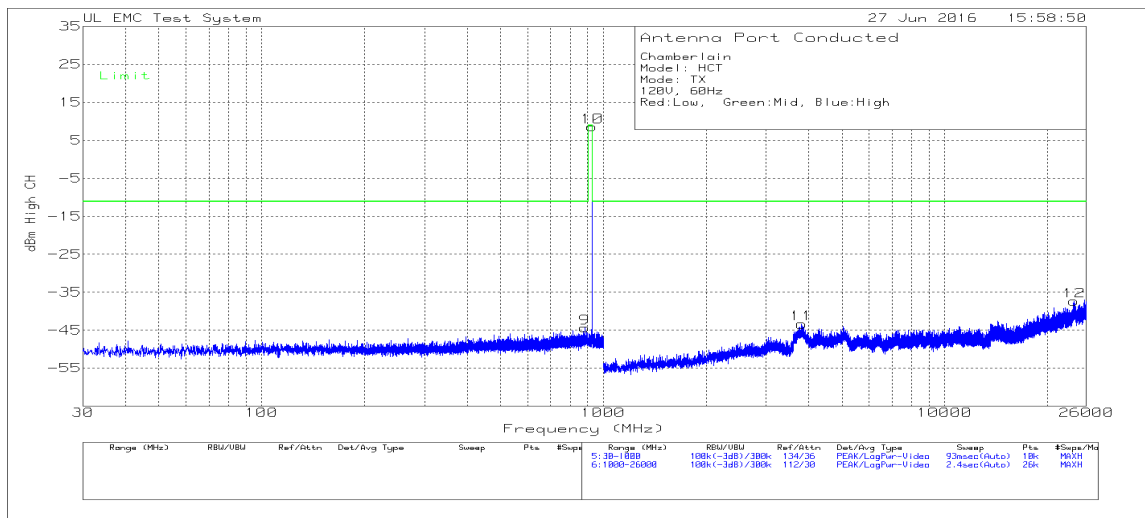
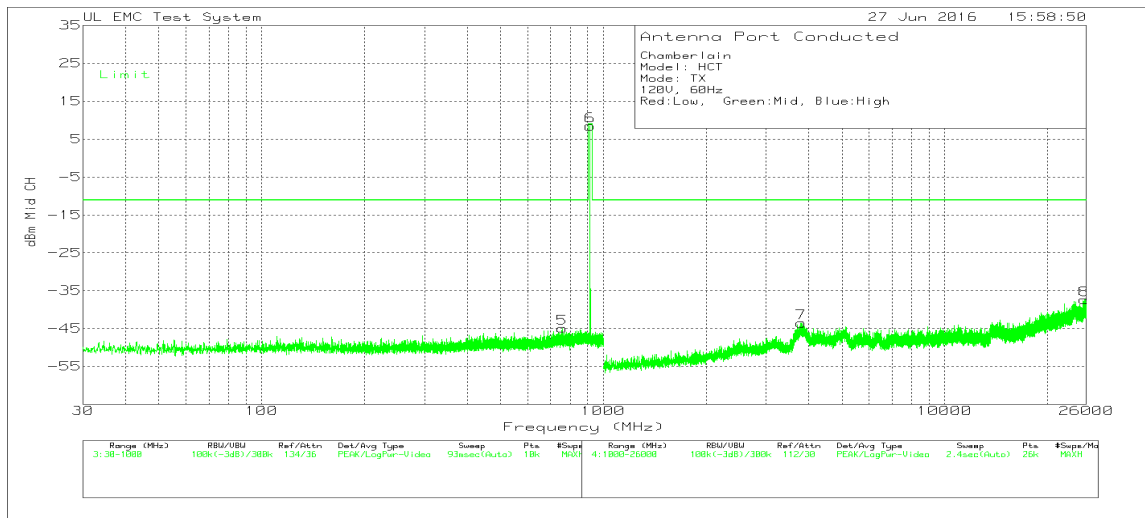
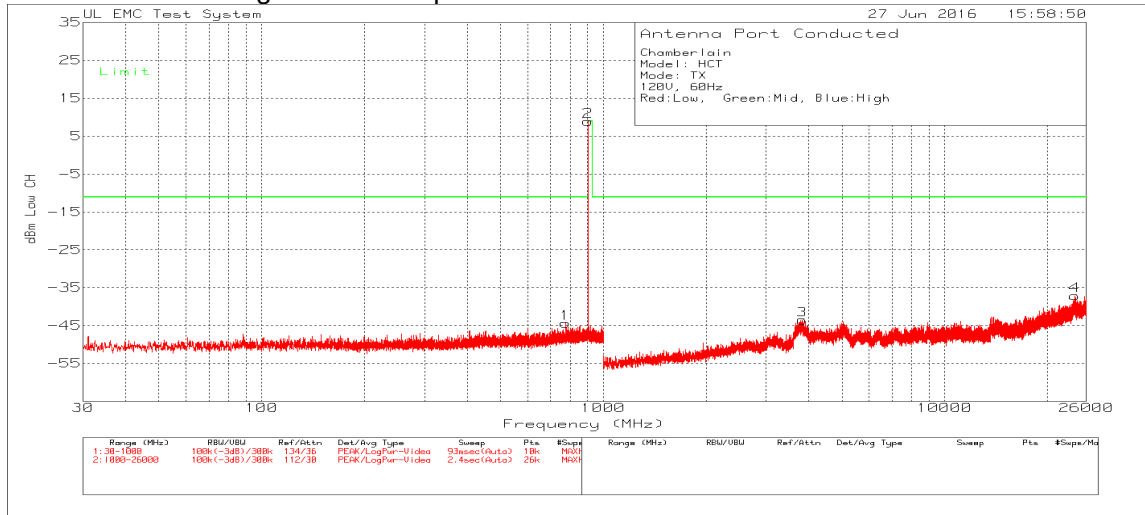


Chamberlain
 Model: HCT
 Mode: TX Hopping
 120V, 60Hz
 Red:Horizontal Green:Vertical

Trace Markers						
No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dBm	Limit:1
1	901.617	59.51dBuV Pk	-107	10.5	10.5	-36.99 -11.17
					Margin (dB)	-25.82
2	901.995	70.04dBuV Pk	-107	10.5	-26.46	-11.17
					Margin (dB)	-15.29
3	902.004	71.33dBuV Pk	-107	10.5	-25.17	8.83
					Margin (dB)	-34
4	902.2785	105.13dBuV Pk	-107	10.5	8.63	8.83
					Margin (dB)	-.2
5	926.709	104.81dBuV Pk	-107	10.5	8.31	8.83
					Margin (dB)	-.52
6	927.996	54.76dBuV Pk	-107	10.5	-41.74	8.83
					Margin (dB)	-50.57
7	928.005	53.32dBuV Pk	-107	10.5	-43.18	-11.17
					Margin (dB)	-32.01
8	931.236	51.03dBuV Pk	-107	10.5	-45.47	-11.17
					Margin (dB)	-34.3

LIMIT 1: Limit
 Pk - Peak detector

Low Middle and High Channel Spurious



Chamberlain
 Model: HCT
 Mode: TX
 120V, 60Hz
 Red:Low, Green:Mid, Blue:High

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dBm	Limit:1
=====						
Low CH						
1	774.96	52.14dBuV Pk	-107	10.5	-44.36	-11.13
					Margin (dB)	-33.23
2	902.2725	105.37dBuV Pk	-107	10.5	8.87	8.87
					Margin (dB)	0
3	3825.851	52.05dBuV Pk	-107	11.4	-43.55	-11.13
					Margin (dB)	-32.42
4	24019.295	55.08dBuV Pk	-107	14.8	-37.12	-11.13
					Margin (dB)	-25.99
Mid CH						
5	759.537	51.57dBuV Pk	-107	10.5	-44.93	-11.13
					Margin (dB)	-33.8
6	914.737	104.97dBuV Pk	-107	10.5	8.47	8.87
					Margin (dB)	-.4
7	3801.814	52.07dBuV Pk	-107	11.4	-43.53	-11.13
					Margin (dB)	-32.4
8	25649.04	54.92dBuV Pk	-107	14.7	-37.38	-11.13
					Margin (dB)	-26.25
High CH						
9	882.824	52.11dBuV Pk	-107	10.5	-44.39	-11.13
					Margin (dB)	-33.26
10	926.765	105.05dBuV Pk	-107	10.5	8.55	8.87
					Margin (dB)	-.32
11	3807.583	52.23dBuV Pk	-107	11.4	-43.37	-11.13
					Margin (dB)	-32.24
12	23871.224	54.85dBuV Pk	-107	14.8	-37.35	-11.13
					Margin (dB)	-26.22

