



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

CERTIFICATION TEST REPORT

FOR

Overhead Door and Gate Operator

MODEL NUMBER: ACXL

**FCC ID: HBW8439
IC: 2666A-8439**

REPORT NUMBER: 11406731A

October 5, 2016

Prepared for
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NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	September 14, 2016	Initial Issue	V Sabalvaro
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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Commercial Access Controller, for Gate Operator, with low power FHSS transceiver and digital device/receiver.

MODEL: ACXL

SERIAL NUMBER: non serialized

DATE TESTED: July 18, 2016 to September 13, 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:



Bartłomiej Mucha
WiSE Staff Engineer
UL LLC



Vincent Sabalvaro
WiSE Project 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, DA 00705.

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 Access Controller, for Gate Operator, with low power FHSS transceiver and digital device/receiver which transmits at 902.25MHz-926.75MHz.

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	14.03	25.32

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

5.4. WORST-CASE CONFIGURATION AND MODE

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

5.5. DESCRIPTION OF TEST SETUP

EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Type	FCC ID
Door and Gate Operator	Chamberlain	1D8478-1	EUT	HBW8439
Power Supply	HK Yinghui Yuan	YHY-12005000	Accessories	-
Power Supply	Mean Well	GST60A12-P1J	Accessories	-

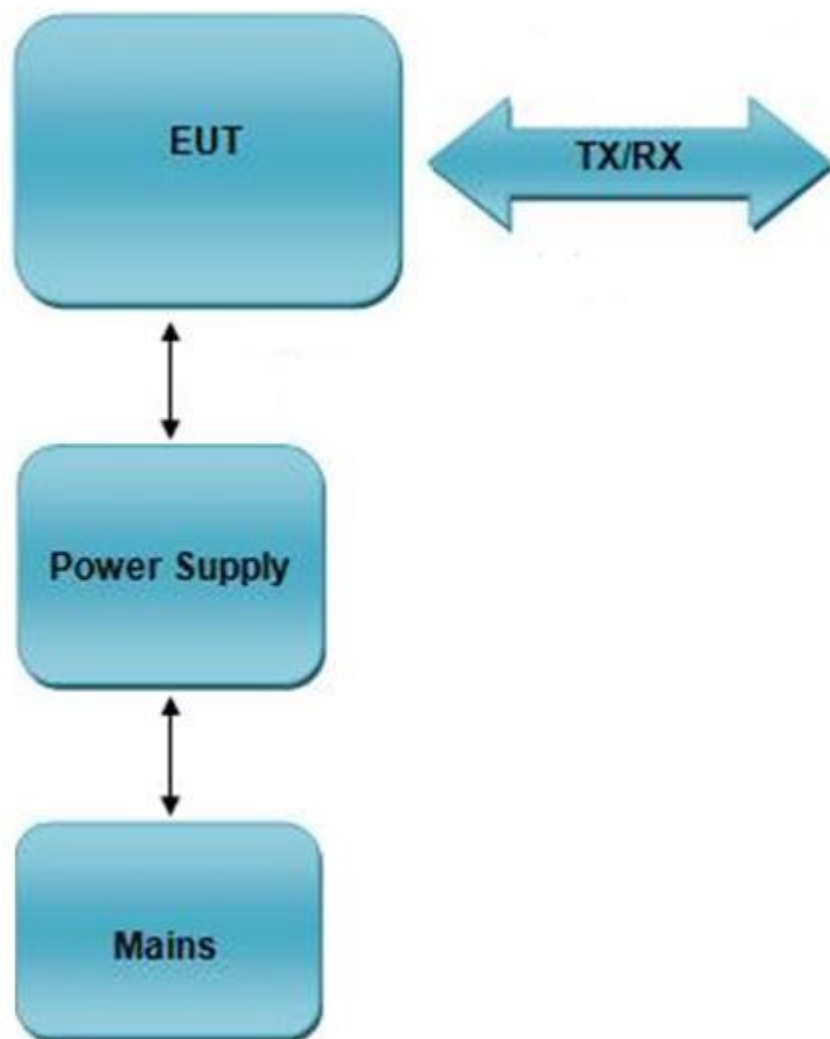
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Standard 120V	3 wire	1.5m	none
2	DC	2	none	2 wire	<3m	none

TEST SETUP

The transmitter is part of the access controller, 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
Signal Analyzer	Agilent	PXA	EMC4360	20160108	20170131
Power Meter	Agilent	N1912A	EMC4362	20160104	20170131
Power Sensor	Agilent	N10149	EMC4364	20160105	20170131
Bicon Antenna	Chase	VBA6106A	EMC4078	20151228	20161231
Log-P Antenna	Chase	UPA6109	EMC4313	20160122	20170131
Loop Antenna	EMCO	6502/1	EMC4026	20160722	20170731
Antenna Array	UL	BOMS	EMC4276	20151115	20161115
Spectrum Analyzer	Agilent	N9030A	EMC4360	20160108	20170131
EMI Test Receiver	Rohde & Schwarz	ESR	EMC4377	20160426	20170431
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	20160216	20170228
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	20160216	20170228

7. ANTENNA PORT TEST RESULTS

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

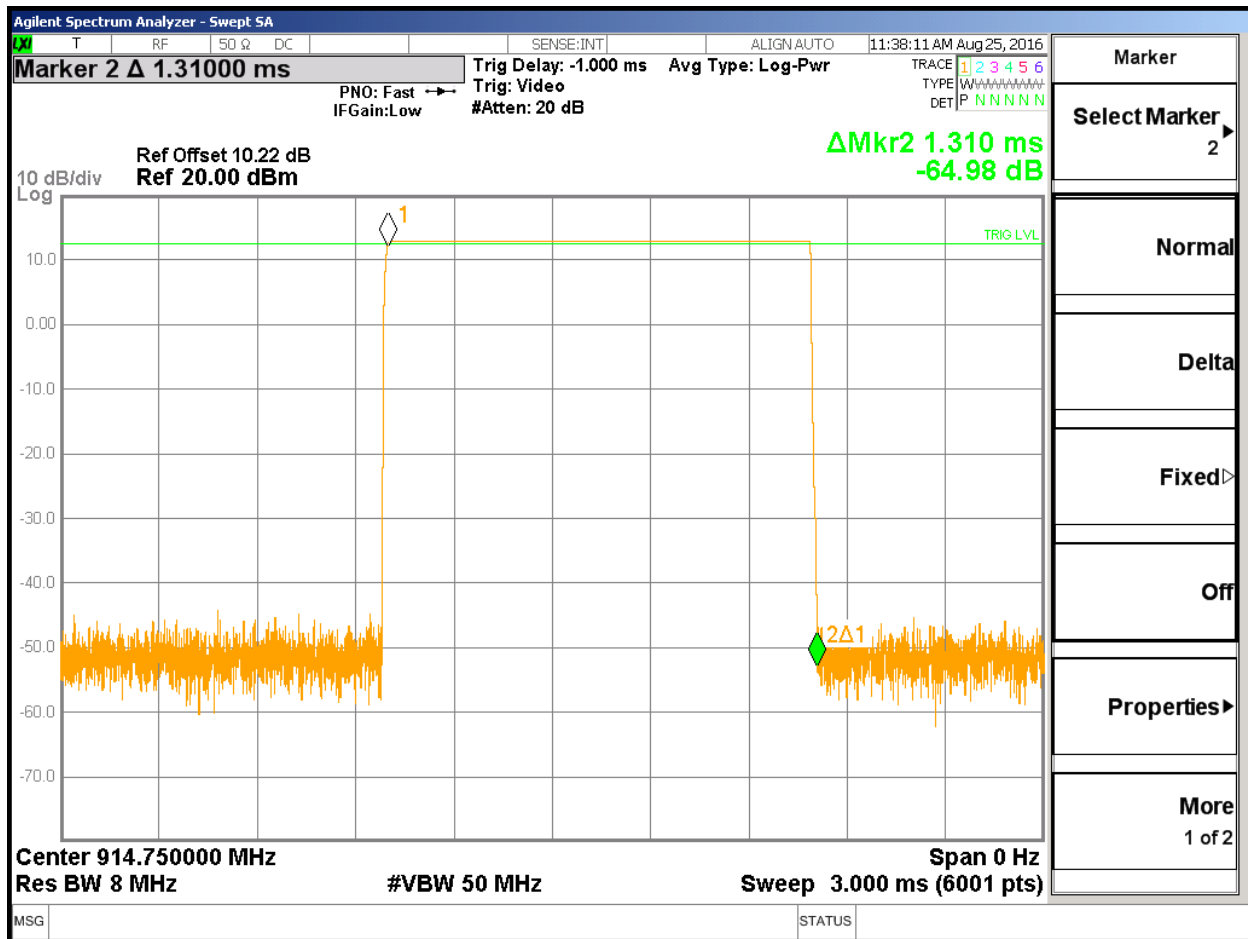
KDB 558074 Zero-Span Spectrum Analyzer Method.

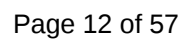
8.1. ON TIME AND DUTY CYCLE RESULTS

	B (msec)	(msec)	x (linear)	Cycle (%)	Correction Factor (dB)	Minimum VBW (kHz)
900 MHz band (Hopping ON)						
FHSS	1.310	100	0.013	1.31%	-37.65	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

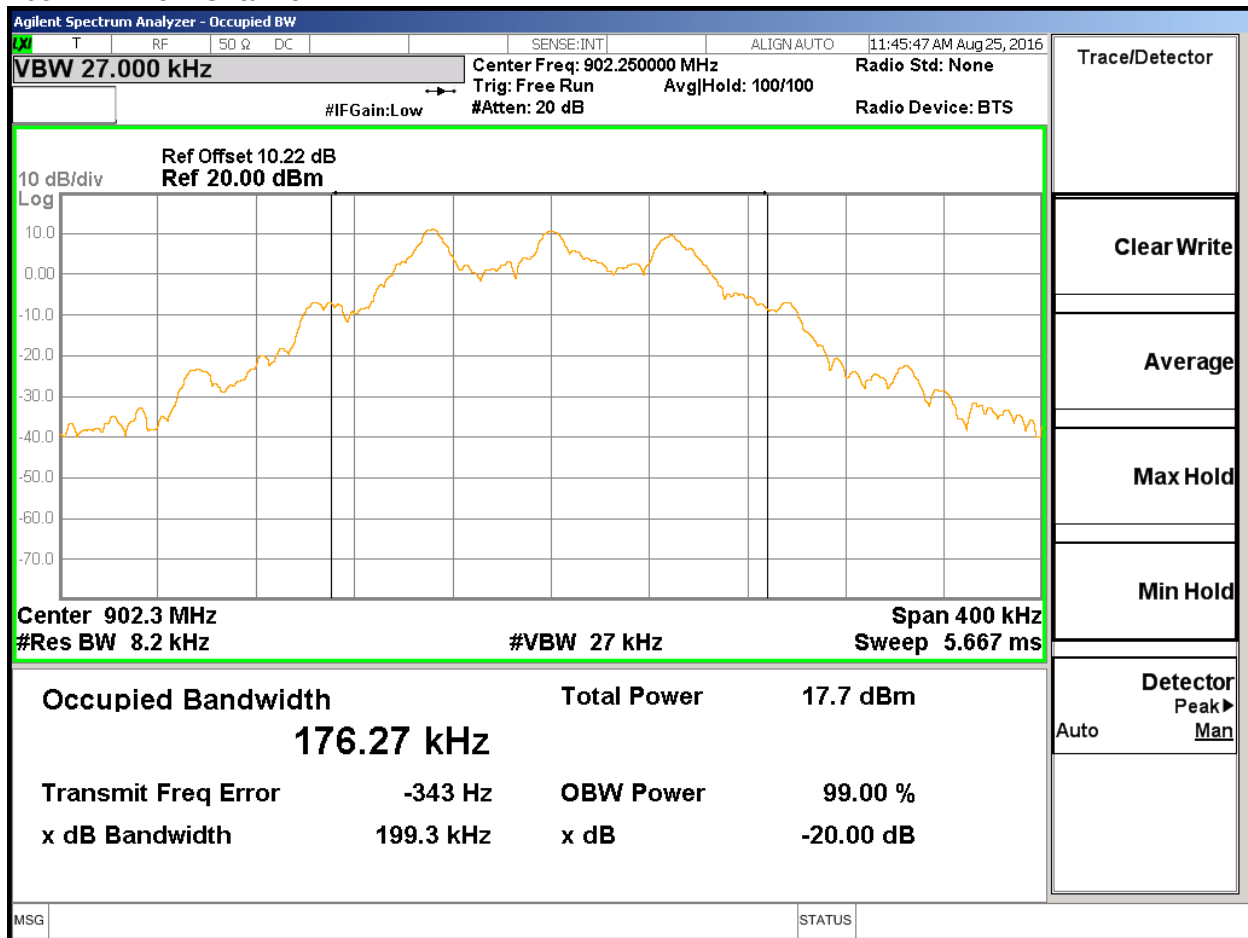
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

RESULTS

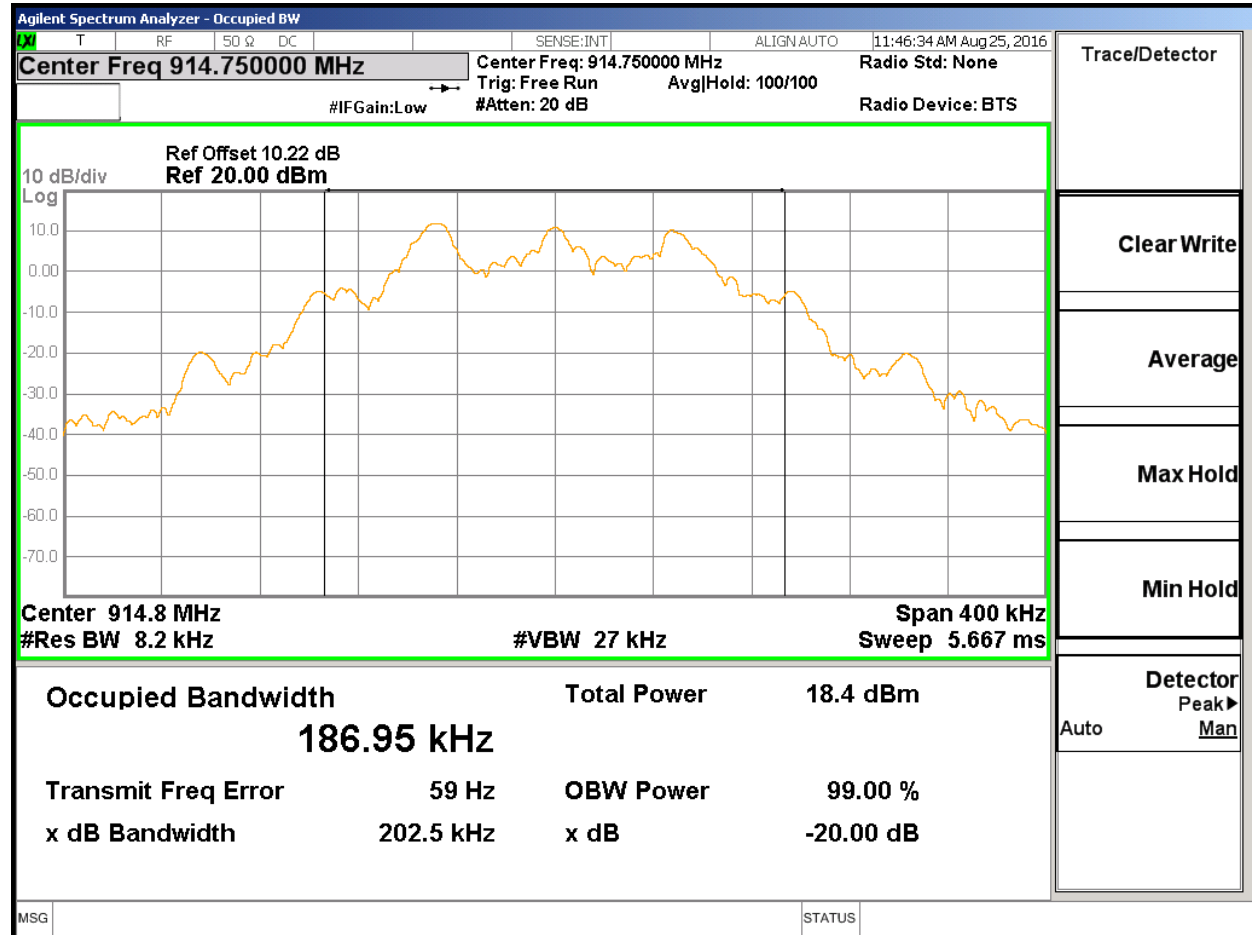
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	902.25	199.3	173.23
Middle	914.75	202.5	185.00
High	926.75	202.6	189.37