LIMIT 1: Limit

Pk - Peak detector

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

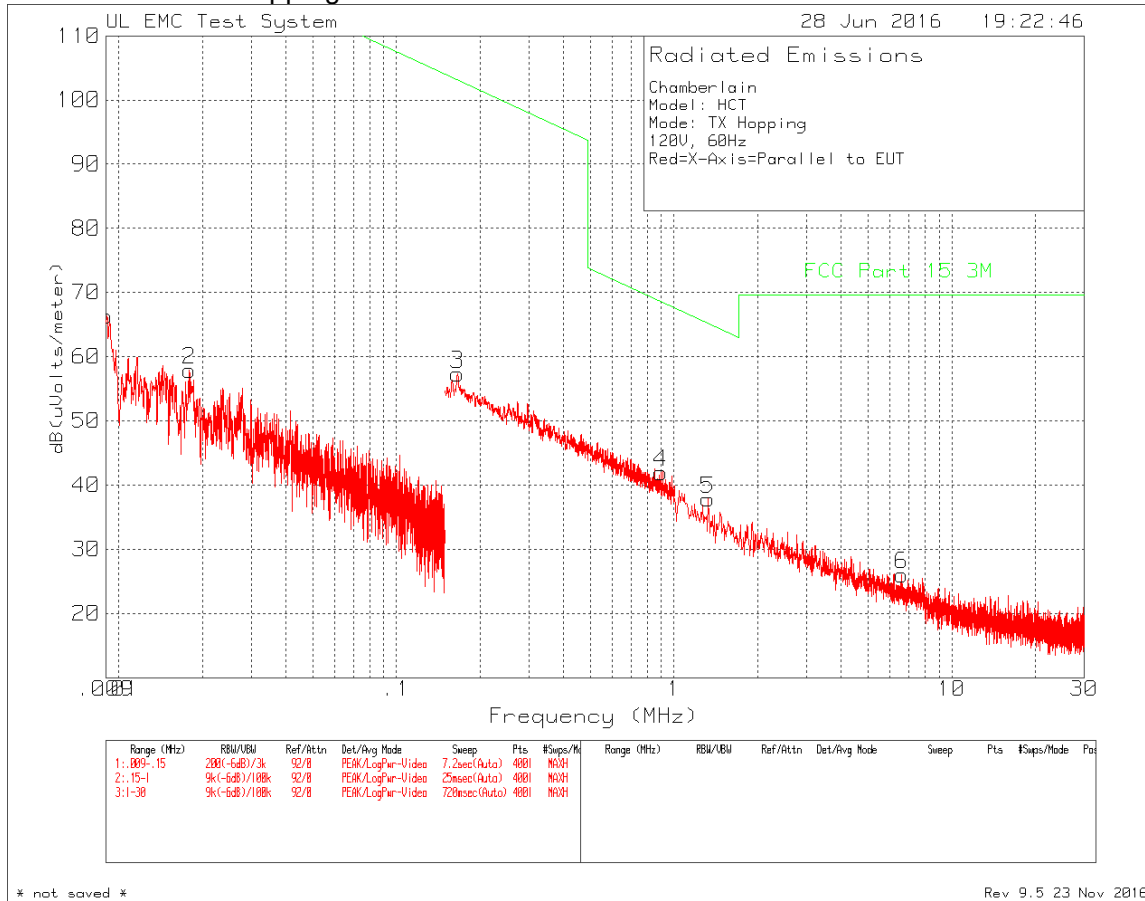
IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7.1.2 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

9.2. TRANSMITTER RADIATED SPURIOUS EMISSIONS

9kHz – 30MHz – Hopping Mode



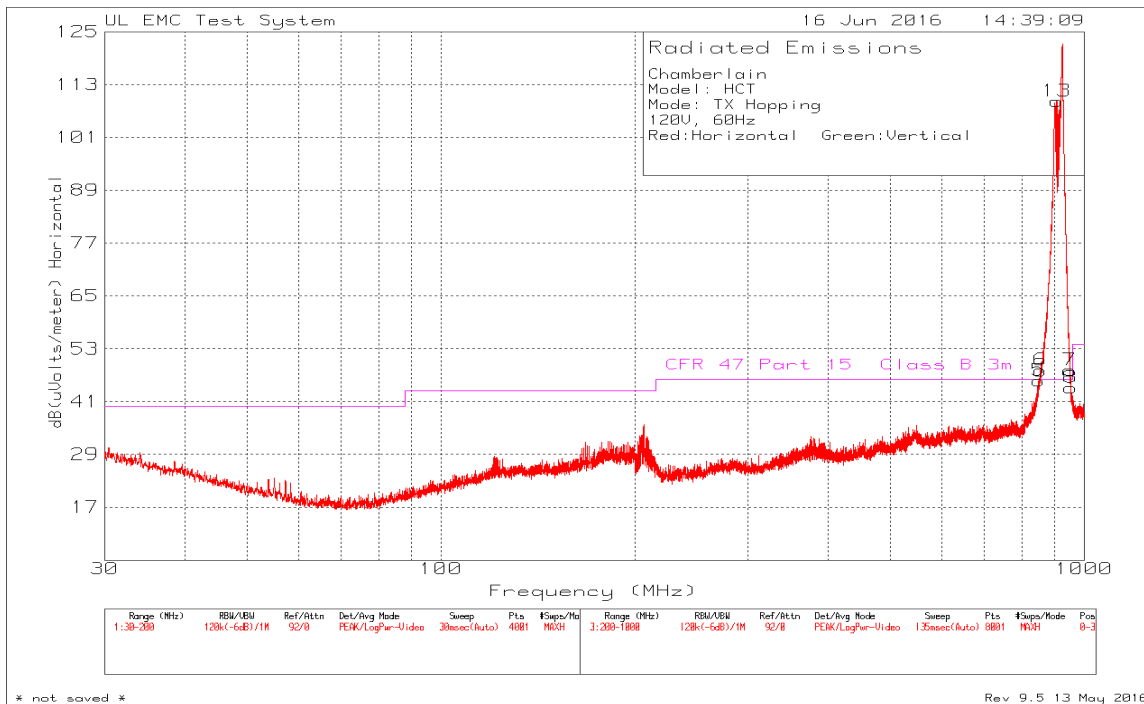
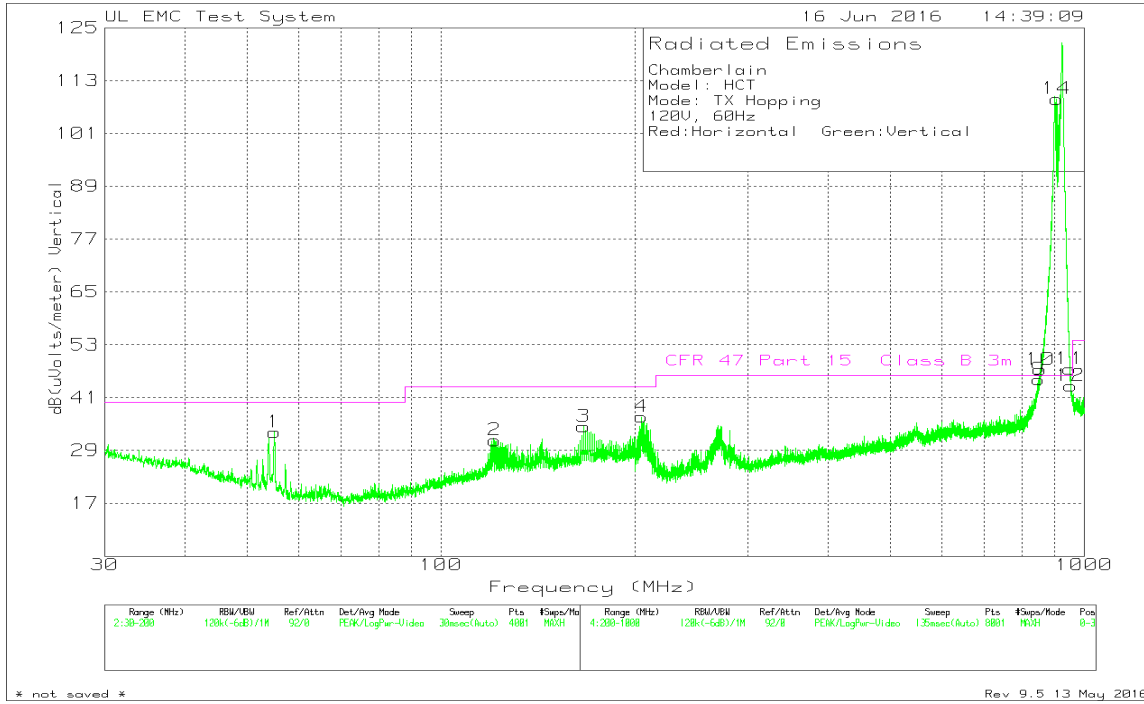
Chamberlain
 Model: HCT
 Mode: TX Hopping
 120V, 60Hz
 Red=X-Axis=Parallel to EUT

Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dB (uVolts/meter)	Limit:1
1	.00904	46.77dBuV Pk Azimuth:0-360	19.6	0	66.37 Margin (dB)	128.47 -62.1
2	.018	42.51dBuV Pk Azimuth:0-360	15.4	0	57.91 Margin (dB)	122.49 -64.58
3	.16598	45.71dBuV Pk Azimuth:0-360	11.6	0	57.31 Margin (dB)	103.2 -45.89
4	.89806	30.25dBuV Pk Azimuth:0-360	11.6	.1	41.95 Margin (dB)	68.54 -26.59
5	1.32625	26.1dBuV Pk Azimuth:0-360	11.6	.1	37.8 Margin (dB)	65.15 -27.35
6	6.60425	14.62dBuV Pk Azimuth:0-360	11.3	.1	26.02 Margin (dB)	69.54 -43.52