20 dB AND 99% BANDWIDTH

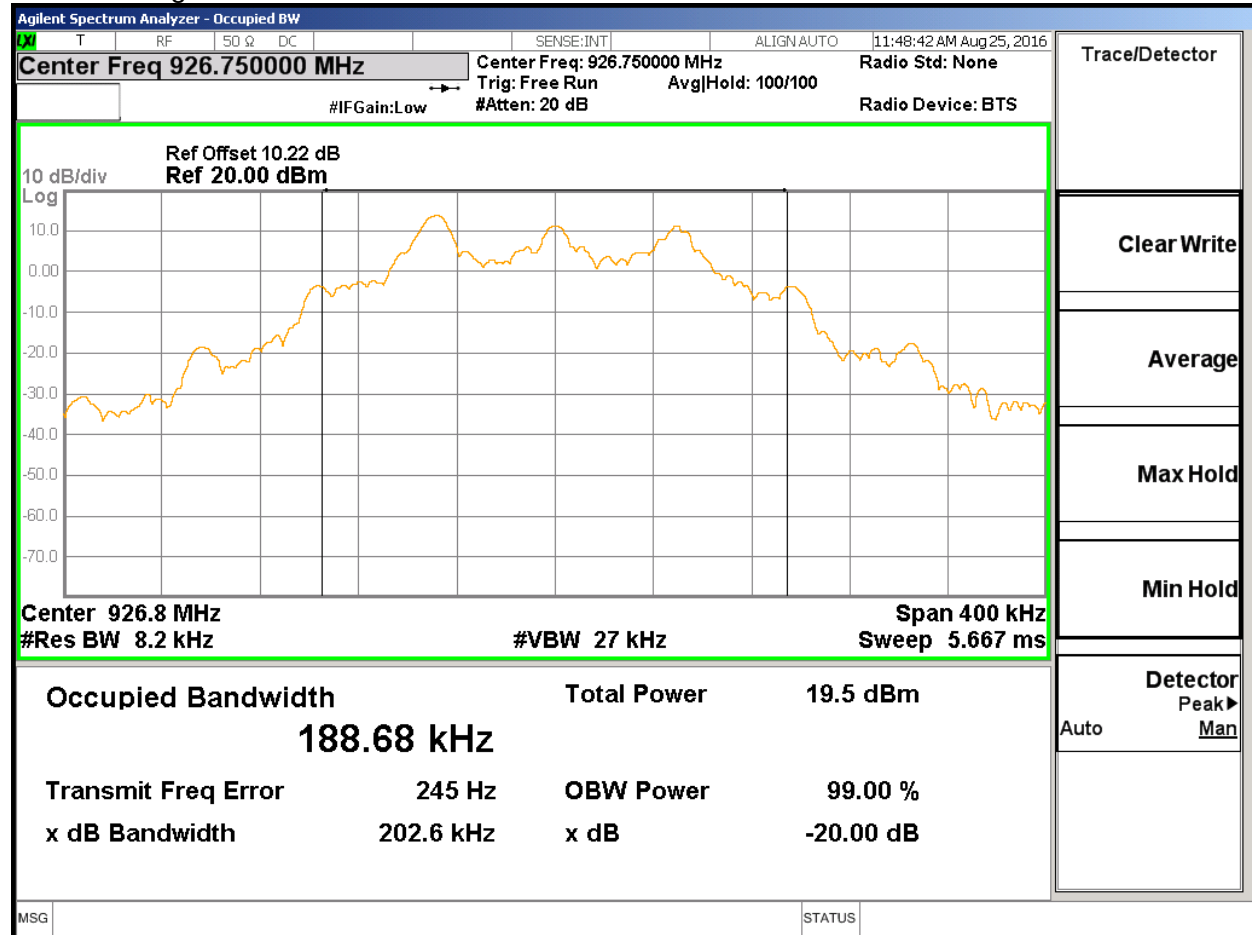
20dB BW Low Channel



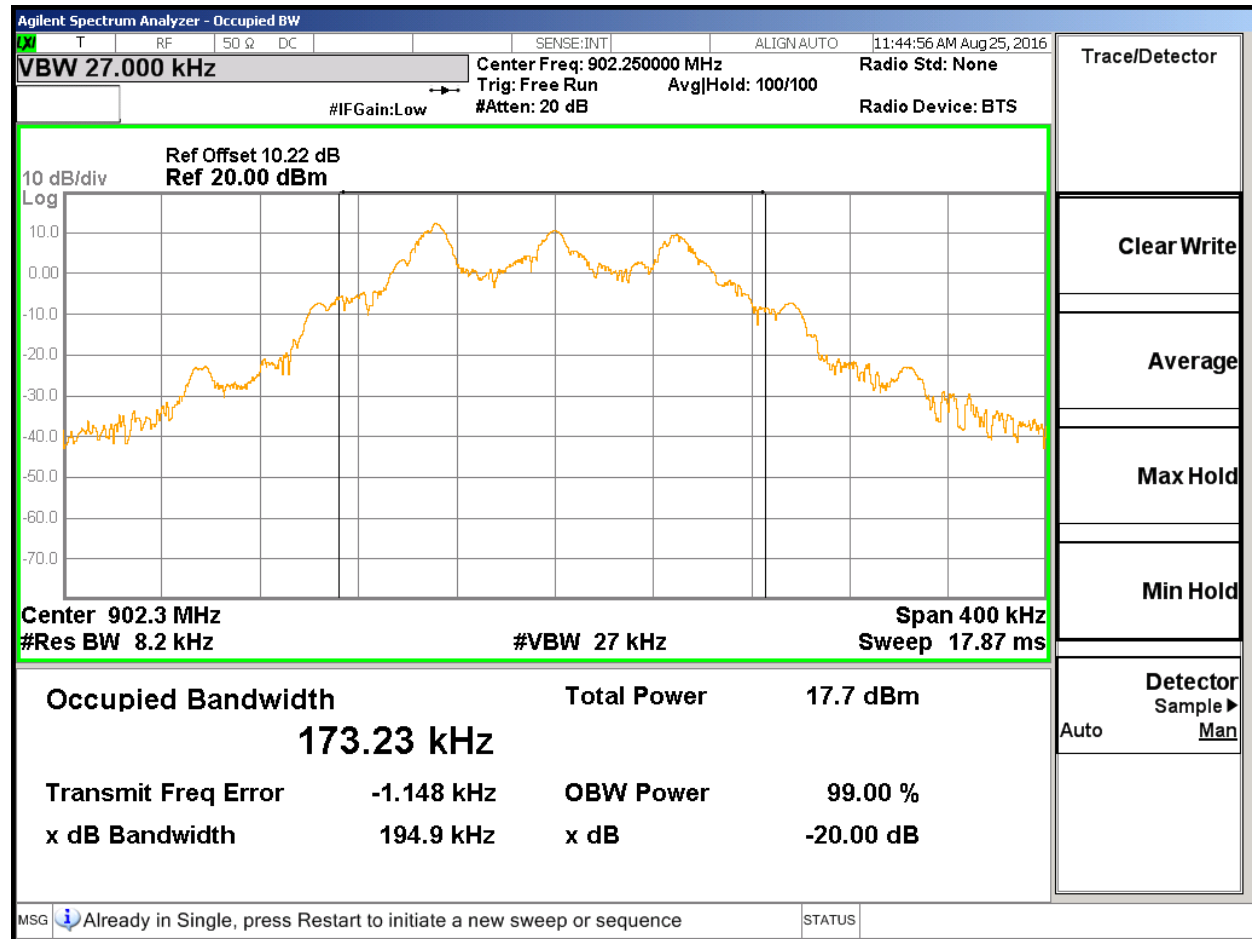
20dB BW Middle Channel



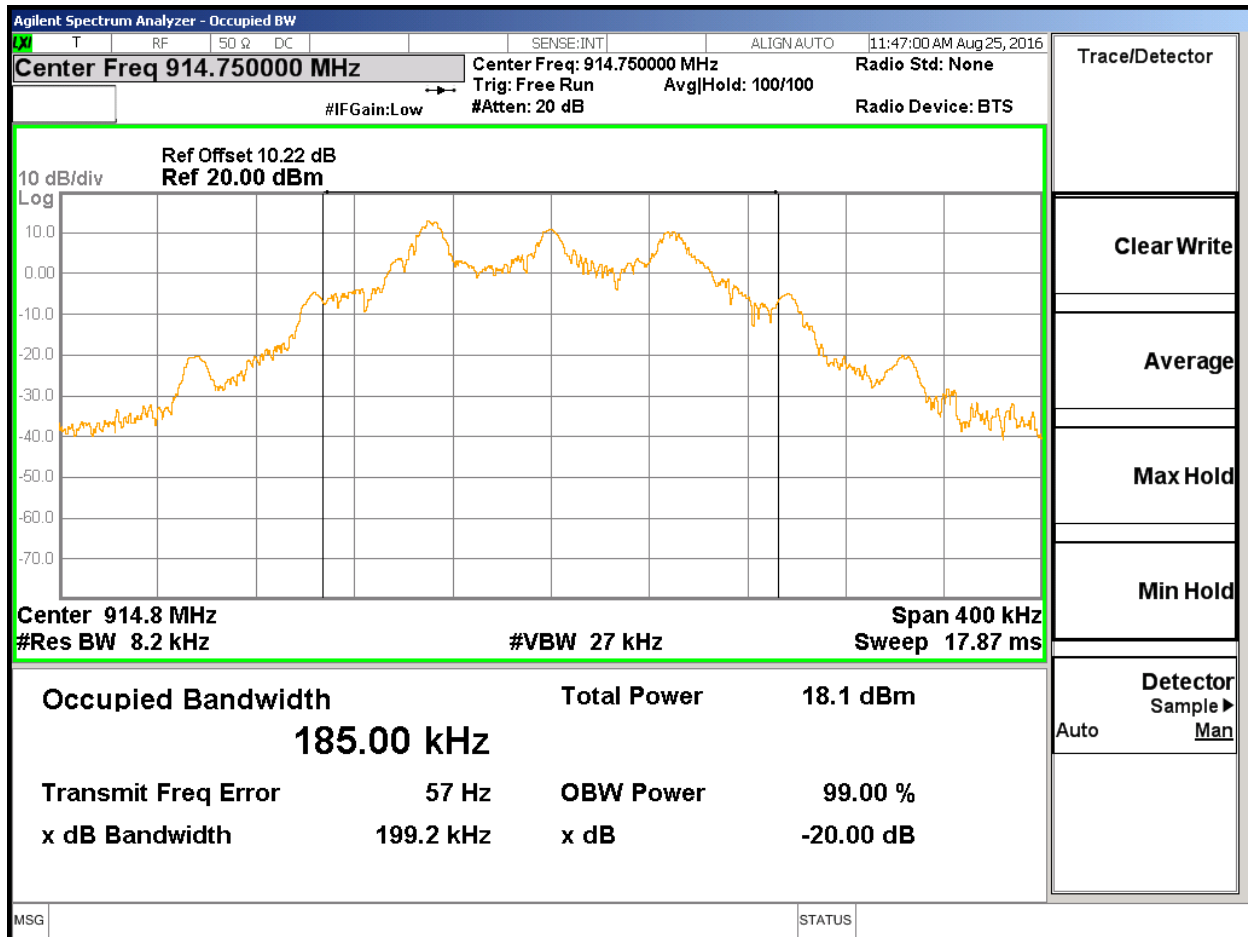
20dB BW High Channel



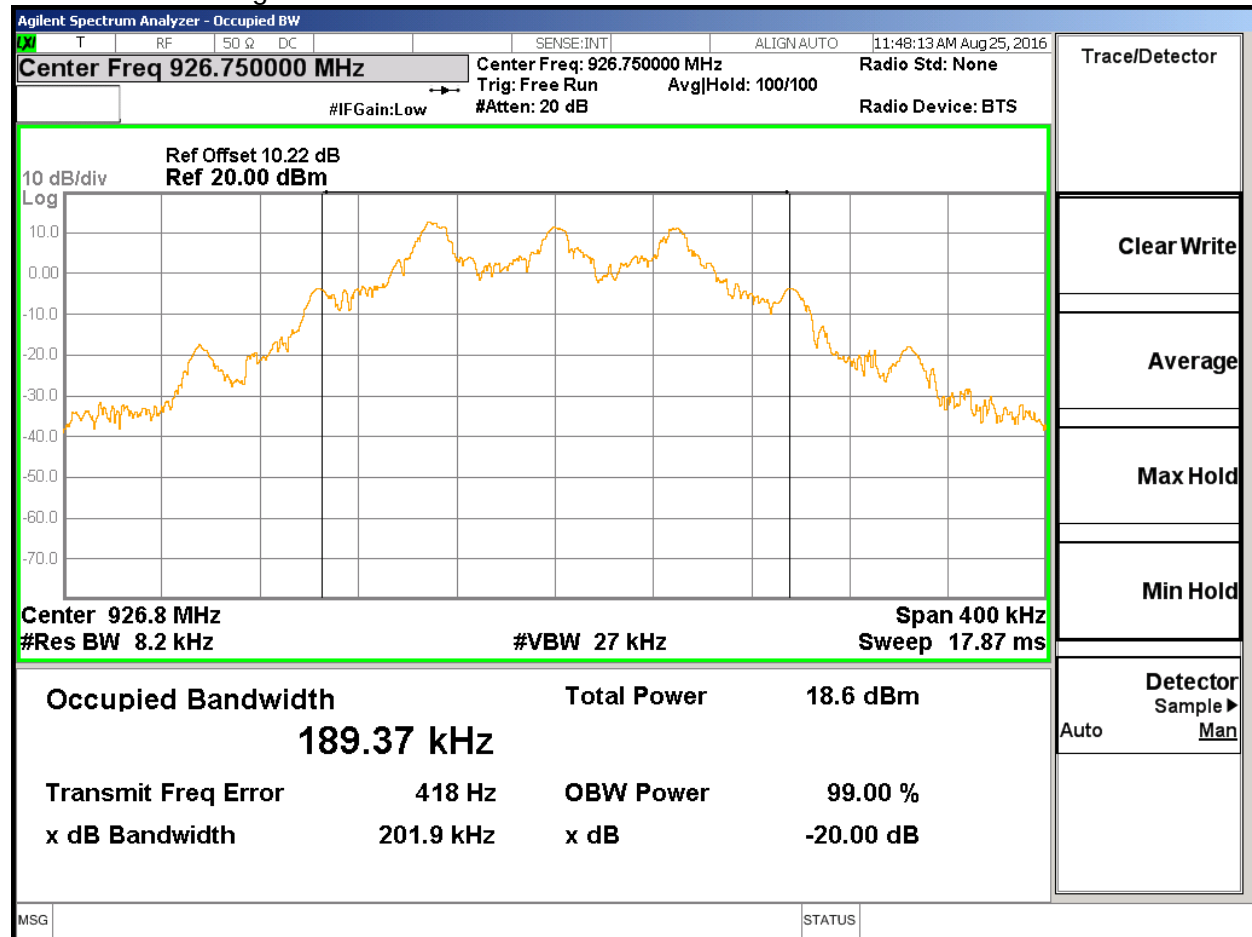
99% Power BW Low Channel



99% Power BW Middle Channel



99% Power BW High Channel



8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

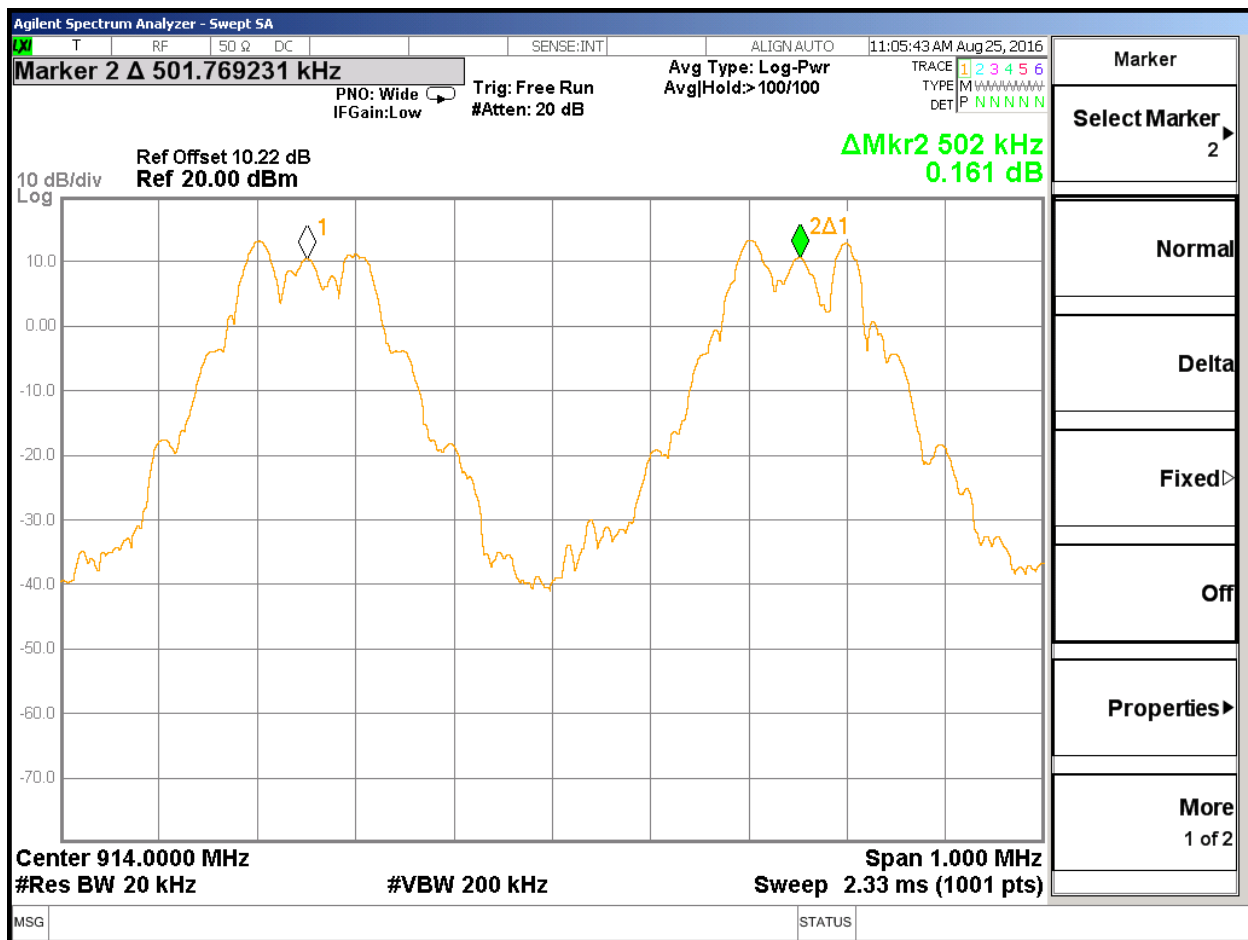
IC RSS-247 5.1 (2)

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



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.