LIMIT 1: FCC Part 15 3M
 Pk - Peak detector

30MHz – 1000MHz – Hopping Mode

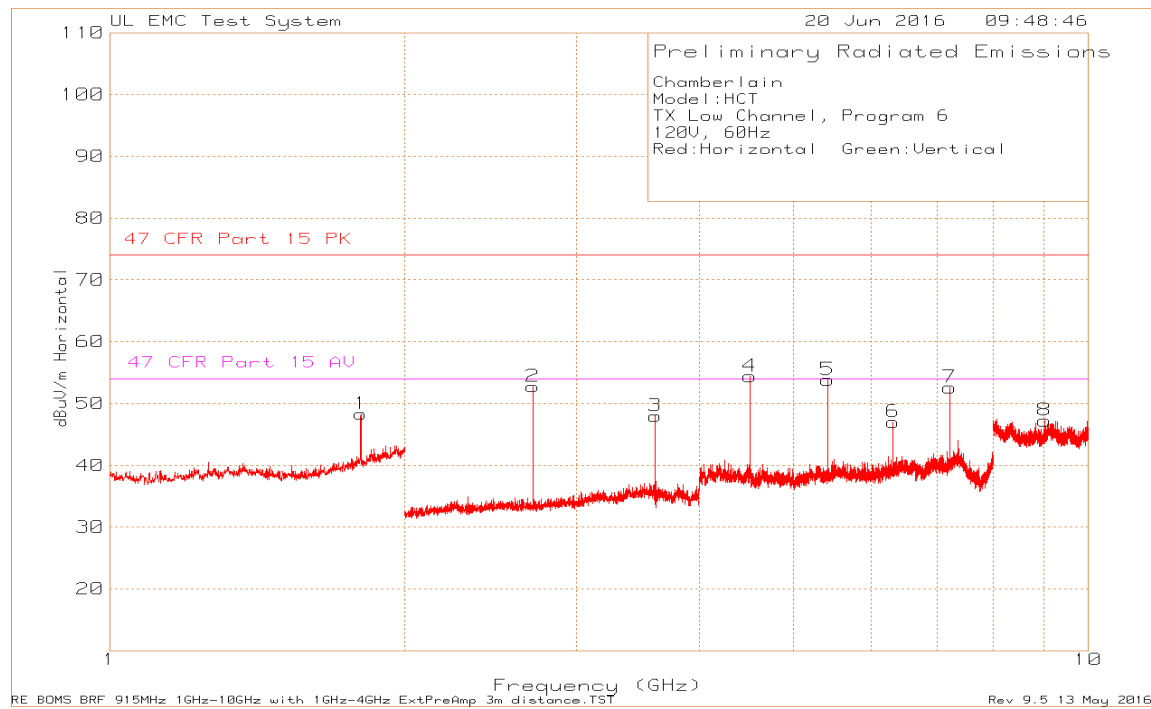
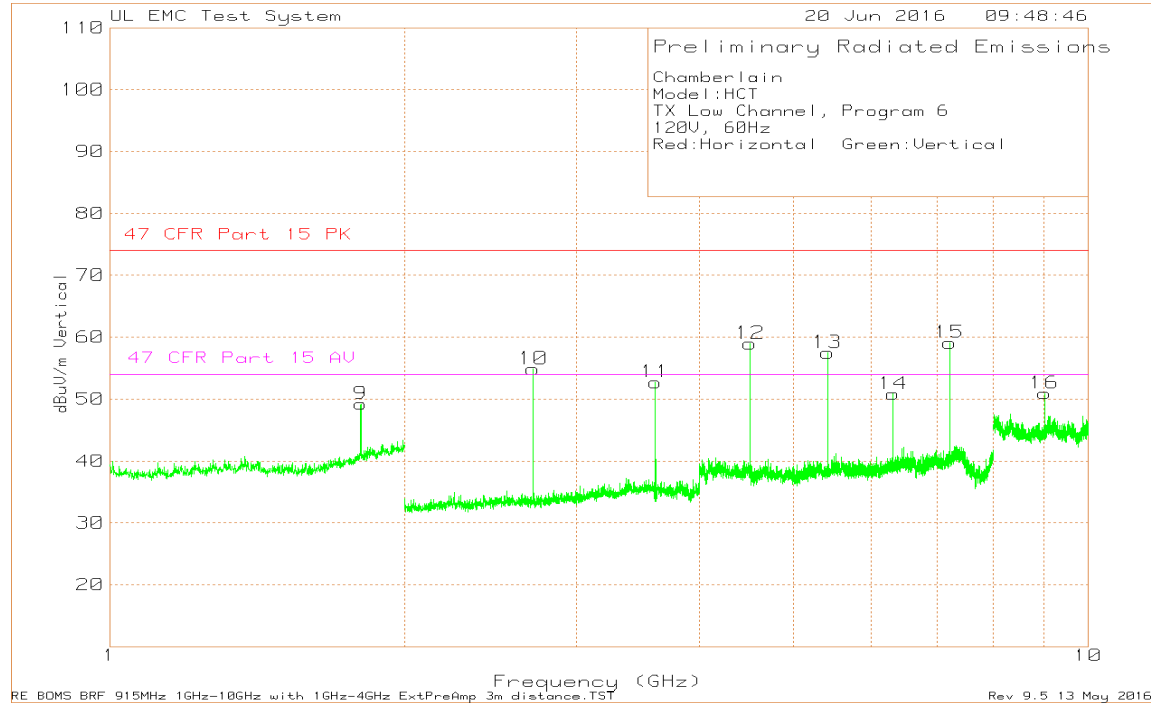


Chamberlain
 Model: HCT
 Mode: TX Hopping
 120V, 60Hz
 Red:Horizontal Green:Vertical
 Trace Markers

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	10m to 3m Factor dB	900MHz BRF Factor dB	Level dBuV/m	Limit 47 CFR part 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	55.075	44.36	Pk	8.3	-30	10.5	-	33.16	-	-	0-360	251	V
2	121.205	37.19	Pk	13.3	-29.7	10.5	-	31.29	-	-	0-360	101	V
3	166.6375	38.13	Pk	15.2	-29.4	10.5	-	34.43	-	-	0-360	101	V
5	849.5	29.96	Pk	22.8	-27.7	10.5	10.2	45.76	-	-	0-360	299	H
6	854.7	29.78	Pk	22.5	-27.8	10.5	13.1	48.08	-	-	0-360	100	H
7	950	30.48	Pk	23.5	-27.4	10.5	11	48.08	-	-	0-360	299	H
8	953.1	30.24	Pk	23.5	-27.2	10.5	7.1	44.14	-	-	0-360	299	H
13	906.3	46.62	Pk	23	-27.7	10.5	56.8	109.22	-	-	0-360	100	H
4	205	44.15	Pk	11.3	-29.4	10.5	0.1	36.65	-	-	0-360	99	V
9	849.4	30.01	Pk	22.1	-27.7	10.5	10.2	45.11	-	-	0-360	399	V
10	854.2	29.97	Pk	21.8	-27.7	10.5	12.8	47.37	-	-	0-360	399	V
11	950.2	30.7	Pk	23	-27.4	10.5	10.7	47.5	-	-	0-360	202	V
12	952.9	29.89	Pk	23.2	-27.2	10.5	7.3	43.69	-	-	0-360	202	V
14	906.3	46.09	Pk	23.1	-27.7	10.5	56.8	108.79	-	-	0-360	298	V

No emissions close to limit were recorded in restricted bands.
 Pk - Peak detector

1GHz – 10GHz, Low channel



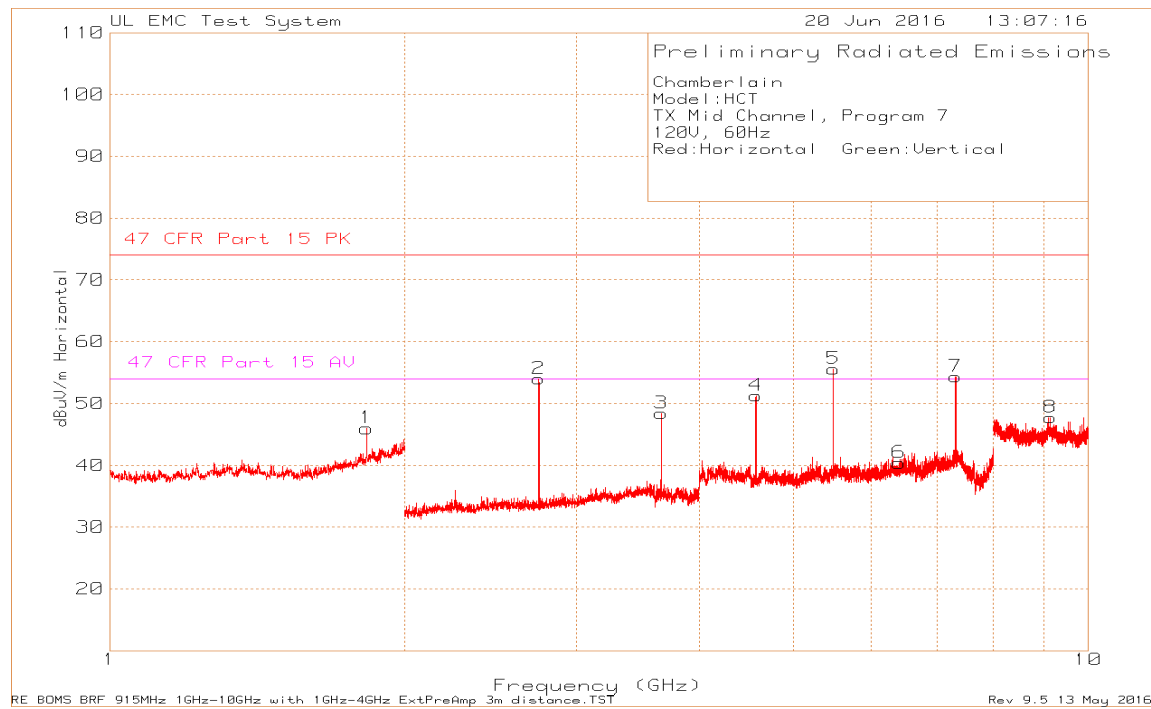
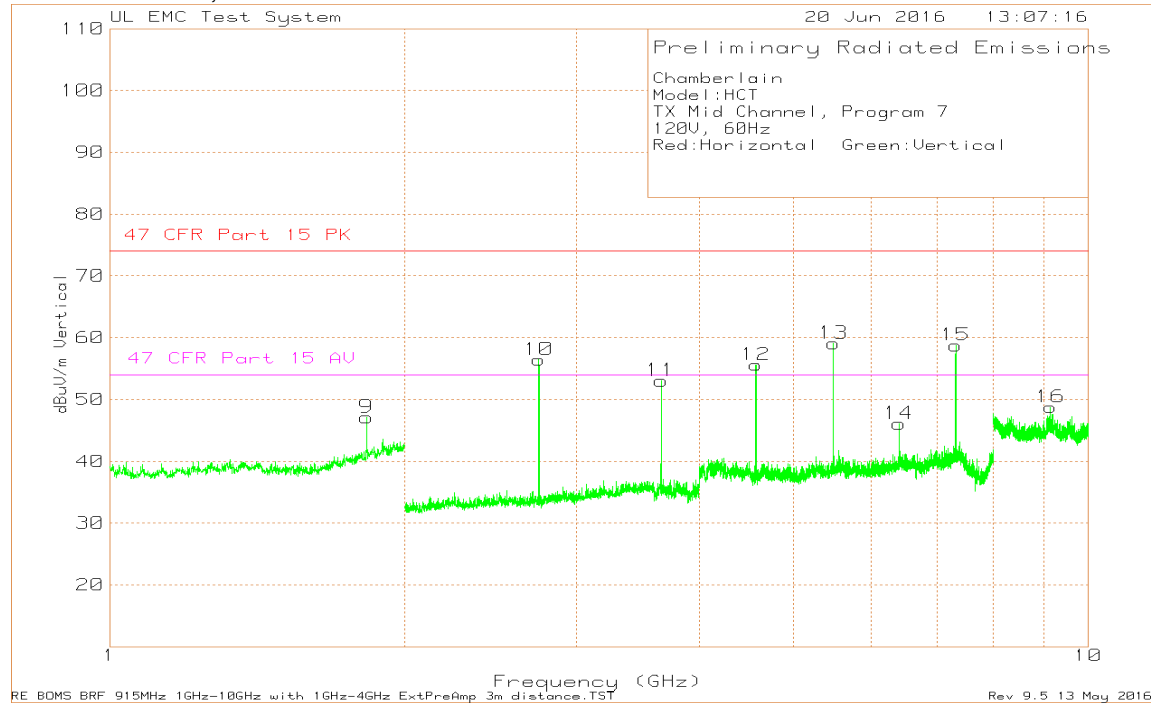
Chamberlain
 Model:HCT
 TX Low Channel, Program 6
 120V, 60Hz
 Red:Horizontal Green:Vertical
 Trace Markers

Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Peak Level dBuV/m	47 CFR Part 15 PK	Margin (dB)	Hopping Duty Cycle Factor dB	Level with Duty Cycle Factor dBuV/m	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.805	72.51	Pk	30.3	0.4	-54.88	48.33	74	-25.67	-37.7	10.63	54	-43.37	0-360	100	H
2	2.706	81.6	Pk	22.1	-	-50.94	52.76	74	-21.24	-37.7	15.06	54	-38.94	0-360	150	H
3	3.609	75.14	Pk	23.2	-	-50.34	48	74	-26	-37.7	10.3	54	-43.7	0-360	150	H
4	4.511	78.46	Pk	27.8	-	-51.86	54.4	74	-19.6	-37.7	16.7	54	-37.3	0-360	150	H
5	5.414	76.19	Pk	27.9	-	-50.26	53.83	74	-20.17	-37.7	16.13	54	-37.87	0-360	150	H
6	6.317	65.58	Pk	29.2	-	-47.74	47.04	74	-26.96	-37.7	9.34	54	-44.66	0-360	150	H
7	7.218	69.16	Pk	29.8	-	-46.35	52.61	74	-21.39	-37.7	14.91	54	-39.09	0-360	150	H
8	9.022	60.93	Pk	36.1	-	-49.78	47.25	74	-26.75	-37.7	9.55	54	-44.45	0-360	150	H
9	1.805	73.41	Pk	30.3	0.4	-54.88	49.23	74	-24.77	-37.7	11.53	54	-42.47	0-360	150	V
10	2.7066	86.33	Pk	22.1	-	-50.94	57.49	74	-16.51	-37.7	19.79	54	-34.21	352	156	V
11	3.6095	79.86	Pk	23.2	-	-50.33	52.73	74	-21.27	-37.7	15.03	54	-38.97	0-360	99	V
12	4.5111	83.38	Pk	27.8	-	-51.86	59.32	74	-14.68	-37.7	21.62	54	-32.38	352	198	V
13	5.4131	80.6	Pk	27.9	-	-50.26	58.24	74	-15.76	-37.7	20.54	54	-33.46	67	140	V
14	6.316	69.39	Pk	29.2	-	-47.74	50.85	74	-23.15	-37.7	13.15	54	-40.85	0-360	100	V
15	7.218	75.65	Pk	29.8	-	-46.35	59.1	74	-14.9	-37.7	21.4	54	-32.6	0-360	150	V
16	9.022	64.61	Pk	36.1	-	-49.78	50.93	74	-23.07	-37.7	13.23	54	-40.77	0-360	99	V

Pk - Peak detector

Average measurements were not conducted, however per DA 00-705 duty cycle factor was measured and it was added to peak level. Because of duty cycle factor is larger than the average to peak limit delta and since all peaks are under the peak limit the device is deemed to comply without any further measurements.