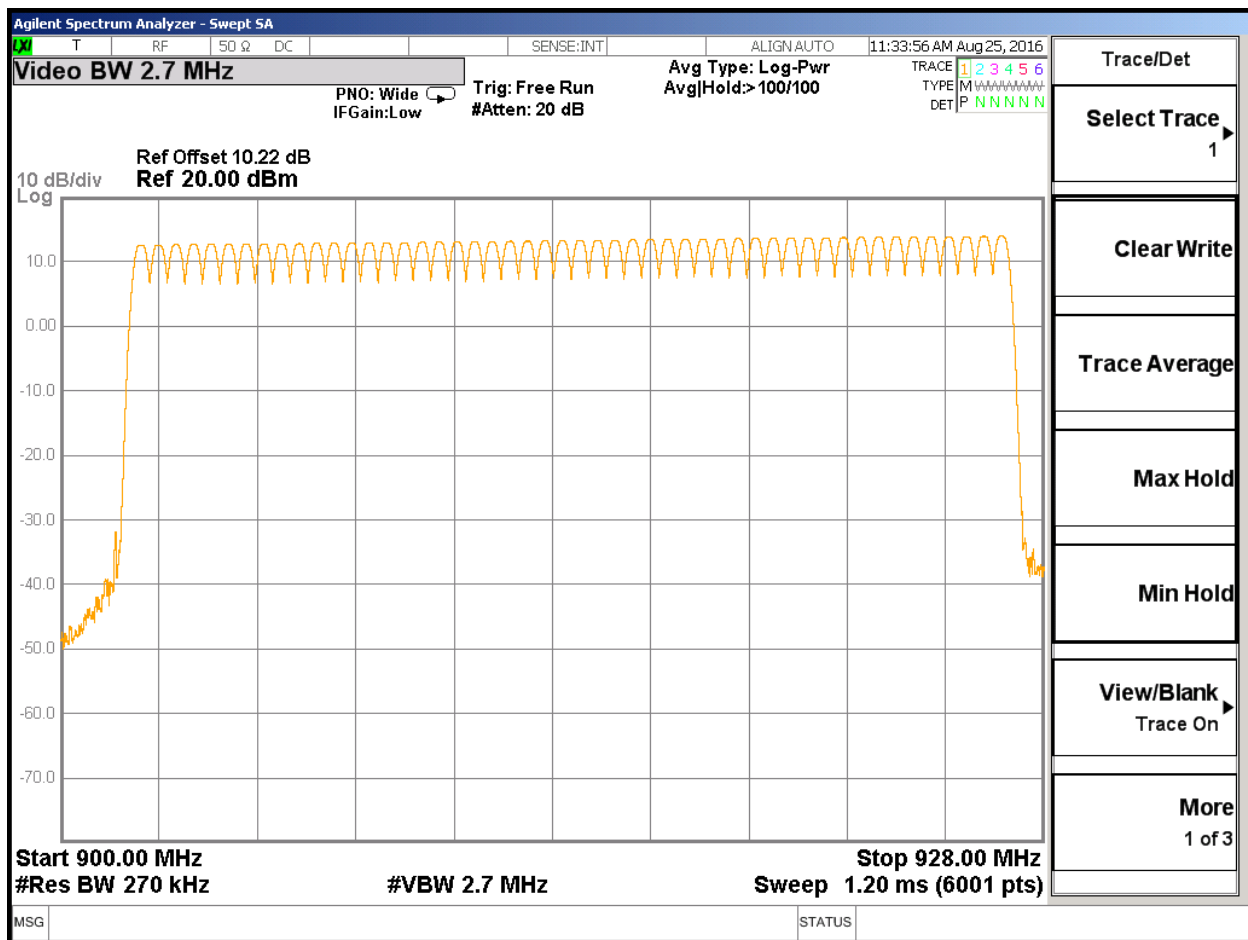
TEST PROCEDURE

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.

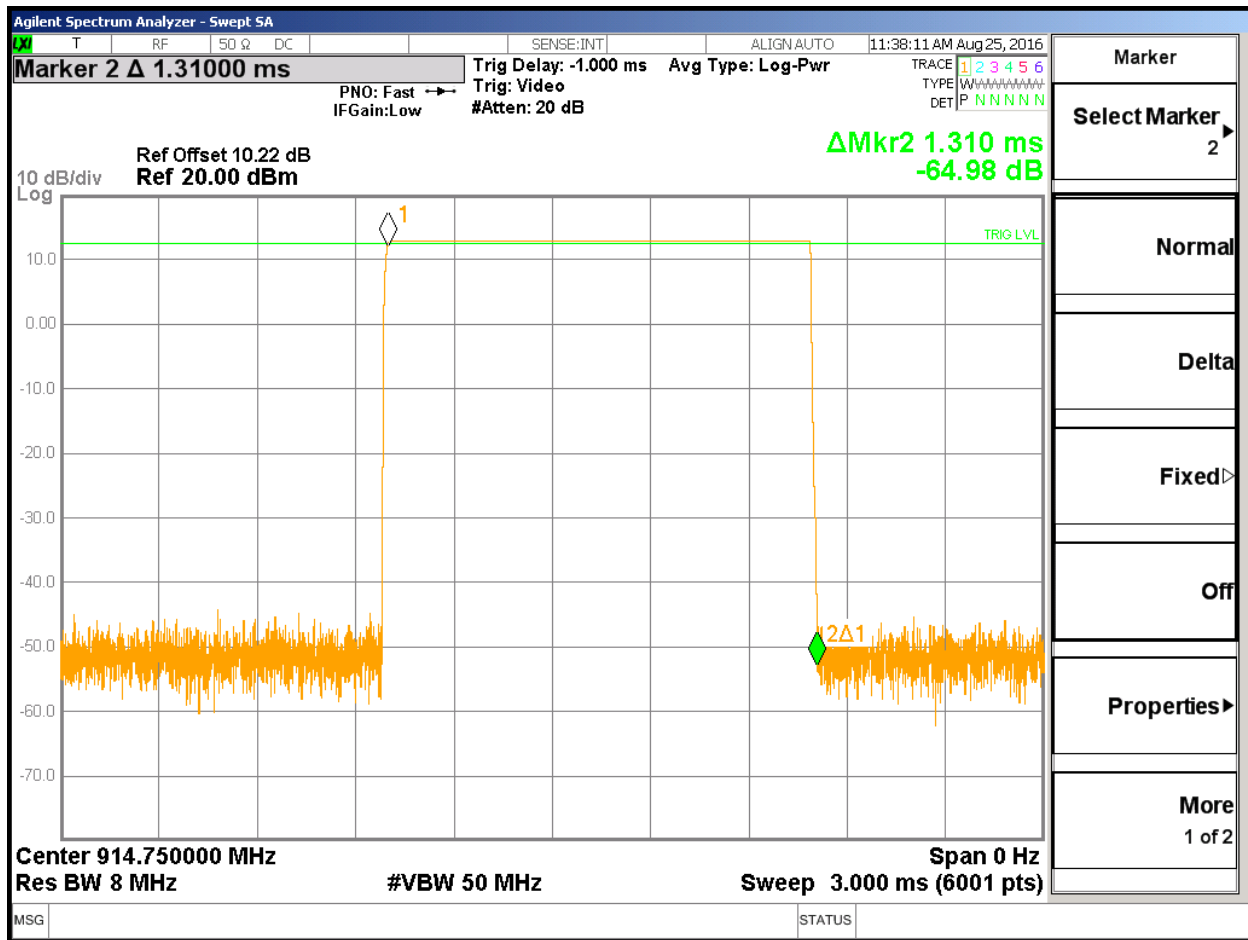
RESULTS

Single pulse width: 1.310mS

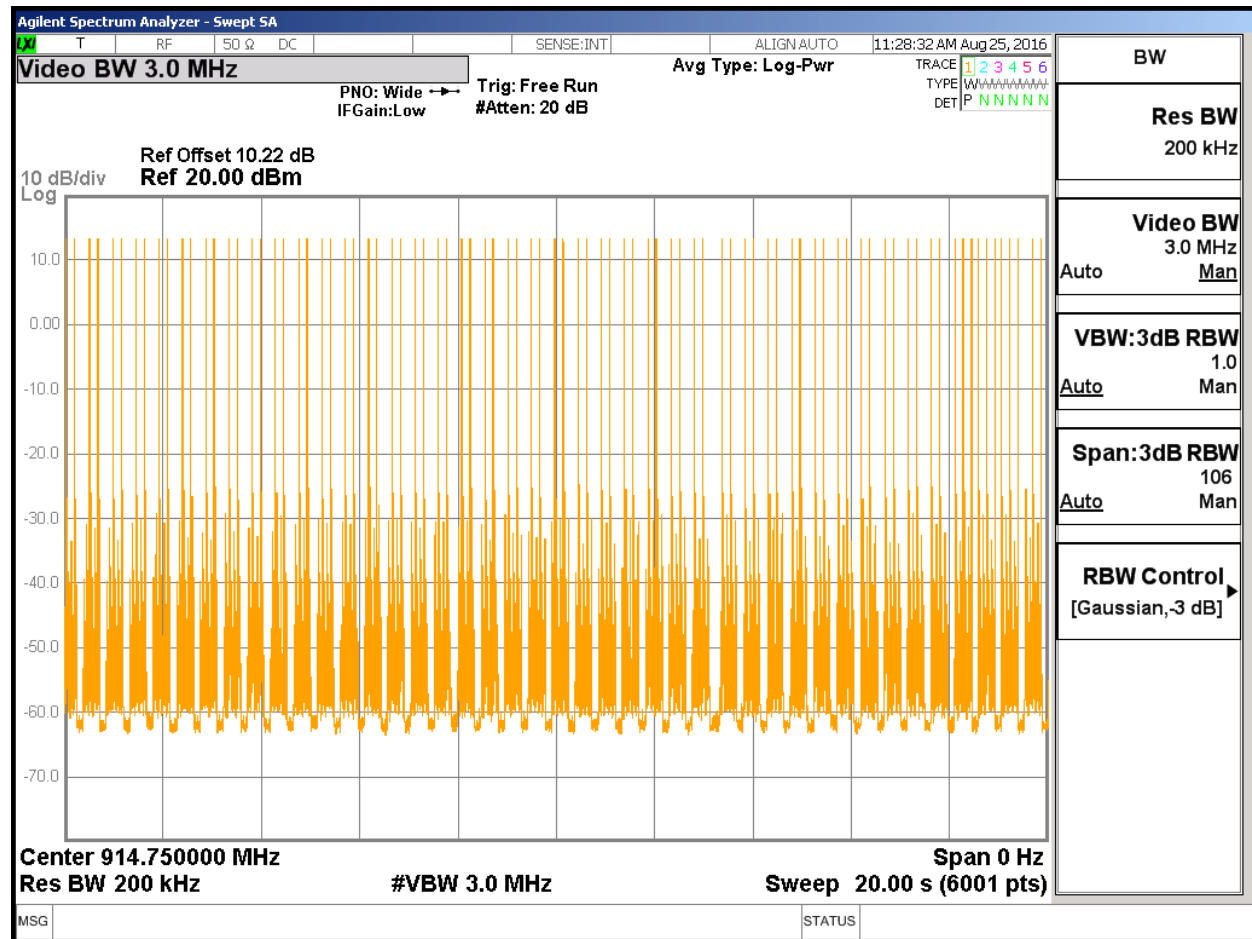
Number of Pulses in 20 seconds: 87

Total TX time in 20s: 114mS

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

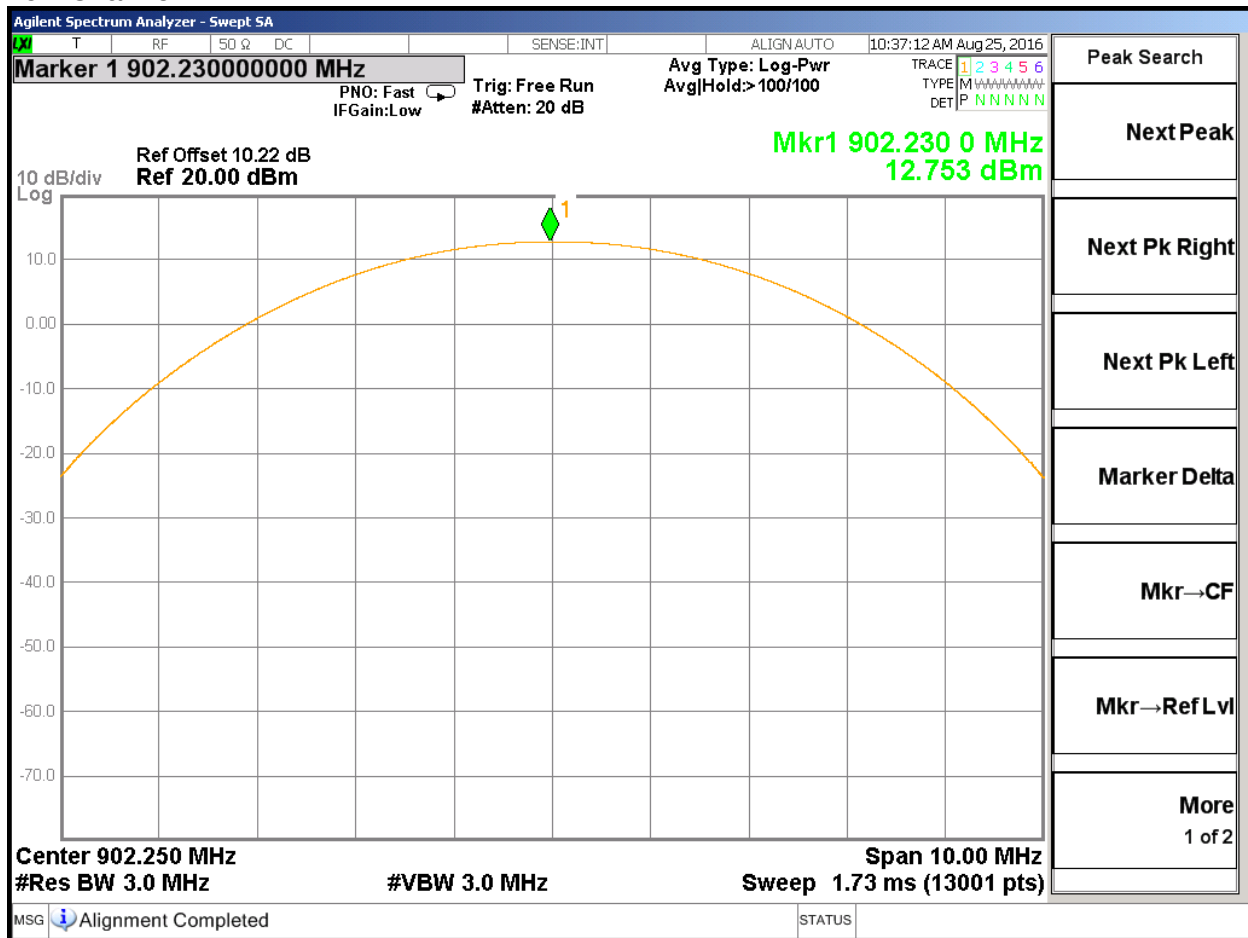
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

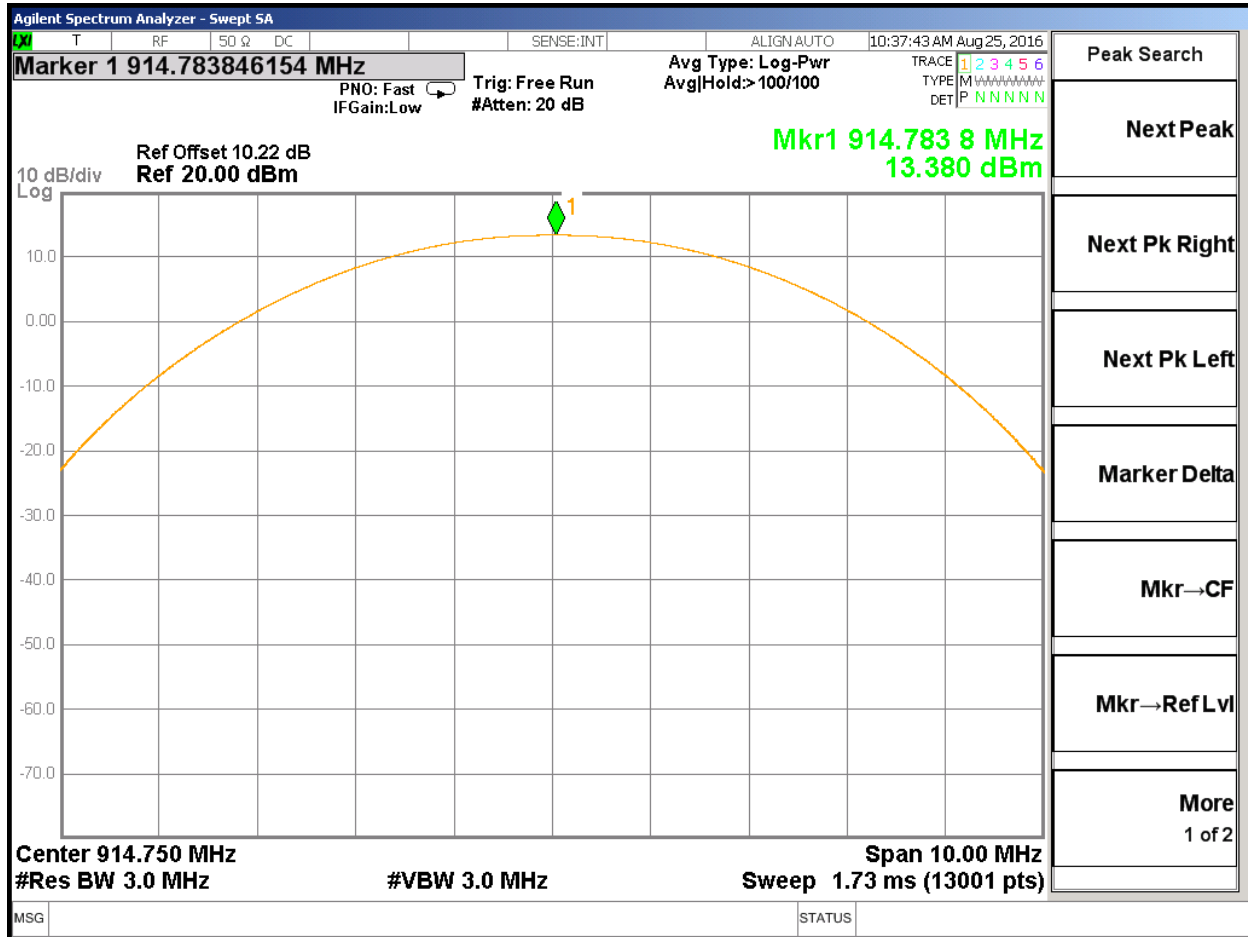
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.25	12.75	30	-17.25
Middle	914.75	13.38	30	-16.62
High	926.75	14.03	30	-15.97