1GHz – 10GHz, Middle channel



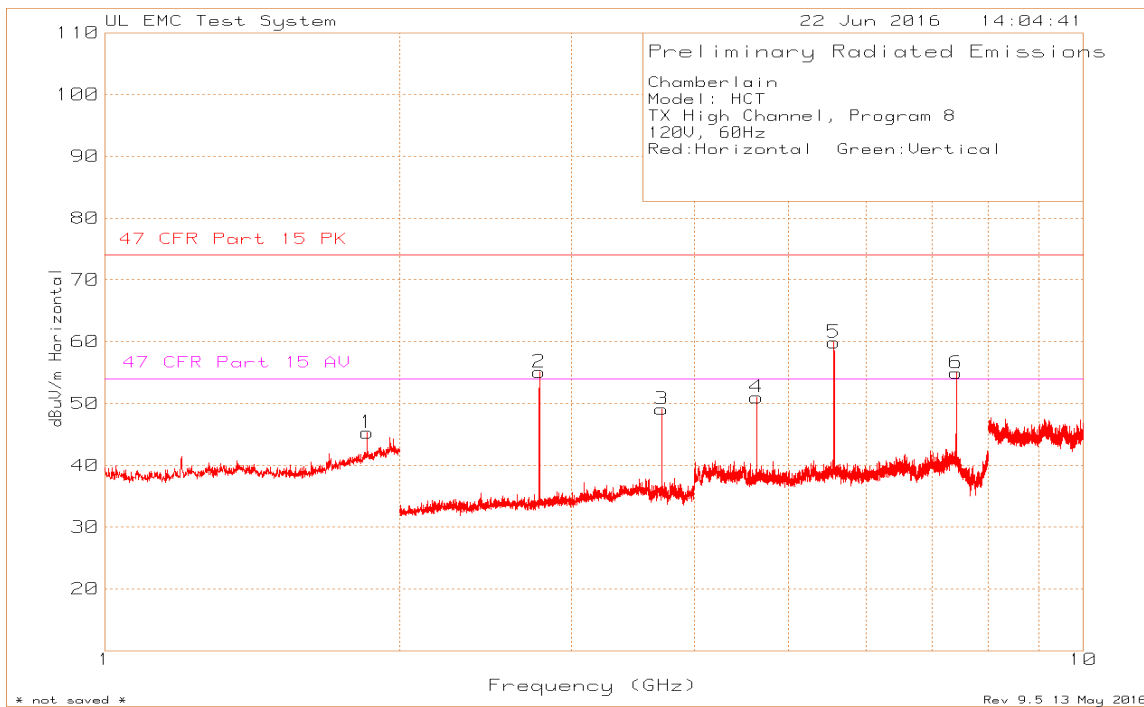
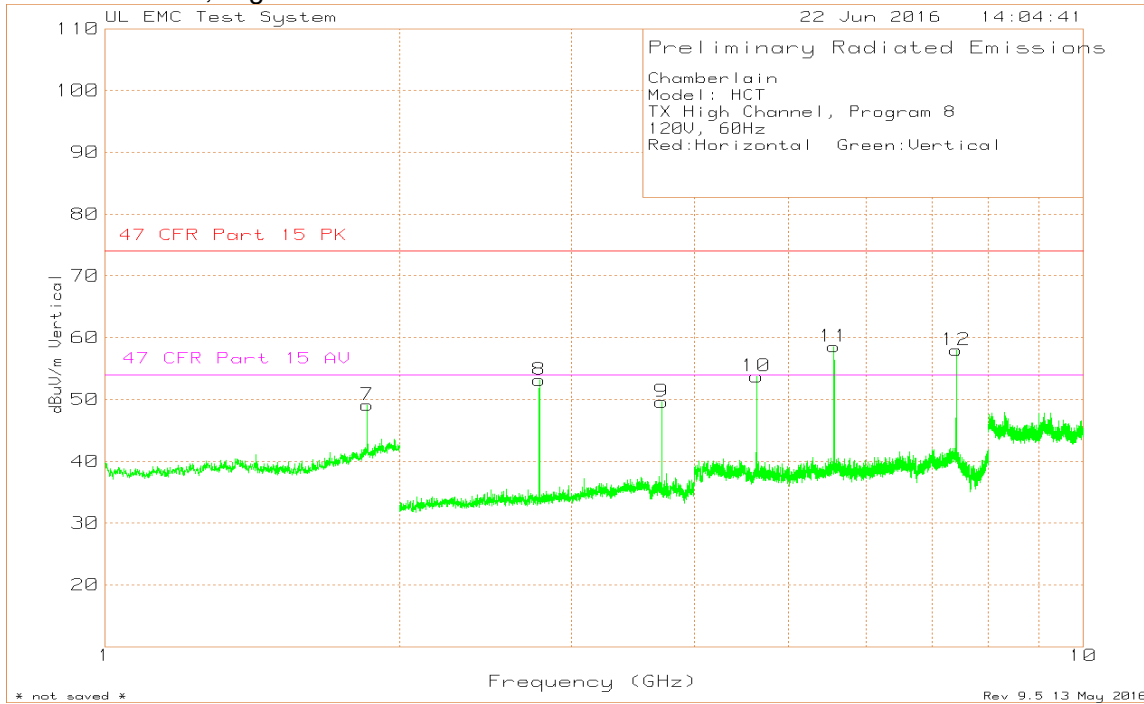
Chamberlain
 Model:HCT
 TX Mid Channel, Program 7
 120V, 60Hz
 Red:Horizontal Green:Vertical
 Trace Markers

Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Peak Level dBuV/m	47 CFR Part 15 PK	Margin (dB)	Hopping Duty Cycle Factor dB	Level with Duty Cycle Factor dBuV/m	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.83	69.75	Pk	30.5	0.4	-54.66	45.99	74	-28.01	-37.7	8.29	54	-45.71	0-360	150	H
2	2.744	82.8	Pk	-	22.1	-50.89	54.01	74	-19.99	-37.7	16.31	54	-37.69	0-360	150	H
3	3.659	74.44	Pk	-	23.4	-49.39	48.45	74	-25.55	-37.7	10.75	54	-43.25	0-360	100	H
4	4.574	75.46	Pk	-	27.7	-51.86	51.3	74	-22.7	-37.7	13.6	54	-40.4	0-360	150	H
5	5.489	77.54	Pk	-	28.1	-50.04	55.6	74	-18.4	-37.7	17.9	54	-36.1	0-360	150	H
6	6.404	58.89	Pk	-	29.2	-47.67	40.42	74	-33.58	-37.7	2.72	54	-51.28	0-360	150	H
7	7.318	69.77	Pk	-	30.6	-46.01	54.36	74	-19.64	-37.7	16.66	54	-37.34	0-360	150	H
8	9.147	59.82	Pk	-	36.3	-48.38	47.74	74	-26.26	-37.7	10.04	54	-43.96	0-360	99	H
9	1.83	70.87	Pk	30.5	0.4	-54.66	47.11	74	-26.89	-37.7	9.41	54	-44.59	0-360	100	V
10	2.744	84.85	Pk	-	22.1	-50.89	56.06	74	-17.94	-37.7	18.36	54	-35.64	352	128	V
11	3.659	79.03	Pk	-	23.4	-49.39	53.04	74	-20.96	-37.7	15.34	54	-38.66	0-360	99	V
12	4.5738	80.59	Pk	-	27.7	-51.86	56.43	74	-17.57	-37.7	18.73	54	-35.27	356	112	V
13	5.489	81.01	Pk	-	28.1	-50.04	59.07	74	-14.93	-37.7	21.37	54	-32.63	0-360	150	V
14	6.403	64.56	Pk	-	29.2	-47.68	46.08	74	-27.92	-37.7	8.38	54	-45.62	0-360	100	V
15	7.3175	74.22	Pk	-	30.6	-46.01	58.81	74	-15.19	-37.7	21.11	54	-32.89	91	128	V
16	9.148	60.85	Pk	-	36.3	-48.38	48.77	74	-25.23	-37.7	11.07	54	-42.93	0-360	150	V

Pk - Peak detector

Average measurements were not conducted, however per DA 00-705 duty cycle factor was measured and it was added to peak level. Because of duty cycle factor is larger than the average to peak limit delta and since all peaks are under the peak limit the device is deemed to comply without any further measurements.

1GHz – 10GHz, High channel



Chamberlain
 Model: HCT
 TX High Channel, Program 8
 120V, 60Hz
 Red:Horizontal Green:Vertical
 Trace Markers

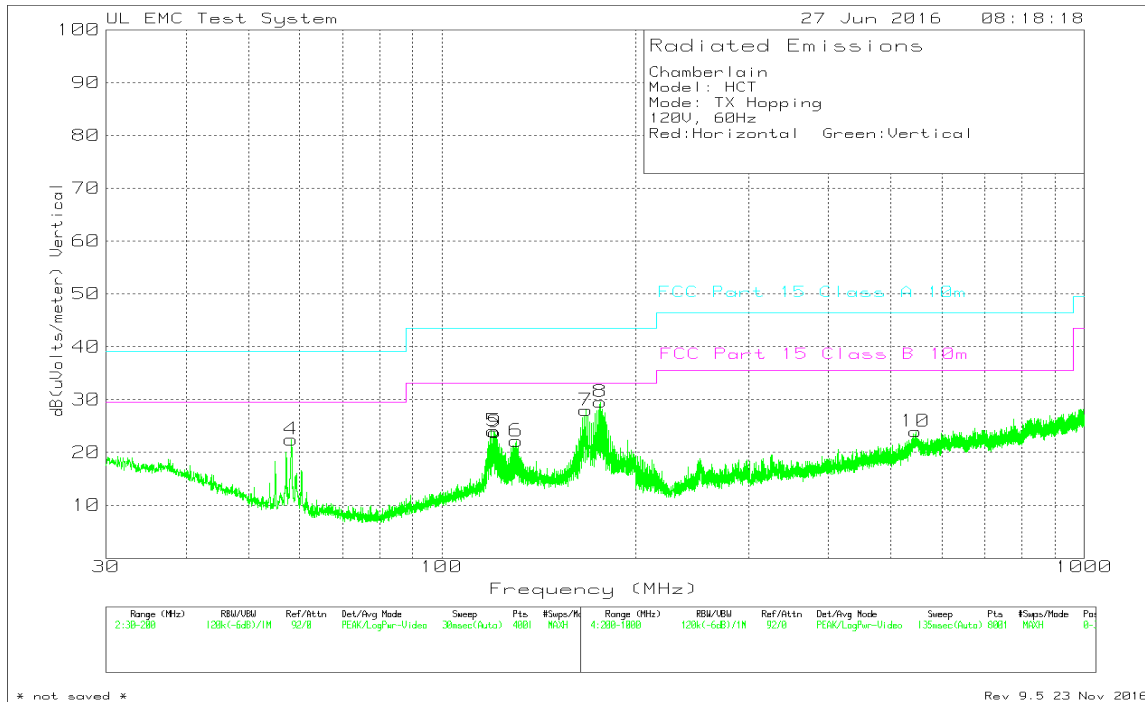
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Peak Level dBuV/m	47 CFR PK	Margin (dB)	Hopping Duty Cycle dB	Level with Duty Cycle Factor dBuV/m	47 CFR AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.854	68.83	Pk	30.7	0.4	-54.65	45.28	74	-28.72	-37.7	7.58	54	-46.42	0-360	100	H
2	2.7801	83.95	Pk	22.2	-	-50.73	55.42	74	-18.58	-37.7	17.72	54	-36.28	119	112	H
3	3.707	75.2	Pk	23.5	-	-49.6	49.1	74	-24.9	-37.7	11.4	54	-42.6	0-360	100	H
4	4.634	75.04	Pk	27.7	-	-51.73	51.01	74	-22.99	-37.7	13.31	54	-40.69	0-360	150	H
5	5.561	81.05	Pk	28.3	-	-49.47	59.88	74	-14.12	-37.7	22.18	54	-31.82	0-360	150	H
6	7.4135	72.41	Pk	31	-	-47.18	56.23	74	-17.77	-37.7	18.53	54	-35.47	274	103	H
7	1.854	72.67	Pk	30.7	0.4	-54.65	49.12	74	-24.88	-37.7	11.42	54	-42.58	0-360	150	V
8	2.78	81.72	Pk	22.2	-	-50.73	53.19	74	-20.81	-37.7	15.49	54	-38.51	0-360	150	V
9	3.707	75.74	Pk	23.5	-	-49.6	49.64	74	-24.36	-37.7	11.94	54	-42.06	0-360	100	V
10	4.634	77.78	Pk	27.7	-	-51.73	53.75	74	-20.25	-37.7	16.05	54	-37.95	0-360	150	V
11	5.561	79.74	Pk	28.3	-	-49.47	58.57	74	-15.43	-37.7	20.87	54	-33.13	0-360	100	V
12	7.4135	74.3	Pk	31	-	-47.18	58.12	74	-15.88	-37.7	20.42	54	-33.58	246	100	V