OUTPUT POWER

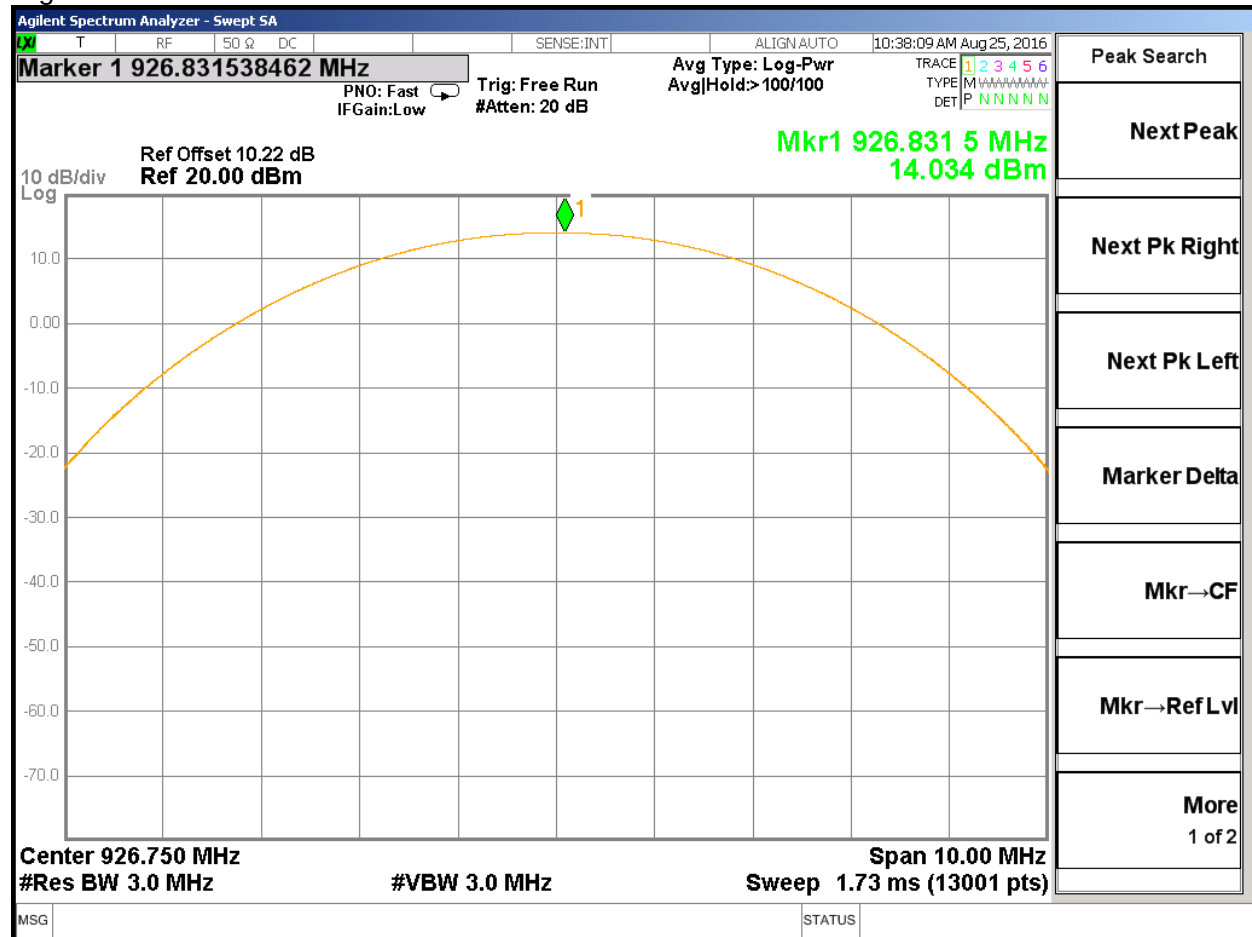
Low Channel



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

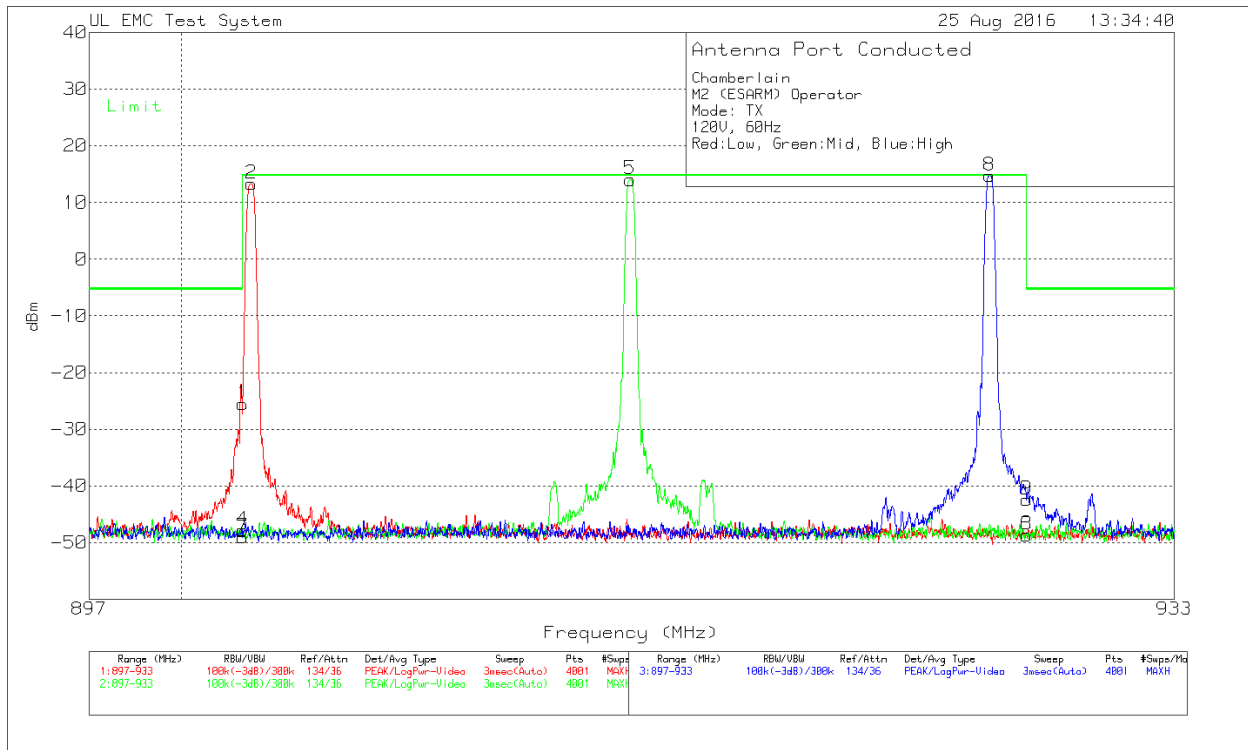
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

M2 (ESARM) Operator

Mode: TX

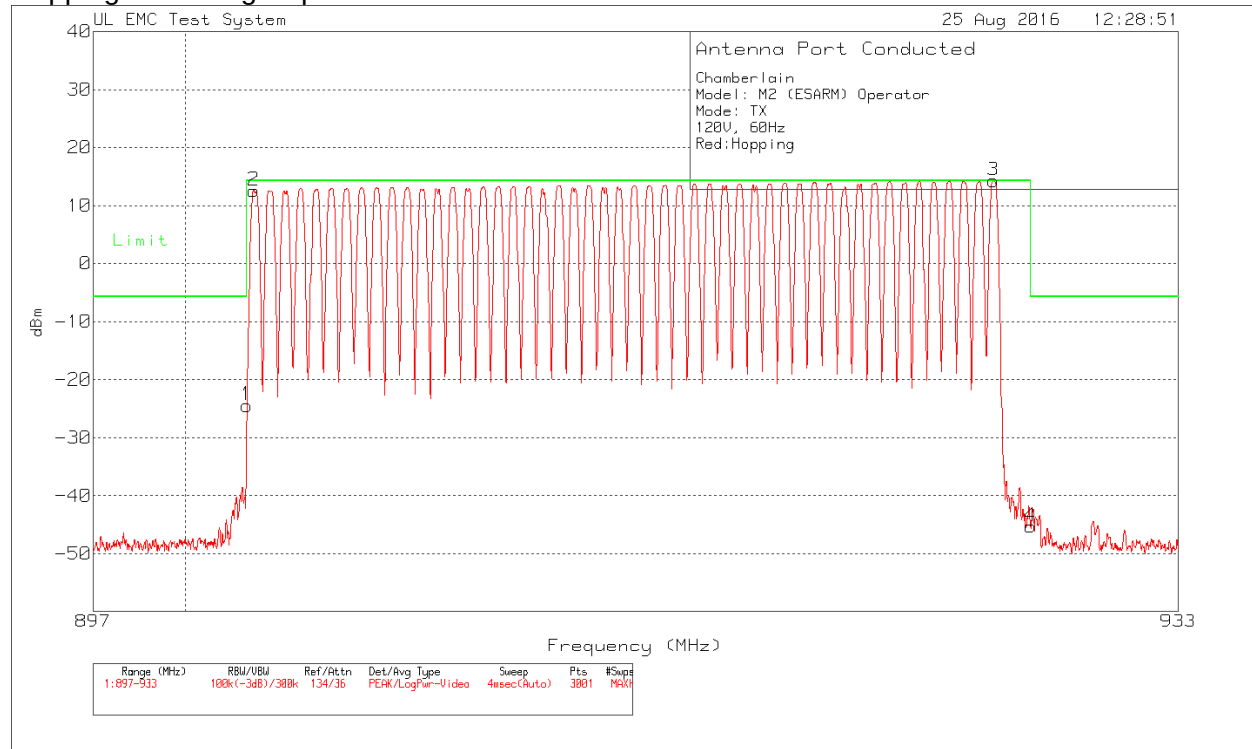
120V, 60Hz

Red:Low, Green:Mid, Blue:High

Test		Meter		Corrected		Margin			
Marker No.	Frequency (MHz)	Reading (dBuV)	Detector	Transducer Factor dB	Path dB	Reading dBm	Limit	(dB)	TX
1	901.995	70.95 Pk		-107	10.5	-25.55	-5.27	-20.28	Low
2	902.2785	109.8 Pk		-107	10.5	13.3	14.73	-1.43	Low
3	928.005	47.84 Pk		-107	10.5	-48.66	-5.27	-43.39	Low
4	901.995	48.62 Pk		-107	10.5	-47.88	-5.27	-42.61	Mid
5	914.7705	110.55 Pk		-107	10.5	14.05	14.73	-0.68	Mid
6	928.005	47.87 Pk		-107	10.5	-48.63	-5.27	-43.36	Mid
7	901.995	47.42 Pk		-107	10.5	-49.08	-5.27	-43.81	High
8	926.7675	111.23 Pk		-107	10.5	14.73	14.73	0	High
9	928.005	54.07 Pk		-107	10.5	-42.43	-5.27	-37.16	High

Pk - Peak detector

Hopping Band Edge Spurious

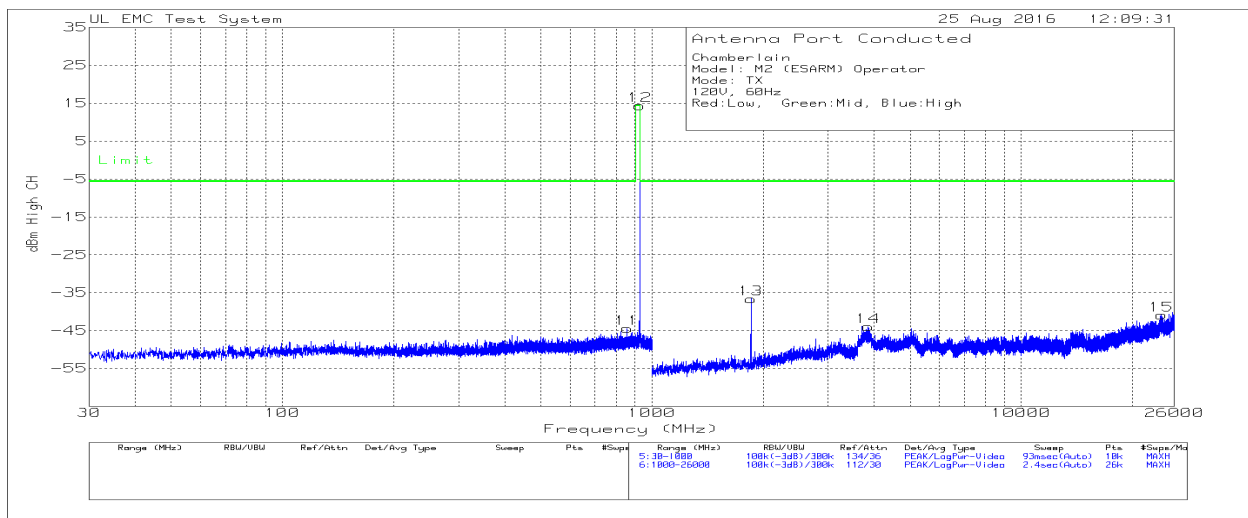
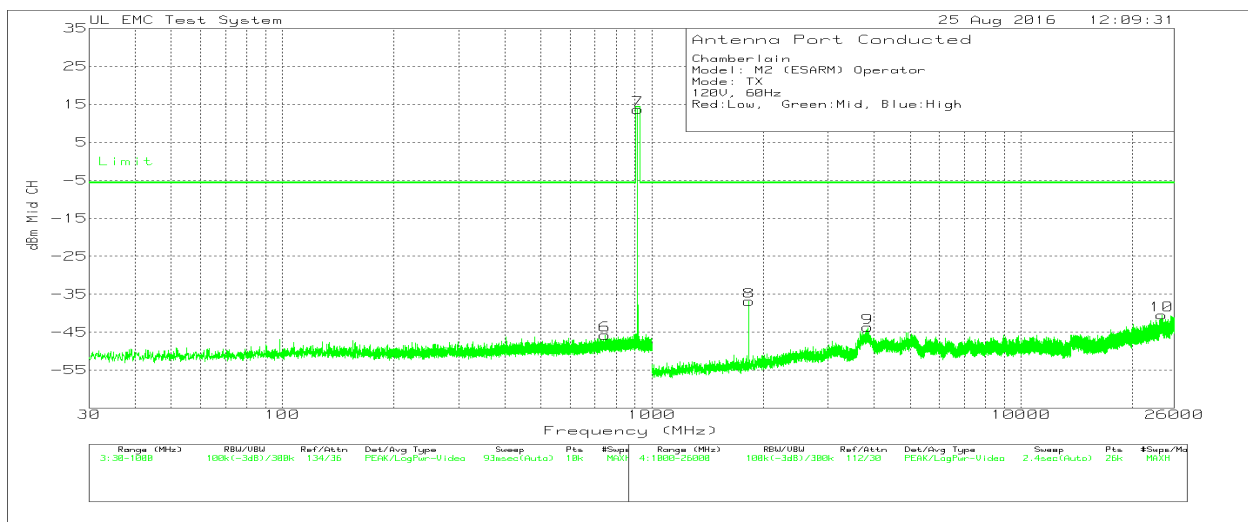
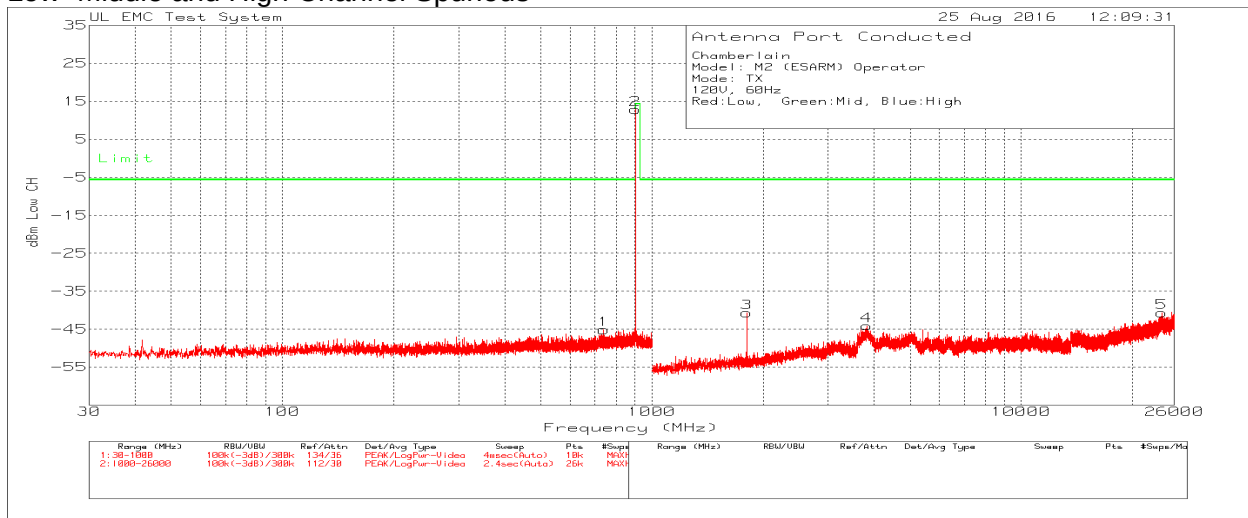