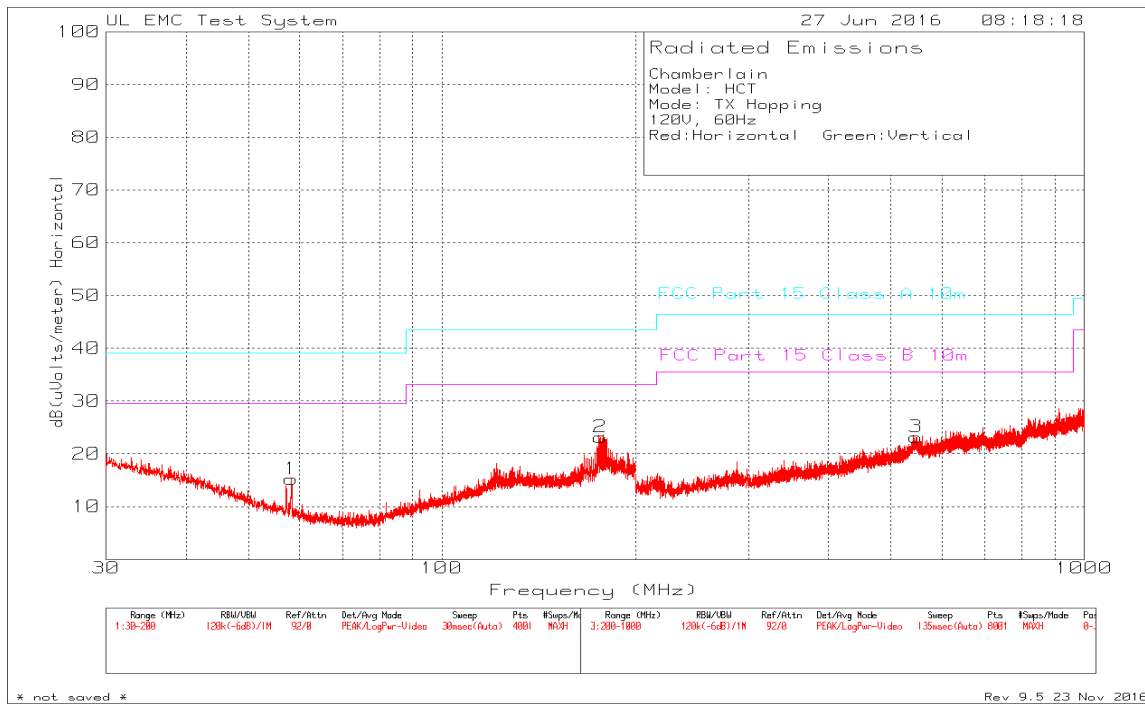
Pk - Peak detector

Average measurements were not conducted, however per DA 00-705 duty cycle factor was measured and it was added to peak level. Because of duty cycle factor is larger than the average to peak limit delta and since all peaks are under the peak limit the device is deemed to comply without any further measurements.

9.3. DIGITAL DEVICE EMISSIONS

30MHz – 1GHz



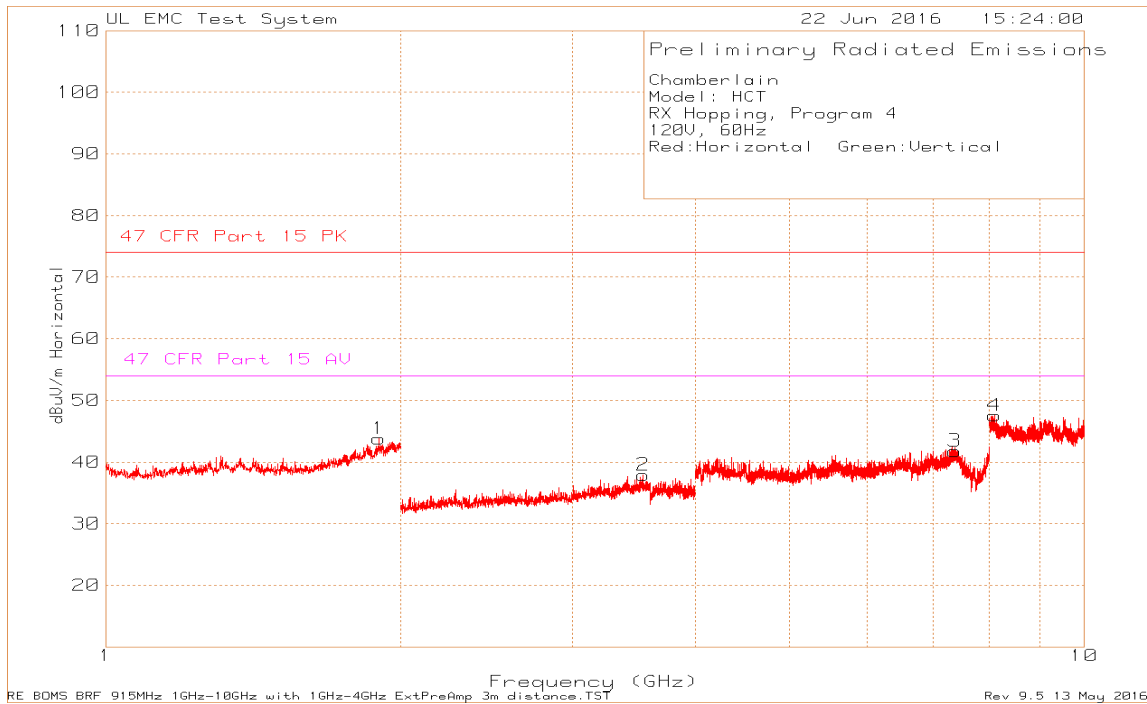
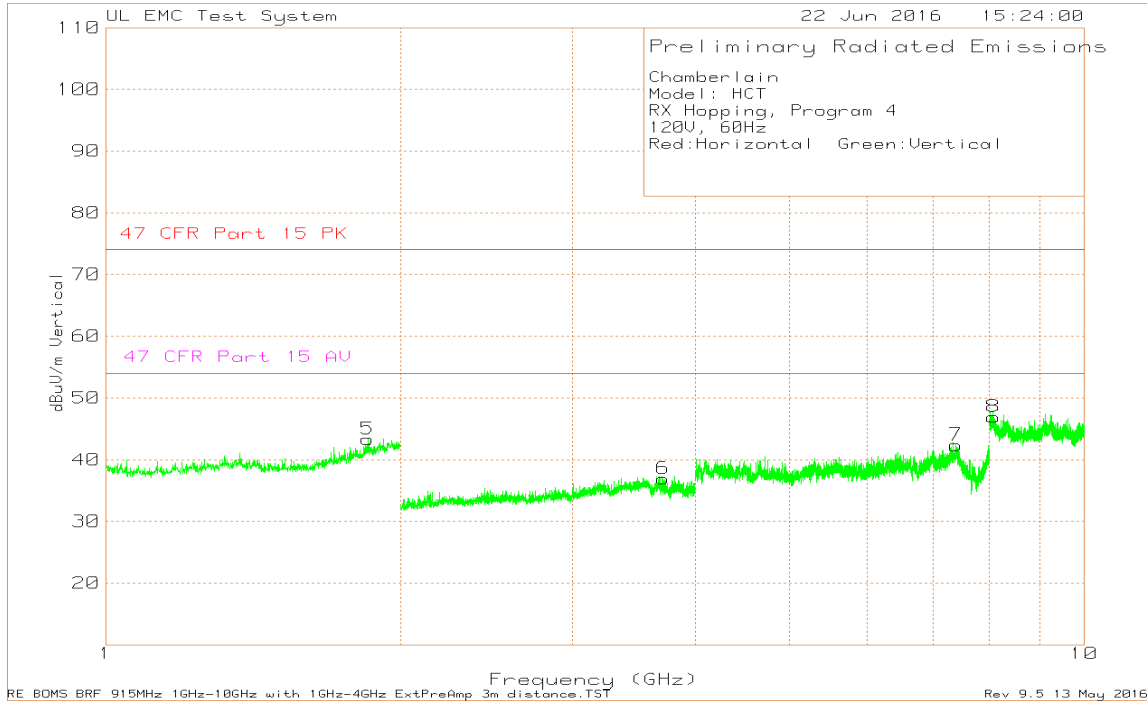


* plots are mislabeled and mode should be labeled as RX Hopping

Chamberlain											
Model: HCT											
Mode: TX Hopping											
120V, 60Hz											
Red:Horizontal Green:Vertical											
Trace Markers											
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC Part 15 Class B 10m dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	58.305	37.7	Pk	7.5	-30	15.2	29.55	-14.35	0-360	398	H
2	176.54	37.25	Pk	15.2	-29.3	23.15	33.07	-9.92	0-360	248	H
4	58.2625	44.96	Pk	7.5	-30	22.46	29.55	-7.09	0-360	251	V
5	120.4825	40.47	Pk	13.3	-29.7	24.07	33.07	-9	0-360	101	V
6	130.47	37.76	Pk	14.1	-29.7	22.16	33.07	-10.91	0-360	101	V
7	167.5725	42.49	Pk	14.9	-29.4	27.99	33.07	-5.08	0-360	101	V
8	176.455	43.77	Pk	15.1	-29.3	29.57	33.07	-3.5	0-360	101	V
9	120.95	40.14	Pk	13.4	-29.7	23.84	33.07	-9.23	0-360	101	V
3	546.4	30.78	Pk	20	-27.6	23.18	35.57	-12.39	0-360	399	H
10	546.3	31.58	Pk	20	-27.6	23.98	35.57	-11.59	0-360	399	V
Pk - Peak detector											
Radiated Emission Data											
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC Part 15 Class B 10m dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	
167.4418	41.95	Qp	14.9	-29.4	27.45	33.07	-5.62	304	102	V	
176.2	41.7	Qp	15.1	-29.3	27.5	33.07	-5.57	48	101	V	
Qp - Quasi-Peak detector											

* plots are mislabeled and mode should be labeled as RX Hopping

1GHz - 10GHz



Chamberlain
 Model: HCT
 RX Hopping, Program 4
 120V, 60Hz
 Red:Horizontal Green:Vertical

Trace Markers

No.	Test Frequency (GHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dBuV/m	Limit:1	2
1	1.901	66.77dBuV Pk	31.2	-54.19	43.78	74	54
		Azimuth:0-360	Height:99	Horz	Margin (dB)	-30.22	-10.22
2	3.542	64.63dBuV Pk	23.4	-50.15	37.88	74	54
		Azimuth:0-360	Height:150	Horz	Margin (dB)	-36.12	-16.12
3	7.375	57.3dBuV Pk	31	-46.55	41.75	74	54
		Azimuth:0-360	Height:150	Horz	Margin (dB)	-32.25	-12.25
4	8.098	58.6dBuV Pk	36.2	-47.26	47.54	74	54
		Azimuth:0-360	Height:150	Horz	Margin (dB)	-26.46	-6.46
5	1.852	66.76dBuV Pk	30.7	-54.14	43.32	74	54
		Azimuth:0-360	Height:150	Vert	Margin (dB)	-30.68	-10.68
6	3.711	63.03dBuV Pk	23.6	-49.71	36.92	74	54
		Azimuth:0-360	Height:150	Vert	Margin (dB)	-37.08	-17.08
7	7.393	58.21dBuV Pk	31.1	-47	42.31	74	54
		Azimuth:0-360	Height:100	Vert	Margin (dB)	-31.69	-11.69
8	8.078	57.6dBuV Pk	36.2	-46.87	46.93	74	54
		Azimuth:0-360	Height:100	Vert	Margin (dB)	-27.07	-7.07

LIMIT 1: 47 CFR Part 15 PK
 LIMIT 2: 47 CFR Part 15 AV

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

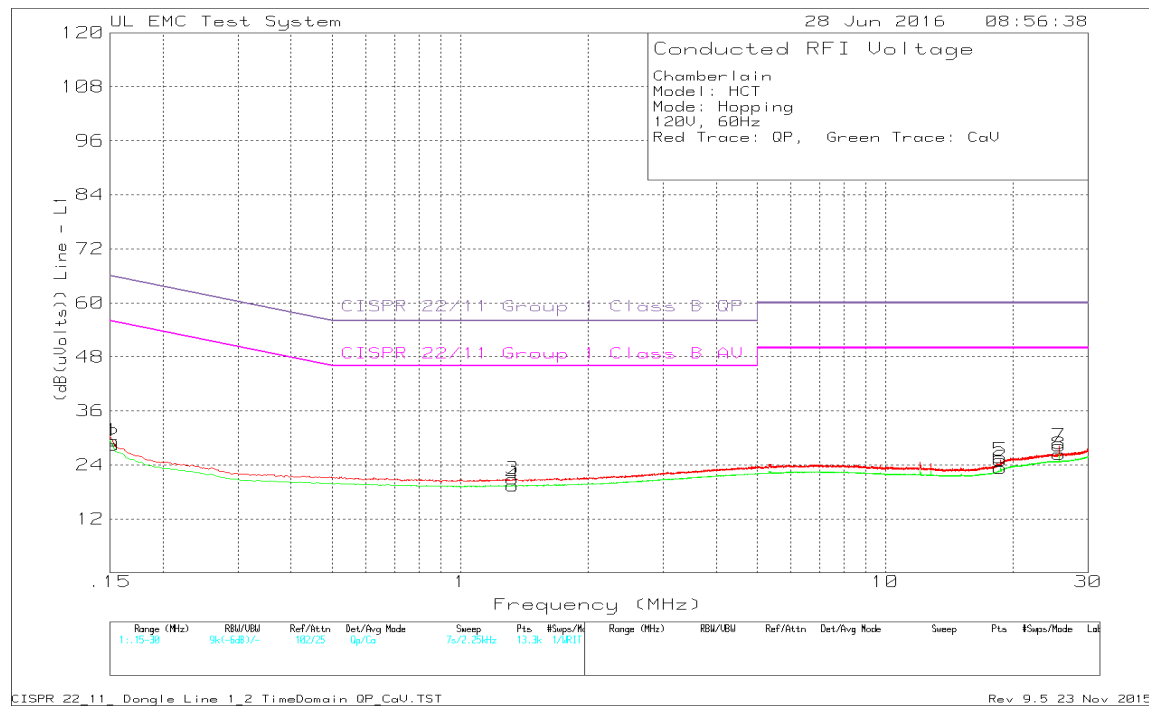
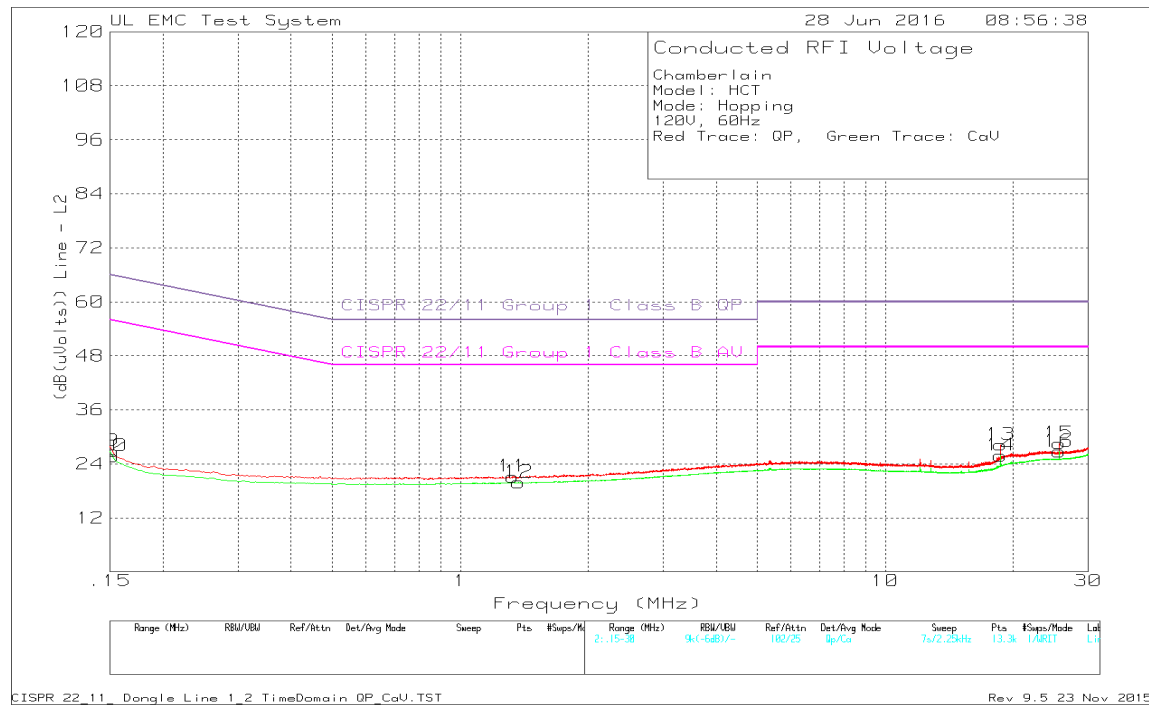
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