Chamberlain
Model: M2 (ESARM) Operator
Mode: TX
120V, 60Hz
Red:Hopping

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)		Transducer Factor dB		Corrected Reading dBm		Margin (dB)
		Detector			Path dB		Limit	
1	902.004	72.33 Pk		-107	10.2	-24.47	14.29	-38.76
2	902.226	109.42 Pk		-107	10.2	12.62	14.29	-1.67
3	926.76	111.09 Pk		-107	10.2	14.29	14.29	0
4	928.008	51.53 Pk		-107	10.2	-45.27	-5.71	-39.56

Pk - Peak detector

Low Middle and High Channel Spurious



Chamberlain
Model: M2 (ESARM) Operator
Mode: TX
120V, 60Hz
Red:Low, Green:Mid, Blue:High

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Tranducer Factor dB	Path dB	Corrected Reading dBm	Limit	Margin (dB)
Low CH								
1	740.331	51.66 Pk		-107	10.2	-45.14	-5.65	-39.49
2	902.2725	109.67 Pk		-107	10.2	12.87	14.35	-1.48
3	1804.776	56.02 Pk		-107	10.3	-40.68	-5.65	-35.03
4	3816.236	52.1 Pk		-107	10.8	-44.1	-5.65	-38.45
5	23997.181	54.65 Pk		-107	11.7	-40.65	-5.65	-35
Mid CH								
6	746.442	51.04 Pk		-107	10.2	-45.76	-5.65	-40.11
7	914.737	110.42 Pk		-107	10.2	13.62	14.35	-0.73
8	1829.775	59.74 Pk		-107	10.4	-36.86	-5.65	-31.21
9	3840.274	52.49 Pk		-107	10.8	-43.71	-5.65	-38.06
10	23993.335	54.83 Pk		-107	11.7	-40.47	-5.65	-34.82
High CH								
11	857.507	52.34 Pk		-107	10.2	-44.46	-5.65	-38.81
12	926.765	111.15 Pk		-107	10.2	14.35	14.35	0
13	1853.813	59.97 Pk		-107	10.4	-36.63	-5.65	-30.98
14	3851.812	52.26 Pk		-107	10.8	-43.94	-5.65	-38.29
15	23940.452	54.42 Pk		-107	11.7	-40.88	-5.65	-35.23

Pk - Peak detector

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

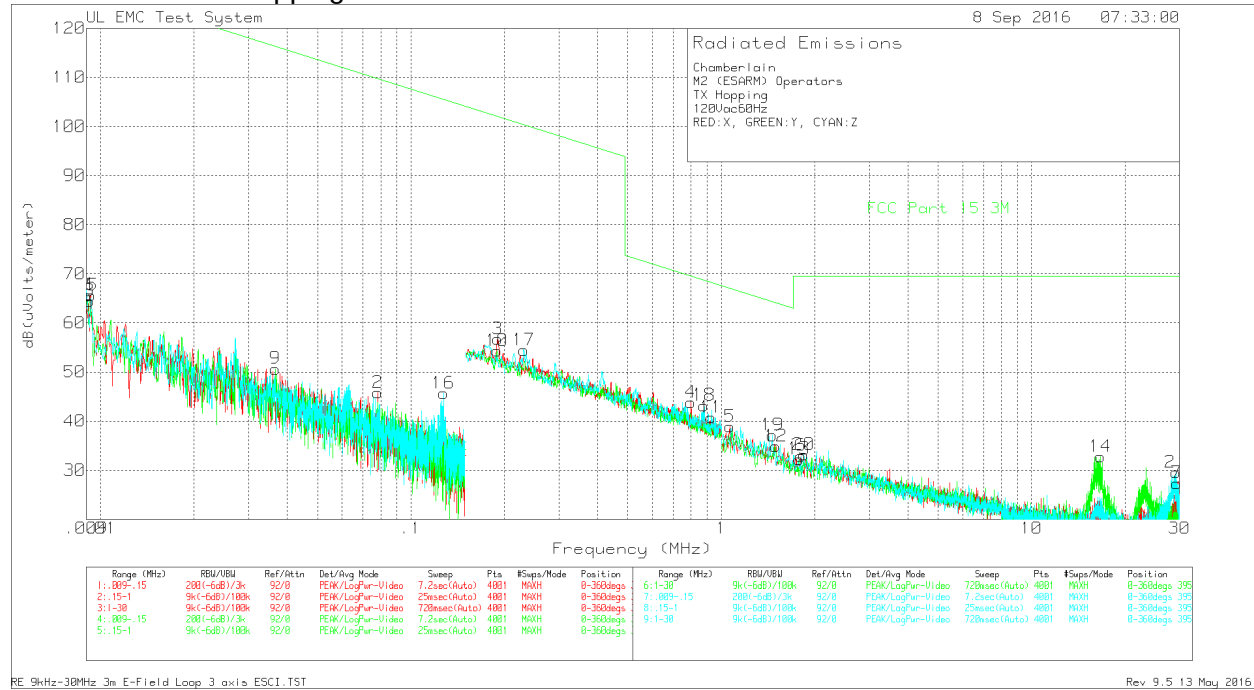
IC RSS-GEN Clause 8.9 (Transmitter)

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
0.009 – 0.49	2,660,725 – 48,978	128.5 – 93.8
0.49 – 1.705	4,8978 – 1,407.6	73.8 – 62.97
1.705 - 30	3000	69.54
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



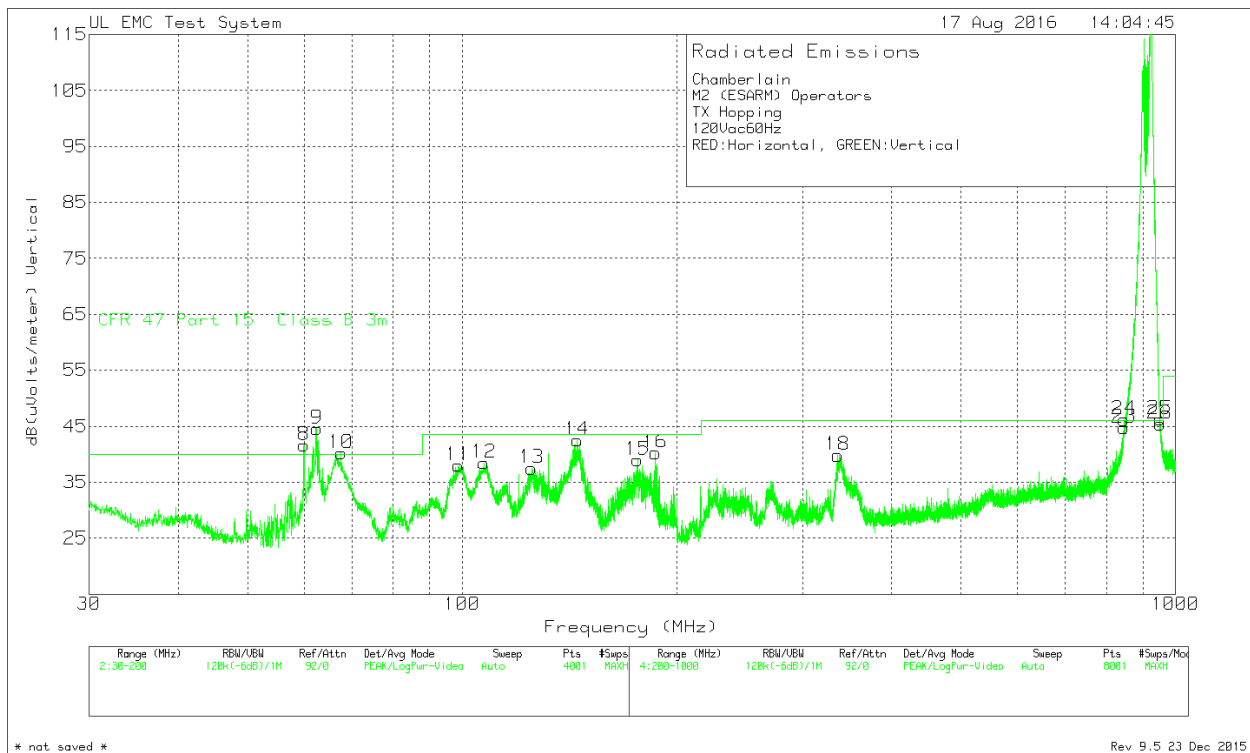
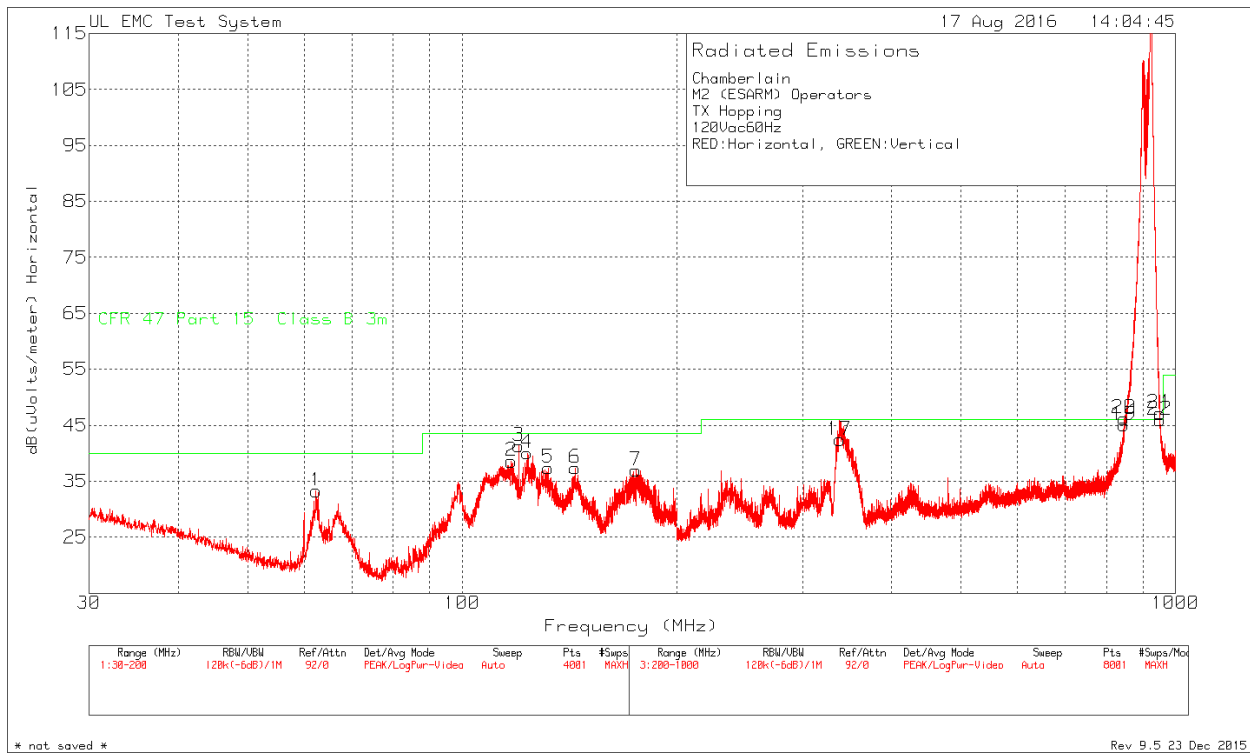
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 3 m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones obtained in an open field based on KDB 937606.

Chamberlain
M2 (ESARM) Operators
TX Hopping
120Vac60Hz
RED:X, GREEN:Y, CYAN:Z

Marker No.	Test	Meter	Antenna	Corrected								
	Frequency (MHz)	Reading (dBuV)	Detector	Factor dBm	Path dB	Reading dB(uVolts/ meter)	AV 3m Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	
	1	0.00928	43.61 Pk		22.1	0	65.71	128.23	-62.52	0-360	100	X
	2	0.078265	34 Pk		11.8	0	45.8	109.72	-63.92	0-360	100	X
	3	0.19047	45.39 Pk		11.3	0	56.69	102	-45.31	0-360	100	X
	4	0.79859	32.32 Pk		11.4	0.1	43.82	69.56	-25.74	0-360	100	X
	5	1.06525	27.39 Pk		11.4	0.1	38.89	67.06	-28.17	0-360	100	X
	6	1.80475	21.36 Pk		11.5	0.1	32.96	69.54	-36.58	0-360	100	X
	7	29.362	18.97 Pk		8.1	0.3	27.37	69.54	-42.17	0-360	100	X
	8	0.00921	42.28 Pk		22.2	0	64.48	128.3	-63.82	0-360	100	Y
	9	0.03658	36.47 Pk		14.2	0	50.67	116.33	-65.66	0-360	100	Y
	10	0.18962	43.05 Pk		11.3	0	54.35	102.04	-47.69	0-360	100	Y
	11	0.92596	29.28 Pk		11.4	0.1	40.78	68.27	-27.49	0-360	100	Y
	12	1.50025	23.25 Pk		11.5	0.1	34.85	64.08	-29.23	0-360	100	Y
	13	1.783	20.68 Pk		11.5	0.1	32.28	69.54	-37.26	0-360	100	Y
	14	16.65275	22.87 Pk		9.7	0.2	32.77	69.54	-36.77	0-360	100	Y
	15	0.009035	43.18 Pk		22.4	0	65.58	128.47	-62.89	0-360	100	Z
	16	0.127265	34.3 Pk		11.4	0	45.7	105.5	-59.8	0-360	100	Z
	17	0.23158	43.15 Pk		11.3	0	54.45	100.31	-45.86	0-360	100	Z
	18	0.88091	31.69 Pk		11.4	0.1	43.19	68.71	-25.52	0-360	100	Z
	19	1.464	25.61 Pk		11.4	0.1	37.11	64.29	-27.18	0-360	100	Z
	20	1.841	21.52 Pk		11.5	0.1	33.12	69.54	-36.42	0-360	100	Z
	21	29.26775	21.18 Pk		8.1	0.3	29.58	69.54	-39.96	0-360	100	Z

Pk - Peak detector

30MHz – 1000MHz – Hopping Mode



Chamberlain
M2 (ESARM) Operators
TX Hopping
120Vac60Hz
RED:Horizontal, GREEN:Vertical

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor dBm	Path dB	10M to 3M Factor dB	BRF 900 dB	Corrected Reading dB(uVolts/ meter)	QP Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	62.385	45.96 Pk	6.7	-29.9	10.5	-	33.26	40	-6.74	0-360	398	H
2	117.125	44.76 Pk	13.1	-29.8	10.5	-	38.56	43.52	-4.96	0-360	398	H
3	120.015	47.21 Pk	13.3	-29.7	10.5	-	41.31	43.52	-2.21	0-360	398	H
4	123.3725	45.63 Pk	13.6	-29.7	10.5	-	40.03	43.52	-3.49	0-360	398	H
5	132.085	42.36 Pk	14.2	-29.7	10.5	-	37.36	43.52	-6.16	0-360	248	H
6	144.0275	42.24 Pk	14.2	-29.6	10.5	-	37.34	43.52	-6.18	0-360	248	H
7	175.265	40.76 Pk	15	-29.3	10.5	-	36.96	43.52	-6.56	0-360	398	H
8	60.005	53.92 Pk	7.1	-29.9	10.5	-	41.62	40	1.62	0-360	252	V
9	62.555	57.47 Pk	6.6	-30	10.5	-	44.57	40	4.57	0-360	252	V
10	67.655	53.2 Pk	6.5	-30	10.5	-	40.2	40	0.2	0-360	398	V
11	98.765	46.81 Pk	10.6	-29.9	10.5	-	38.01	43.52	-5.51	0-360	102	V
12	107.3075	46.07 Pk	11.7	-29.8	10.5	-	38.47	43.52	-5.05	0-360	102	V
13	125.115	42.99 Pk	13.7	-29.7	10.5	-	37.49	43.52	-6.03	0-360	102	V
14	144.9625	47.41 Pk	14.2	-29.6	10.5	-	42.51	43.52	-1.01	0-360	102	V
15	176.1575	42.68 Pk	15.1	-29.3	10.5	-	38.98	43.52	-4.54	0-360	102	V
16	186.6125	42.96 Pk	15.9	-29.1	10.5	-	40.26	43.52	-3.26	0-360	102	V
17	338.2	45.92 Pk	14.5	-28.7	10.5	0.2	42.42	46.02	-3.6	0-360	299	H
19	846.4	31.06 Pk	22.7	-27.8	10.5	8.6	45.06	46.02	-0.96	0-360	199	H
20	846.8	31.99 Pk	22.7	-27.8	10.5	8.8	46.19	46.02	0.17	0-360	299	H
21	950.7	30.62 Pk	23.5	-27.4	10.5	9.9	47.12	46.02	1.1	0-360	100	H
22	951	29.76 Pk	23.5	-27.4	10.5	9.6	45.96	46.02	-0.06	0-360	199	H
18	336.2	43.32 Pk	14.5	-28.7	10.5	0.2	39.82	46.02	-6.2	0-360	98	V
23	847	30.42 Pk	22.7	-27.8	10.5	8.9	44.72	46.02	-1.3	0-360	98	V
24	847.2	31.79 Pk	22.7	-27.8	10.5	9	46.19	46.02	0.17	0-360	98	V
25	951	30.09 Pk	23.5	-27.4	10.5	9.6	46.29	46.02	0.27	0-360	199	V
26	951.5	29.7 Pk	23.5	-27.3	10.5	9	45.4	46.02	-0.62	0-360	399	V

No emissions of the transit frequency close to limit were recorded in restricted bands.

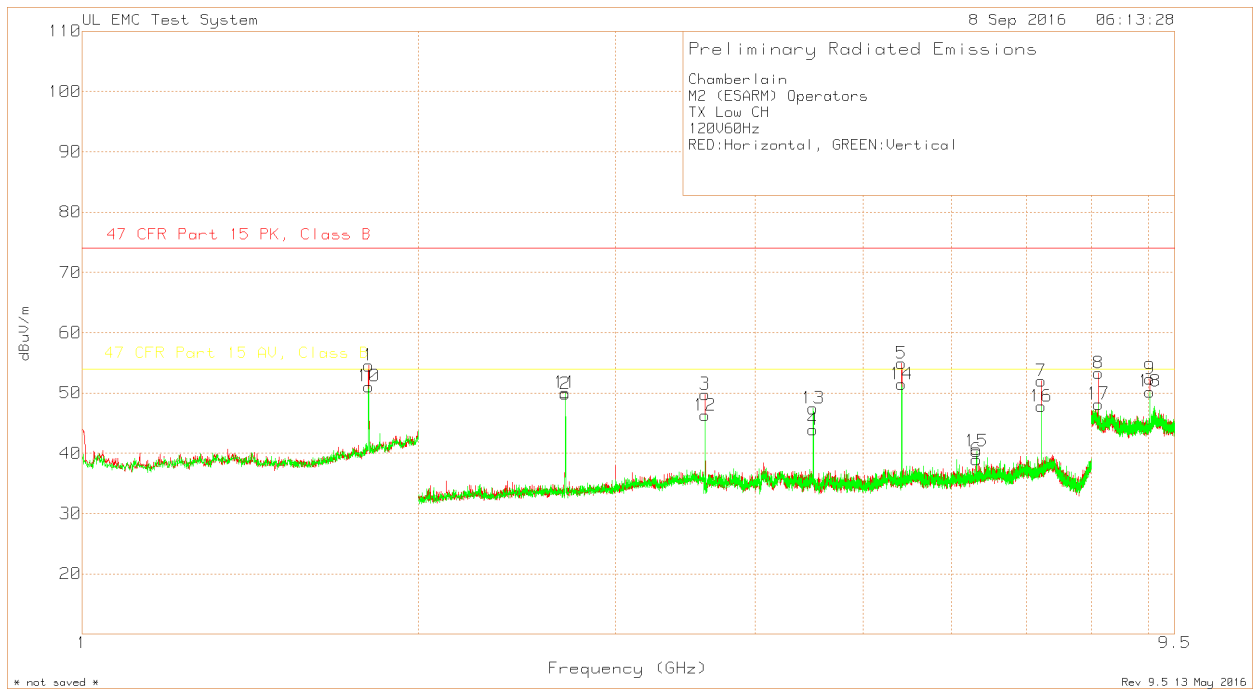
Pk - Peak detector

Radiated Emission Data

Test Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor dBm	Path dB	10M to 3M Factor dB	BRF 900MHz dB	Corrected Reading dB(uVolts/ meter)	QP Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
117.09584	41.26 Qp	13.1	-29.8	10.5	-	35.06	43.52	-8.46	244	394	H
120.01344	46.59 Qp	13.3	-29.7	10.5	-	40.69	43.52	-2.83	70	389	H
123.48026	40.74 Qp	13.6	-29.7	10.5	-	35.14	43.52	-8.38	82	381	H
62.57024	50.44 Qp	6.6	-30	10.5	-	37.54	40	-2.46	0	238	V
60.0122	49.06 Qp	7.1	-29.9	10.5	-	36.76	40	-3.24	313	238	V
67.6994	49.86 Qp	6.5	-30	10.5	-	36.86	40	-3.14	326	233	V
98.9235	42.29 Qp	10.6	-29.9	10.5	-	33.49	43.52	-10.03	92	124	V
107.4173	41.86 Qp	11.7	-29.8	10.5	-	34.26	43.52	-9.26	101	101	V
144.81862	41.25 Qp	14.2	-29.6	10.5	-	36.35	43.52	-7.17	274	102	V
176.23178	36.6 Qp	15.1	-29.3	10.5	-	32.9	43.52	-10.62	348	101	V
186.68402	38.82 Qp	15.9	-29.1	10.5	-	36.12	43.52	-7.4	40	101	V
338.24362	46.65 Qp	14.5	-28.7	10.5	0.2	43.15	46.02	-2.87	321	260	H

Qp - Quasi-Peak detector

1GHz – 10GHz, Low channel



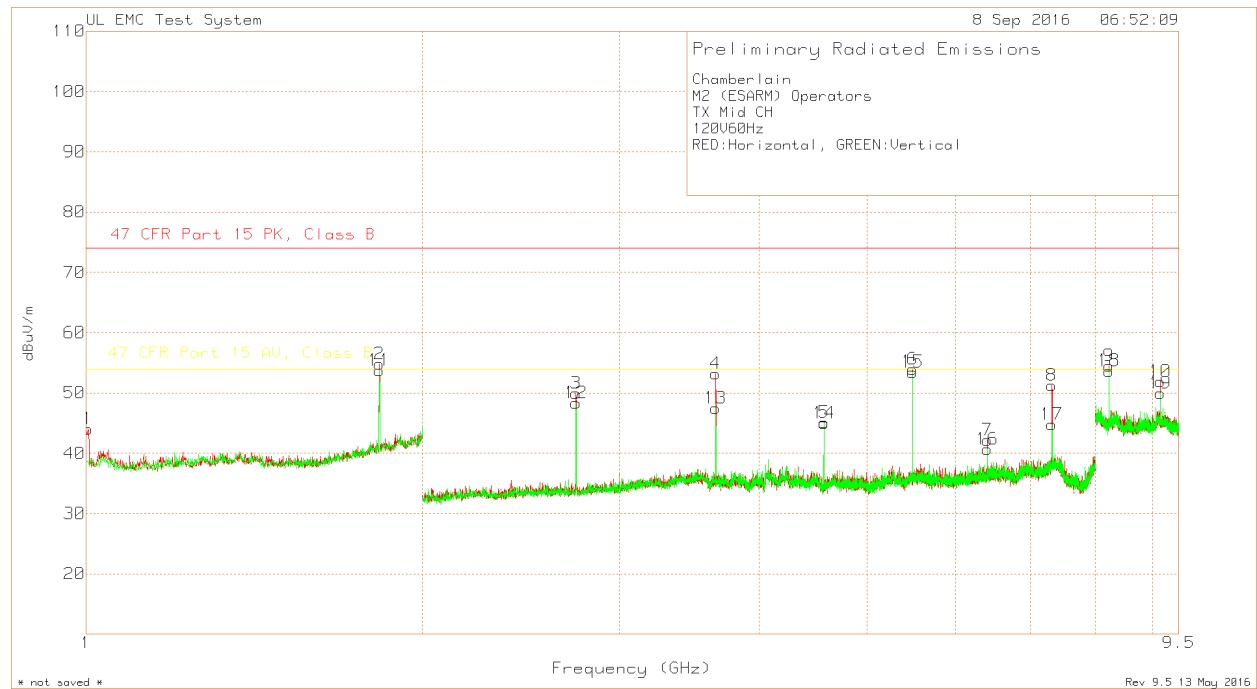
Chamberlain
M2 (ESARM) Operators
TX Low CH
120V60Hz
RED:Horizontal, GREEN:Vertical

Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor dBrn	900MHz					Hopping		AV					Height [cm]	Polarity
				BRF Factor dB	Path (dB)	PK Level dBuV/m	PK Limit	Pk Margin (dB)	Duty Cycle Correction Factor dB	AV Level dBuV/m	AV Limit	Margin (dB)	Azimuth [Degs]				
														Detector	Factor dBm		
1	1.805	78.83 Pk	30.3	0.3	-54.88	54.55	74	-19.45	-37.65	16.9	54	-37.1	0-360	150	H		
2	2.707	78.66 Pk	22.1	-	-50.95	49.81	74	-24.19	-37.65	12.16	54	-41.84	0-360	100	H		
3	3.609	76.92 Pk	23.2	-	-50.34	49.78	74	-24.22	-37.65	12.13	54	-41.87	0-360	100	H		
4	4.511	67.97 Pk	27.8	-	-51.86	43.91	74	-30.09	-37.65	6.26	54	-47.74	0-360	148	H		
5	5.413	77.28 Pk	27.9	-	-50.26	54.92	74	-19.08	-37.65	17.27	54	-36.73	0-360	102	H		
6	6.316	57.49 Pk	29.2	-	-47.74	38.95	74	-35.05	-37.65	1.3	54	-52.7	0-360	148	H		
7	7.218	68.56 Pk	29.8	-	-46.35	52.01	74	-21.99	-37.65	14.36	54	-39.64	0-360	148	H		
8	8.12	64.84 Pk	36.2	-	-47.78	53.26	74	-20.74	-37.65	15.61	54	-38.39	0-360	150	H		
9	9.023	66.03 Pk	36.1	-	-49.77	52.36	74	-21.64	-37.65	14.71	54	-39.29	0-360	150	H		
10	1.805	75.36 Pk	30.3	0.3	-54.88	51.08	74	-22.92	-37.65	13.43	54	-40.57	0-360	150	V		
11	2.706	78.91 Pk	22.1	-	-50.94	50.07	74	-23.93	-37.65	12.42	54	-41.58	0-360	99	V		
12	3.609	73.4 Pk	23.2	-	-50.34	46.26	74	-27.74	-37.65	8.61	54	-45.39	0-360	99	V		
13	4.511	71.49 Pk	27.8	-	-51.86	47.43	74	-26.57	-37.65	9.78	54	-44.22	0-360	150	V		
14	5.413	73.84 Pk	27.9	-	-50.26	51.48	74	-22.52	-37.65	13.83	54	-40.17	0-360	150	V		
15	6.316	58.9 Pk	29.2	-	-47.74	40.36	74	-33.64	-37.65	2.71	54	-51.29	0-360	150	V		
16	7.218	64.36 Pk	29.8	-	-46.35	47.81	74	-26.19	-37.65	10.16	54	-43.84	0-360	150	V		
17	8.121	59.76 Pk	36.2	-	-47.81	48.15	74	-25.85	-37.65	10.5	54	-43.5	0-360	99	V		
18	9.023	63.89 Pk	36.1	-	-49.77	50.22	74	-23.78	-37.65	12.57	54	-41.43	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



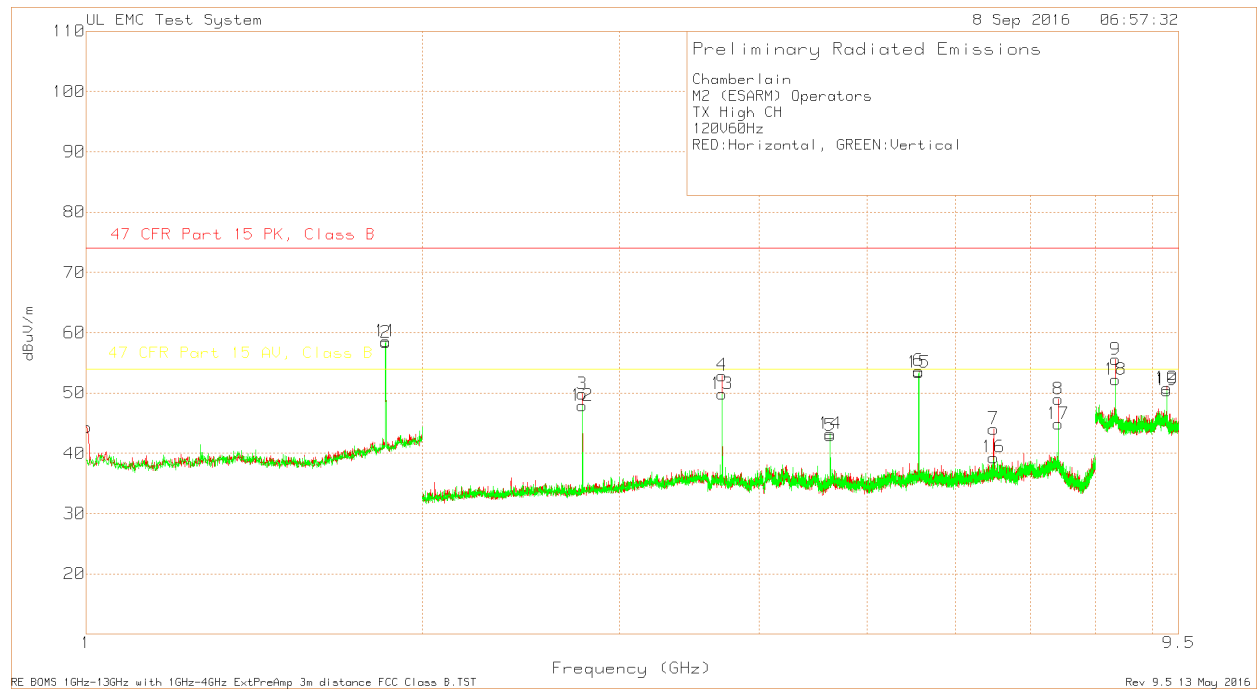
Chamberlain
M2 (ESARM) Operators
TX Mid CH
120V60Hz
RED:Horizontal, GREEN:Vertical

Marker No.	Test Frequency (GHz)	Meter Reading (dBuV) Detector	900MHz		Antenna Factor dBm	BRF Factor dB	Path (dB)	PK Level dBuV/m	PK Limit	Pk Margin (dB)	Hopping		AV Level dBuV/m	AV Limit (dB)	Azimuth [Degs]	Height [cm]	Polarity
			Factor	Factor							Duty Cycle Correction	Factor dB					
1	1.004	72.94 Pk			27.5	0.8	-57.26	43.98	74	-30.02	-	-	54	-10.02	0-360	150 H	
2	1.83	78.55 Pk			30.5	0.4	-54.66	54.79	74	-19.21	-37.65	17.14	54	-36.86	0-360	150 H	
3	2.744	78.76 Pk			22.1	-	-50.89	49.97	74	-24.03	-37.65	12.32	54	-41.68	0-360	100 H	
4	3.66	79.13 Pk			23.4	-	-49.37	53.16	74	-20.84	-37.65	15.51	54	-38.49	0-360	150 H	
5	4.574	69.23 Pk			27.7	-	-51.86	45.07	74	-28.93	-37.65	7.42	54	-46.58	0-360	148 H	
6	5.488	75.93 Pk			28.1	-	-50.06	53.97	74	-20.03	-37.65	16.32	54	-37.68	0-360	102 H	
7	6.403	60.68 Pk			29.2	-	-47.68	42.2	74	-31.8	-37.65	4.55	54	-49.45	0-360	102 H	
8	7.318	66.62 Pk			30.6	-	-46.01	51.21	74	-22.79	-37.65	13.56	54	-40.44	0-360	148 H	
9	8.232	66.77 Pk			36.4	-	-48.7	54.47	74	-19.53	-37.65	16.82	54	-37.18	0-360	99 H	
10	9.147	63.95 Pk			36.3	-	-48.38	51.87	74	-22.13	-37.65	14.22	54	-39.78	0-360	150 H	
11	1.83	77.47 Pk			30.5	0.4	-54.66	53.71	74	-20.29	-37.65	16.06	54	-37.94	0-360	150 V	
12	2.744	77.14 Pk			22.1	-	-50.89	48.35	74	-25.65	-37.65	10.7	54	-43.3	0-360	99 V	
13	3.659	73.43 Pk			23.4	-	-49.39	47.44	74	-26.56	-37.65	9.79	54	-44.21	0-360	99 V	
14	4.574	69.17 Pk			27.7	-	-51.86	45.01	74	-28.99	-37.65	7.36	54	-46.64	0-360	150 V	
15	5.489	75.38 Pk			28.1	-	-50.04	53.44	74	-20.56	-37.65	15.79	54	-38.21	0-360	100 V	
16	6.403	59.15 Pk			29.2	-	-47.68	40.67	74	-33.33	-37.65	3.02	54	-50.98	0-360	100 V	
17	7.318	60.18 Pk			30.6	-	-46.01	44.77	74	-29.23	-37.65	7.12	54	-46.88	0-360	100 V	
18	8.232	65.96 Pk			36.4	-	-48.7	53.66	74	-20.34	-37.65	16.01	54	-37.99	0-360	100 V	
19	9.1475	62.05 Pk			36.3	-	-48.38	49.97	74	-24.03	-37.65	12.32	54	-41.68	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
M2 (ESARM) Operators
TX High CH
120V60Hz
RED:Horizontal, GREEN:Vertical