Line Conducted Emissions 150kHz – 30MHz



Chamberlain											
Model: HCT											
Mode: Hopping											
120V, 60Hz											
Red Trace: QP, Green Trace: CaV											
Trace Markers											
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor dB	Path Factor	Doungle Factor dB	Level dBuV	CISPR 22/11 Group 1 Class B QP	QP Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
Line											
1	0.15225	15.63	Qp	0.1	13.6	0	29.33	65.88	-36.55	-	-
2	0.15225	14.7	Ca	0.1	13.6	0	28.4	-	-	55.88	-27.48
3	1.329	10.34	Qp	0	10.6	0	20.94	56	-35.06	-	-
4	1.329	8.88	Ca	0	10.6	0	19.48	-	-	46	-26.52
5	18.6495	13.04	Qp	0	11.4	0.6	25.04	60	-34.96	-	-
6	18.6495	11.31	Ca	0	11.4	0.6	23.31	-	-	50	-26.69
7	25.59975	15.48	Qp	0	11.7	1.1	28.28	60	-31.72	-	-
8	25.59975	13.61	Ca	0	11.7	1.1	26.41	-	-	50	-23.59
Neutral											
9	0.15225	12.54	Qp	0.1	14.2	0	26.84	65.88	-39.04	-	-
10	0.15225	11.4	Ca	0.1	14.2	0	25.7	-	-	55.88	-30.18
11	1.32675	10.07	Qp	0	11.1	0	21.17	56	-34.83	-	-
12	1.37175	8.79	Ca	0	11.1	0	19.89	-	-	46	-26.11
13	18.65175	15.77	Qp	0	11.9	0.6	28.27	60	-31.73	-	-
14	18.65175	13.34	Ca	0	11.9	0.6	25.84	-	-	50	-24.16
15	25.59975	15.38	Qp	0	12.2	1	28.58	60	-31.42	-	-
16	25.59975	13.55	Ca	0	12.2	1	26.75	-	-	50	-23.25
Qp - Quasi-Peak detector											
Ca - CISPR Average detection											

11. SETUP PHOTOS

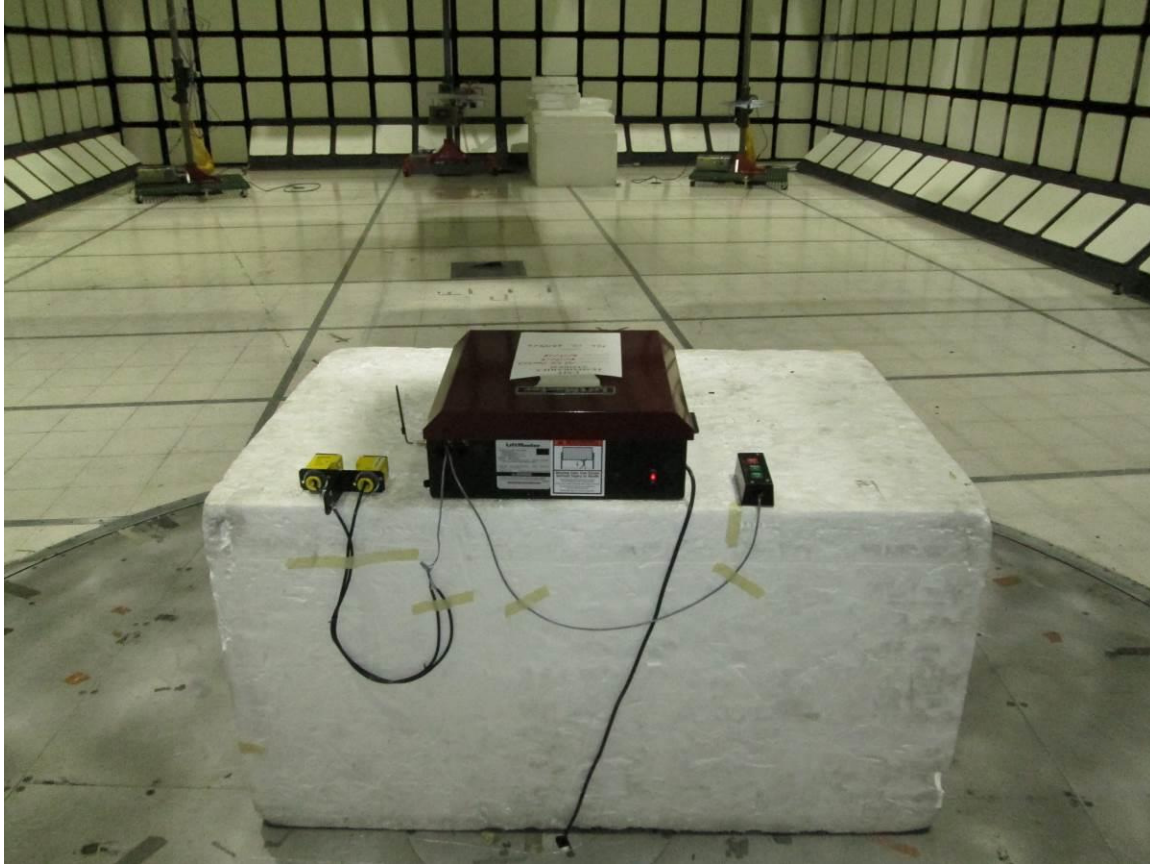
Line conducted emissions



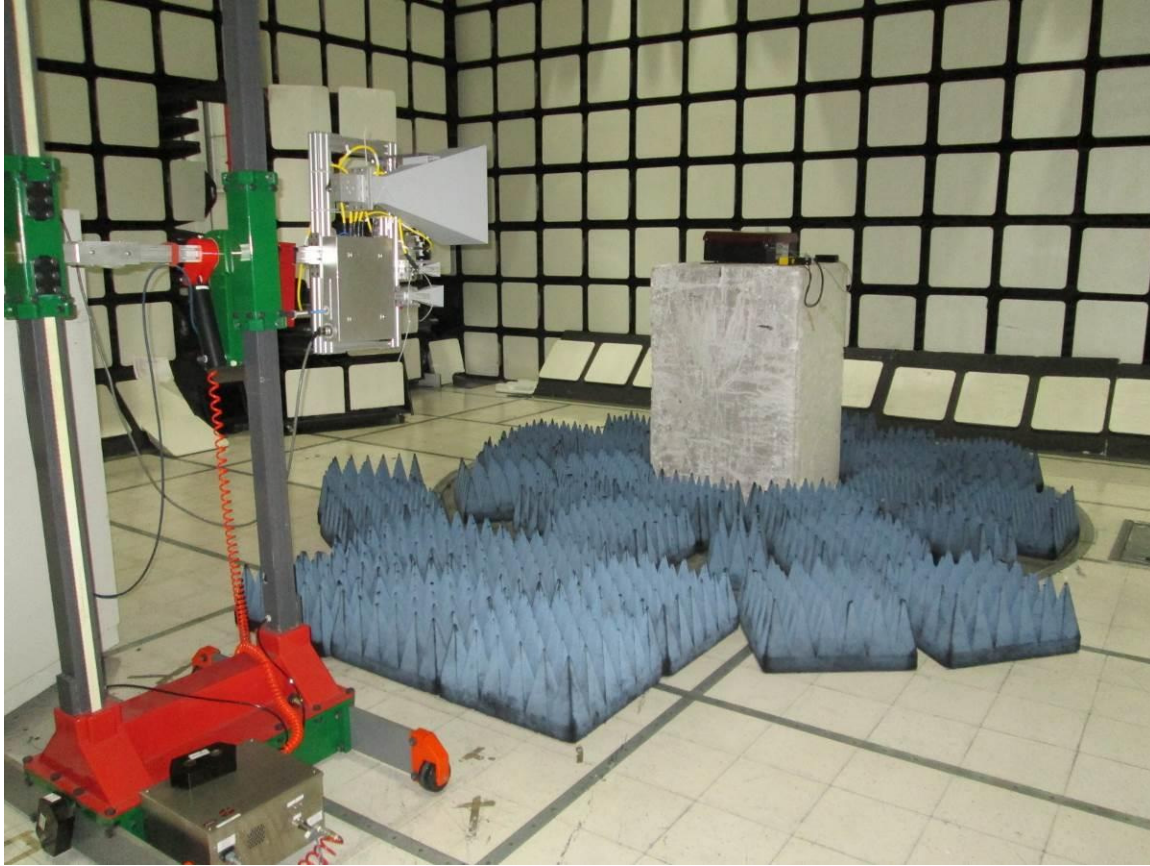
Radiated Emissions 9kHz – 30MHz



Radiated Emissions below 1GHz



Radiated Emissions above 1GHz



Antenna Port Conducted Emissions



END OF REPORT