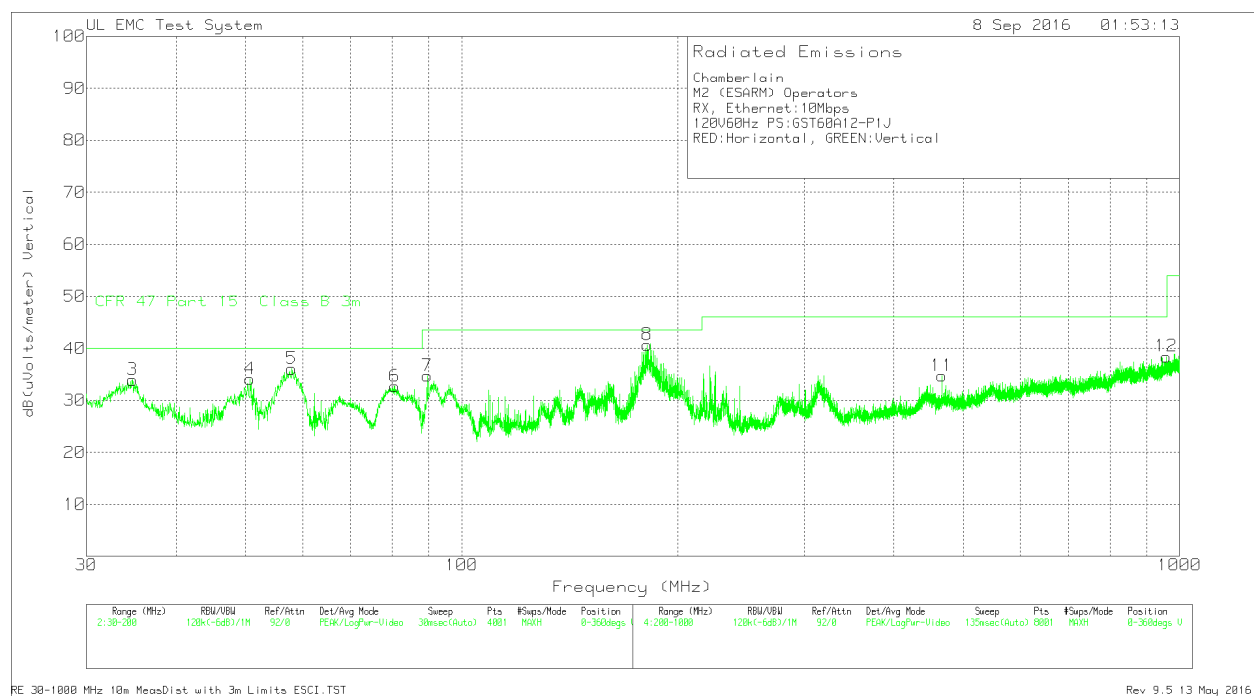
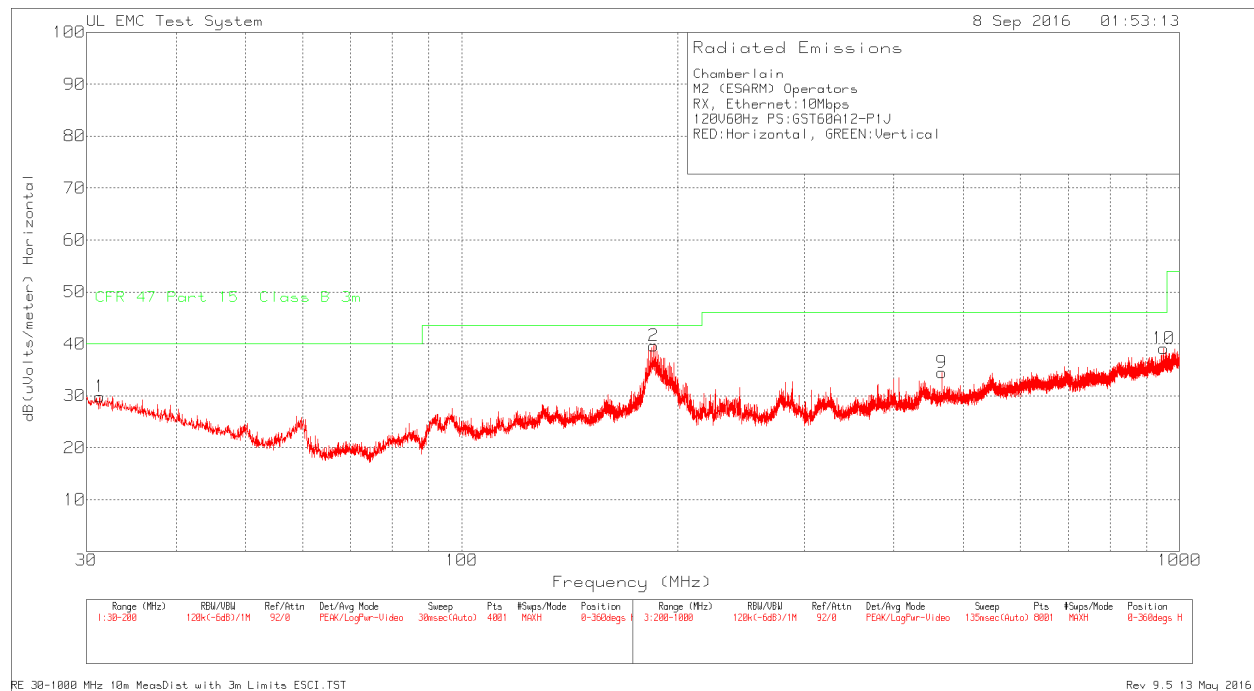
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV) Detector	Antenna Factor dBm	BRF Factor dB	Path (dB)	PK Level dBuV/m	PK Limit	Pk Margin (dB)	Hopping Duty Cycle		AV Level dBuV/m	AV Limit (dB)	Azimuth [Degs]	Height [cm]	Polarity
									Correction Factor dB						
1	1.001	73.28 Pk	27.5	0.8	-57.26	44.32	74	-29.68	-	-	54	-9.68	0-360	150 H	
2	1.854	82.01 Pk	30.7	0.3	-54.65	58.36	74	-15.64	-37.65	20.71	54	-33.29	0-360	150 H	
3	2.78	78.36 Pk	22.2	-	-50.73	49.83	74	-24.17	-37.65	12.18	54	-41.82	0-360	100 H	
4	3.707	79.01 Pk	23.5	-	-49.6	52.91	74	-21.09	-37.65	15.26	54	-38.74	0-360	100 H	
5	4.634	66.97 Pk	27.7	-	-51.73	42.94	74	-31.06	-37.65	5.29	54	-48.71	0-360	148 H	
6	5.561	74.84 Pk	28.3	-	-49.47	53.67	74	-20.33	-37.65	16.02	54	-37.98	0-360	102 H	
7	6.488	62.36 Pk	29.1	-	-47.41	44.05	74	-29.95	-37.65	6.4	54	-47.6	0-360	102 H	
8	7.414	65.16 Pk	31	-	-47.18	48.98	74	-25.02	-37.65	11.33	54	-42.67	0-360	102 H	
9	8.341	66.28 Pk	36.5	-	-47.25	55.53	74	-18.47	-37.65	17.88	54	-36.12	0-360	99 H	
10	9.267	63.03 Pk	36.4	-	-48.61	50.82	74	-23.18	-37.65	13.17	54	-40.83	0-360	99 H	
11	1.854	82.21 Pk	30.7	0.3	-54.65	58.56	74	-15.44	-37.65	20.91	54	-33.09	0-360	150 V	
12	2.78	76.43 Pk	22.2	-	-50.73	47.9	74	-26.1	-37.65	10.25	54	-43.75	0-360	100 V	
13	3.707	75.94 Pk	23.5	-	-49.6	49.84	74	-24.16	-37.65	12.19	54	-41.81	0-360	100 V	
14	4.634	67.26 Pk	27.7	-	-51.73	43.23	74	-30.77	-37.65	5.58	54	-48.42	0-360	150 V	
15	5.561	74.59 Pk	28.3	-	-49.47	53.42	74	-20.58	-37.65	15.77	54	-38.23	0-360	99 V	
16	6.488	57.63 Pk	29.1	-	-47.41	39.32	74	-34.68	-37.65	1.67	54	-52.33	0-360	150 V	
17	7.415	61.04 Pk	31	-	-47.18	44.86	74	-29.14	-37.65	7.21	54	-46.79	0-360	150 V	
18	8.34	62.95 Pk	36.5	-	-47.24	52.21	74	-21.79	-37.65	14.56	54	-39.44	0-360	100 V	
19	9.268	62.65 Pk	36.4	-	-48.61	50.44	74	-23.56	-37.65	12.79	54	-41.21	0-360	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



Chamberlain
M2 (ESARM) Operators
RX, Ethernet:10Mbps
120V60Hz PS:GST60A12-P1J
RED:Horizontal, GREEN:Vertical

Marker No.	Test Frequency (MHz)	Meter		Antenna		10M to 3M Factor dB	Corrected Reading dB(uVolts/meter)	QP Limit	QP		Azimuth [Degs]	Height [cm]	Polarity
		Reading (dBuV)	Detector	Factor dBm	Path dB				Margin (dB)				
1	31.3175	31.69	Pk	17.6	-30	10.5	29.79	40	-10.21	0-360		398	H
2	184.9975	42.44	Pk	15.8	-29.1	10.5	39.64	43.52	-3.88	0-360		398	H
3	34.76	37.13	Pk	16.3	-30	10.5	33.93	40	-6.07	0-360		101	V
4	50.74	43.47	Pk	10.1	-30	10.5	34.07	40	-5.93	0-360		251	V
5	57.965	47.96	Pk	7.6	-30	10.5	36.06	40	-3.94	0-360		251	V
6	80.6175	44.72	Pk	7.4	-29.9	10.5	32.72	40	-7.28	0-360		398	V
7	89.5	44.91	Pk	9.2	-29.9	10.5	34.71	43.52	-8.81	0-360		251	V
8	181.215	43.89	Pk	15.5	-29.2	10.5	40.69	43.52	-2.83	0-360		101	V
9	466.7	35.09	Pk	17	-28.1	10.5	34.49	46.02	-11.53	0-360		199	H
10	950.6	32.51	Pk	23.5	-27.4	10.5	39.11	46.02	-6.91	0-360		98	H
11	466.6	35.33	Pk	17	-28.1	10.5	34.73	46.02	-11.29	0-360		399	V
12	957.9	31.64	Pk	23.6	-27.3	10.5	38.44	46.02	-7.58	0-360		99	V

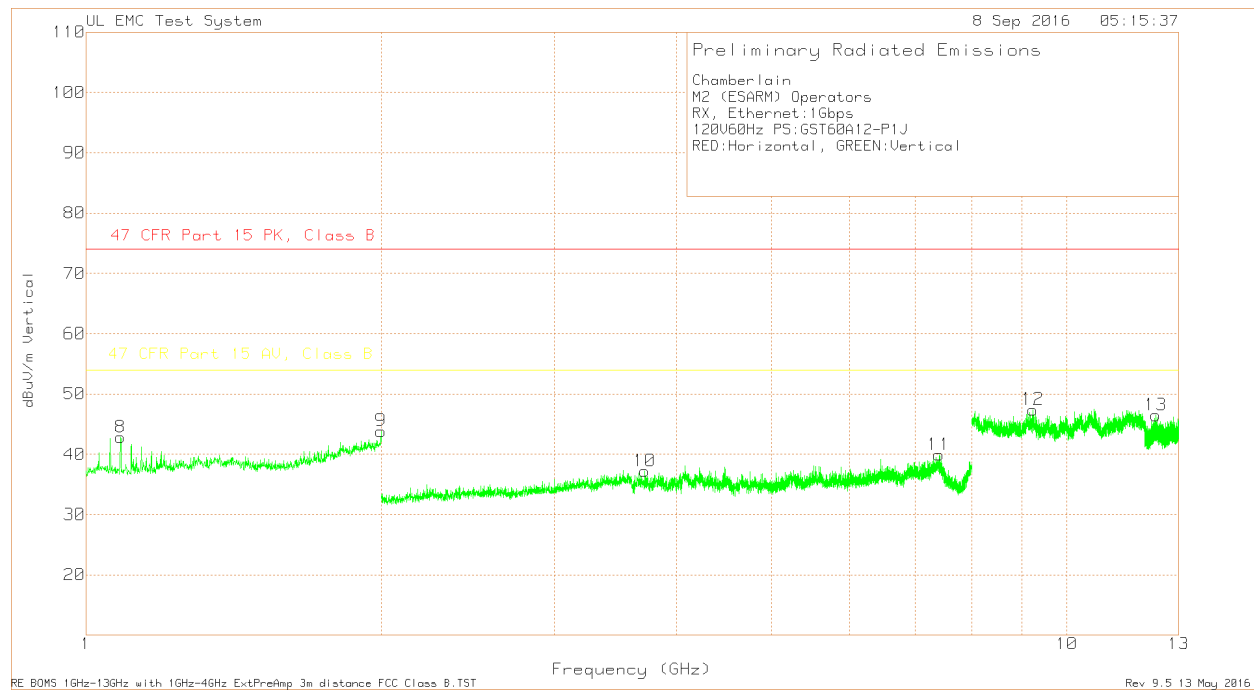
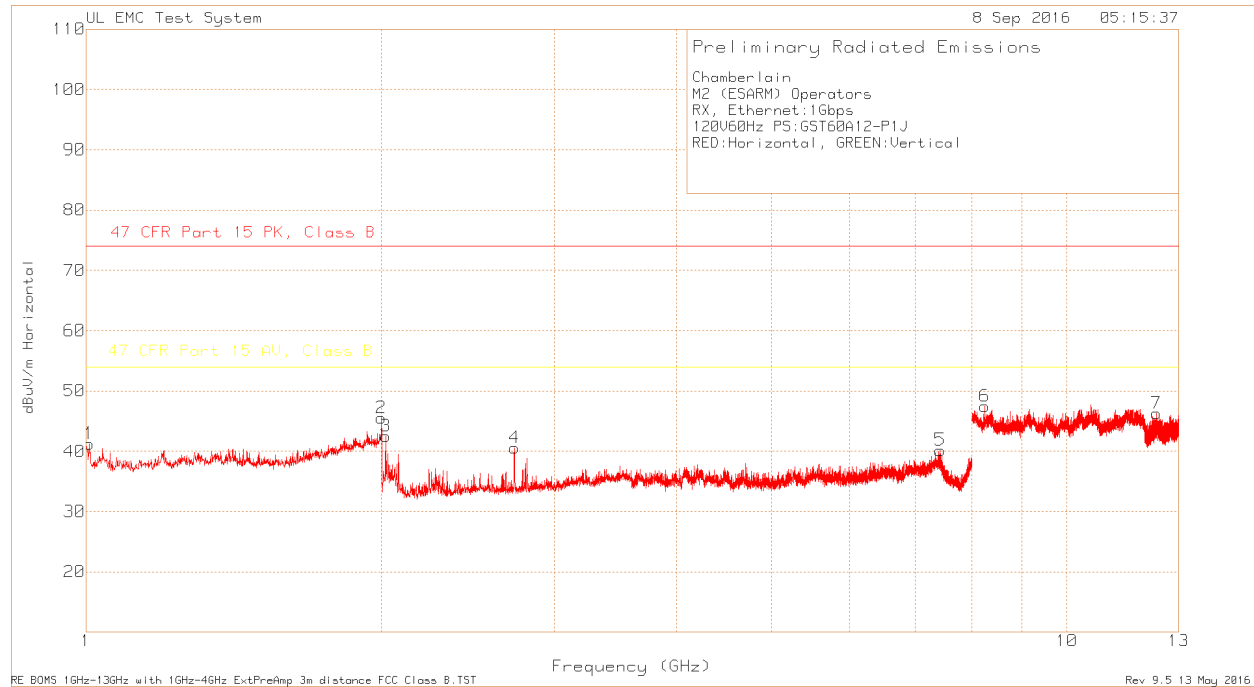
Pk - Peak detector

Radiated Emission Data

Test Frequency (MHz)	Meter		Antenna		10M to 3M Factor dB	Corrected Reading dB(uVolts/meter)	QP Limit	QP		Azimuth [Degs]	Height [cm]	Polarity
	Reading (dBuV)	Detector	Factor dBm	Path dB				Margin (dB)				
184.981125	41.8	Qp	15.8	-29.1	10.5	39	43.52	-4.52		327	332	H
181.0928	43.21	Qp	15.5	-29.2	10.5	40.01	43.52	-3.51		63	101	V
58.136	44.32	Qp	7.6	-30	10.5	32.42	40	-7.58		213	251	V
50.3965	38.77	Qp	10.2	-30	10.5	29.47	40	-10.53		193	100	V

Qp - Quasi-Peak detector

1GHz – 10GHz



Chamberlain
M2 (ESARM) Operators
RX, Ethernet:1Gbps
120V60Hz PS:GST60A12-P1J
RED:Horizontal, GREEN:Vertical

	Test	Meter		Antenna		Corrected		PK		AV			
Marker	Frequency	Reading		Factor	Path	Reading	PK	Margin	AV	Margin	Azimuth	Height	
No.	(GHz)	(dBuV)	Detector	dBm	(dB)	dBuV/m	Limit	(dB)	Limit	(dB)	[Degs]	[cm]	Polarity
1	1.007	71	Pk		27.5	-57.26	41.24	74	-32.76	54	-12.76	0-360	150 H
2	2	67.71	Pk		31.8	-54	45.51	74	-28.49	54	-8.49	0-360	150 H
3	2.02	73.98	Pk		21.2	-52.67	42.51	74	-31.49	54	-11.49	0-360	99 H
4	2.734	69.35	Pk		22.1	-50.9	40.55	74	-33.45	54	-13.45	0-360	99 H
5	7.427	56.48	Pk		30.8	-47.11	40.17	74	-33.83	54	-13.83	0-360	101 H
6	8.247	59.48	Pk		36.4	-48.44	47.44	74	-26.56	54	-6.56	0-360	150 H
7	12.3408	51.91	Pk		39.4	-45.01	46.3	74	-27.7	54	-7.7	0-360	99 H
8	1.084	72.85	Pk		27.6	-57.61	42.84	74	-31.16	54	-11.16	0-360	99 V
9	1.998	66.06	Pk		31.8	-54.01	43.85	74	-30.15	54	-10.15	0-360	150 V
10	3.712	63.32	Pk		23.6	-49.74	37.18	74	-36.82	54	-16.82	0-360	150 V
11	7.405	55.91	Pk		31.1	-47.07	39.94	74	-34.06	54	-14.06	0-360	99 V
12	9.232	58.77	Pk		36.4	-47.76	47.41	74	-26.59	54	-6.59	0-360	150 V
13	12.3267	52.38	Pk		39.4	-45.32	46.46	74	-27.54	54	-7.54	0-360	99 V

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.

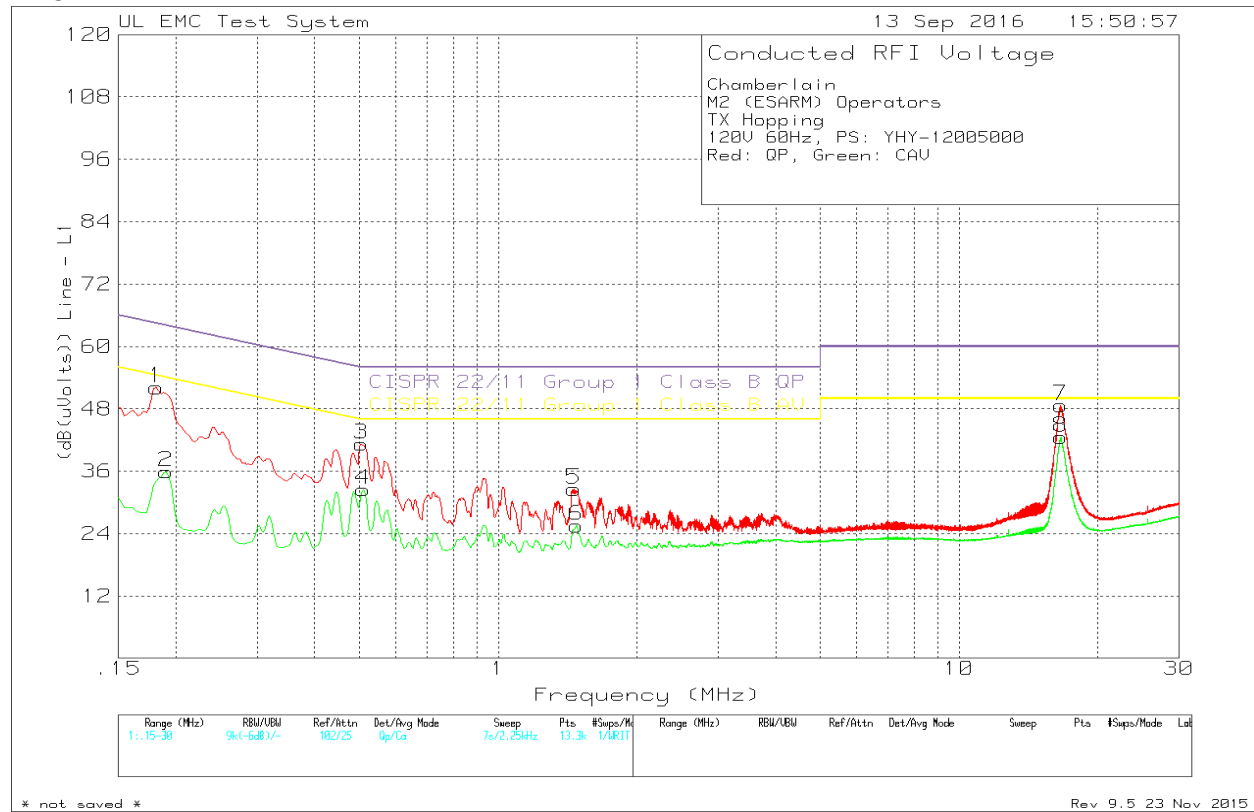
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

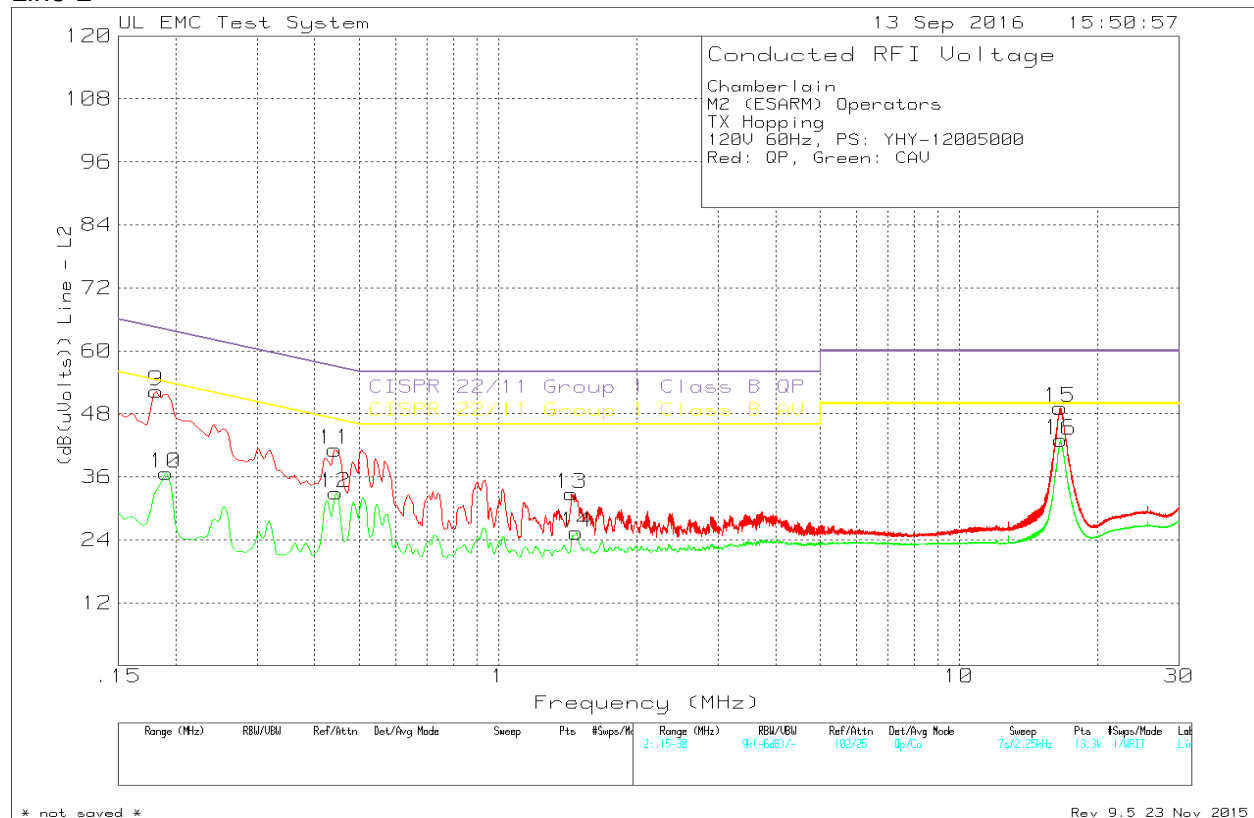
Line Conducted Emissions 150kHz – 30MHz

Power supply: YHY-1200500

Line-1



Line-2



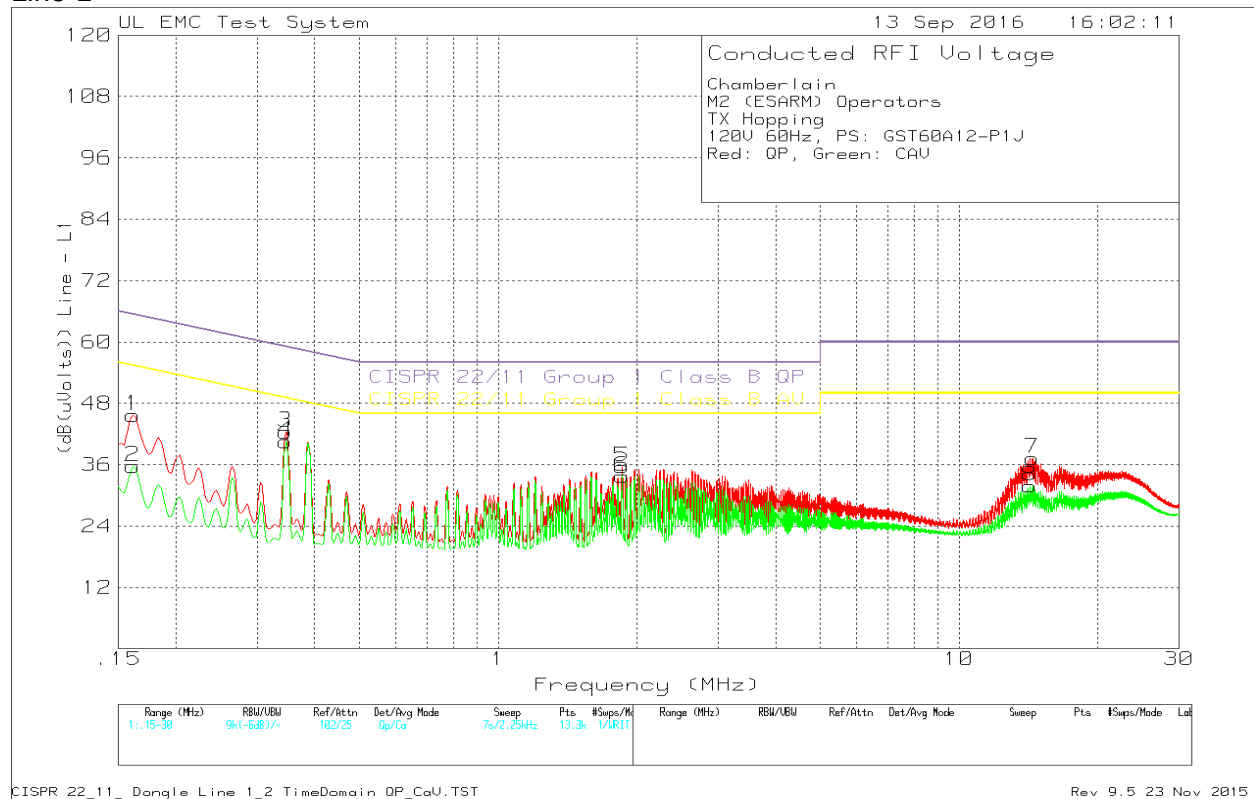
Chamberlain
M2 (ESARM) Operators
TX Hopping
120V 60Hz, PS: YHY-12005000
Red: QP, Green: CAV

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor dBm	Path dB	Corrected Reading dB(uVolts)	QP Limit	QP Margin (dB)	AV Limit	AV Margin (dB)
Range 1: Line - L1 .15 - 30MHz										
1	0.1815	40.26	Qp	0.1	11.7	52.06	64.42	-12.36	-	-
2	0.1905	24.32	Ca	0.1	11.5	35.92	-	-	54.01	-18.09
3	0.5055	30.55	Qp	0	10.7	41.25	56	-14.75	-	-
4	0.51	21.8	Ca	0	10.7	32.5	-	-	46	-13.5
5	1.4595	21.93	Qp	0	10.6	32.53	56	-23.47	-	-
6	1.47975	14.97	Ca	0	10.6	25.57	-	-	46	-20.43
7	16.5975	36.82	Qp	0	11.8	48.62	60	-11.38	-	-
8	16.6155	30.76	Ca	0	11.8	42.56	-	-	50	-7.44
Range 2: Line - L2 .15 - 30MHz										
9	0.1815	40.01	Qp	0.1	12.2	52.31	64.42	-12.11	-	-
10	0.1905	24.51	Ca	0.1	12.1	36.71	-	-	54.01	-17.3
11	0.4425	29.99	Qp	0	11.2	41.19	57.01	-15.82	-	-
12	0.44475	21.74	Ca	0	11.2	32.94	-	-	46.97	-14.03
13	1.4415	21.71	Qp	0	11.1	32.81	56	-23.19	-	-
14	1.4775	14.31	Ca	0	11.1	25.41	-	-	46	-20.59
15	16.566	36.85	Qp	0	12.3	49.15	60	-10.85	-	-
16	16.6065	30.7	Ca	0	12.3	43	-	-	50	-7

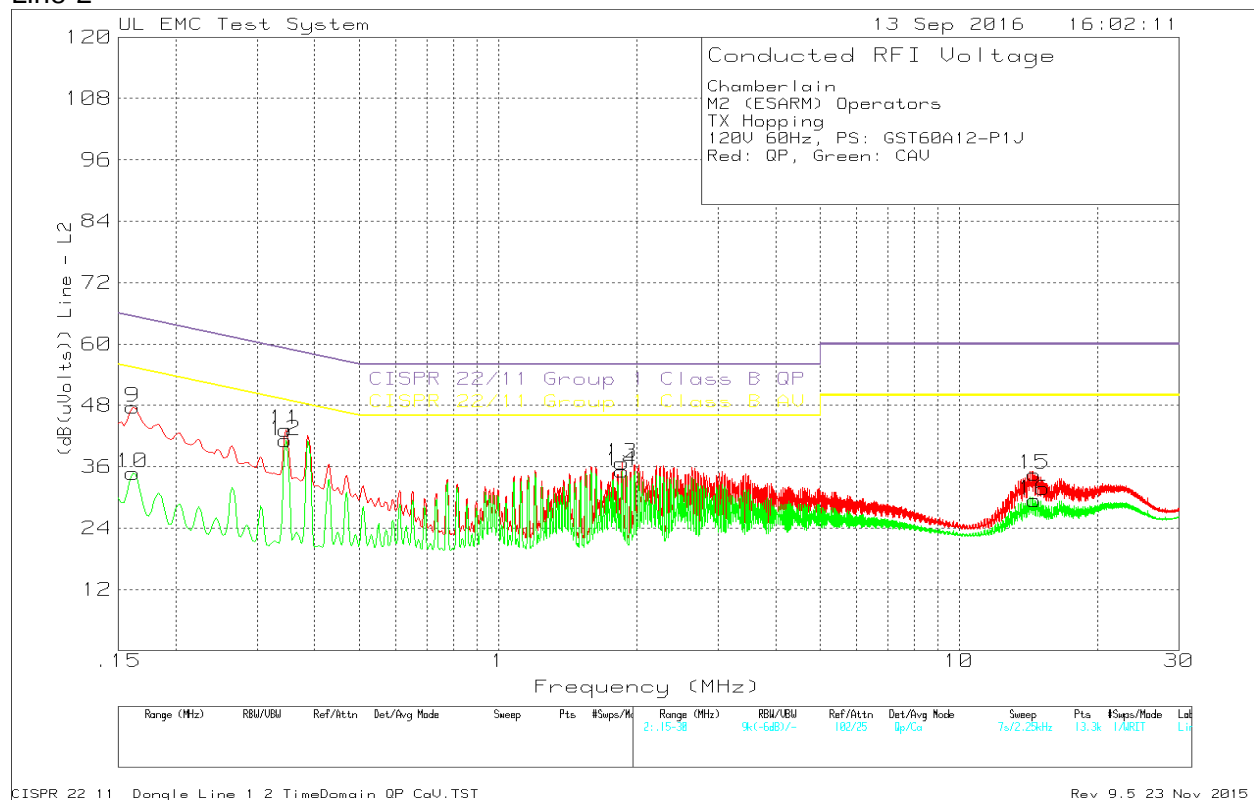
Qp - Quasi-Peak detector
Ca - CISPR Average detection

Power supply: GST60A12-P1J

Line-1



Line-2



Chamberlain
M2 (ESARM) Operators
TX Hopping
120V 60Hz, PS: GST60A12-P1J
Red: QP, Green: CAV

Marker No.	Test Frequency (MHz)	Meter Reading (dBUV) Detector	LISN Factor dBm	Path dB	Corrected Reading dB(uVolts)	QP Limit	QP Margin (dB)	AV Limit	AV Margin (dB)
Range 1: Line - L1 .15 - 30MHz									
1	0.16125	32.98 Qp	0.1	12.6	45.68	65.4	-19.72	-	-
2	0.16125	22.98 Ca	0.1	12.6	35.68	-	-	55.4	-19.72
3	0.34575	31.57 Qp	0	10.8	42.37	59.06	-16.69	-	-
4	0.34575	29.77 Ca	0	10.8	40.57	-	-	49.06	-8.49
5	1.85775	25 Qp	0	10.6	35.6	56	-20.4	-	-
6	1.8555	23.17 Ca	0	10.6	33.77	-	-	46	-12.23
7	14.41613	25.56 Qp	0.1	11.6	37.26	60	-22.74	-	-
8	14.22825	20.23 Ca	0.1	11.5	31.83	-	-	50	-18.17
Range 2: Line - L2 .15 - 30MHz									
9	0.16125	34.34 Qp	0.1	13.2	47.64	65.4	-17.76	-	-
10	0.16125	21.49 Ca	0.1	13.2	34.79	-	-	55.4	-20.61
11	0.34575	31.92 Qp	0	11.3	43.22	59.06	-15.84	-	-
12	0.34575	29.82 Ca	0	11.3	41.12	-	-	49.06	-7.94
13	1.85775	25.63 Qp	0	11.1	36.73	56	-19.27	-	-
14	1.8555	24.05 Ca	0	11.1	35.15	-	-	46	-10.85
15	14.559	22.33 Qp	0.1	12.1	34.53	60	-25.47	-	-
16	14.568	17.22 Ca	0.1	12.1	29.42	-	-	50	-20.58

Qp - Quasi-Peak detector
Ca - CISPR Average detection