FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

LEVITON MFG. CO. INC.
201 NORTH SERVICE ROAD
MELVILLE, NY 11747

EUT

LIGHT DIMMER

MODEL NUMBER: VRMX1, VRR15, DZR15, VRS15, DZS15, DZMX1

FCC ID: QGH-VRMX1
IC: 2473A-VRMX1

REPORT NUMBER: 4786592274

ISSUE DATE: 2014-11-10

Prepared for
LEVITON MFG. CO. INC.
201 NORTH SERVICE ROAD
MELVILLE, NY 11747

Prepared by
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NVLAP LAB CODE 100255-0

Revision History

Rev.		Issue Date		Revisions		Revised By
--		2014-11-10		Initial Issue		Joseph Danisi

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: **LEVITON MFG. CO. INC.**
201 NORTH SERVICE ROAD
MELVILLE, NY 11747

EUT DESCRIPTION: DIMMER

MODEL: VRMX1, VRR15, DZR15, VRS15, DZS15, DZMX1

SERIAL NUMBER: Non- Serailized

DATE TESTED: 2014-10-08 to 2014-11-10

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	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 By:

Bob DeLisi
WiSE Principal Engineer
UL

Tested By:

Joseph Danisi
WiSE Project Lead
UL

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1285 Walt Whitman Rd. Melville, NY 11747, USA.

UL Melville is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/1002550.htm.

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

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

Test	Uncertainty
Conducted Emissions (worst case 9kHz-30MHz)	2.0, k=2 (95%)
Radiated Emissions, 30-200MHz, Horizontal	3.6, k=2 (95%)
Radiated Emissions, 30-200MHz, Vertical	3.8, k=2 (95%)
Radiated Emissions, 200-1000MHz, Horizontal	2.8, k=2 (95%)
Radiated Emissions, 200-1000MHz, Vertical	3.7, k=2 (95%)
Radiated Emissions, 1-26GHz (worst case, Ground Plane)	5.7, k=2 (95%)

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Z-Wave dimmers and switches (VRMX1, DZMX1, VRS15, DZS15, VRR15 and DZR15) belong to Leviton Vizia RF family of devices based on Zensys RF Z-wave platform. They plug into an AC outlet and a load they control plugs into the outlet on the device itself. They provide users with the ability to remotely control external AC powered devices, like lamp, appliances and etc.

The radio module is manufactured by Leviton Mfg. Co. Inc.

In addition based on the manufacturer Leviton the VRMX1 will be the representative sample and it is there responsibility that the model numbers listed below perform as the one evaluated. The RF circuit is identical between each model VRR15, DZR15, VRS15, DZS15, and DZMX1 the only difference is as follows:

Difference between logic PCB's OX-77964 and OX-81939 difference between power PCBs: OX-77965, OX-81941 and OX-81991.

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	Output PK E-field Strength (dBuV/m)
908.4	Constant packet	89.07

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral antenna, permanently attached PCB.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was U01 Sigma Designs (formerly Zensys) their part no. ZM3102 4.54 patch 2 firmware rev. 1.0 U02 Microchip their part no. PIC16F1933I/SS firmware rev. 1.0

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case orientation was determined as the X-Axis and configured and evaluated throughout tests.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Dimmer	Leviton	VRMX1	Non serilaized	QGH-VRMX1
Load	-	-	-	Incandescent light bulb

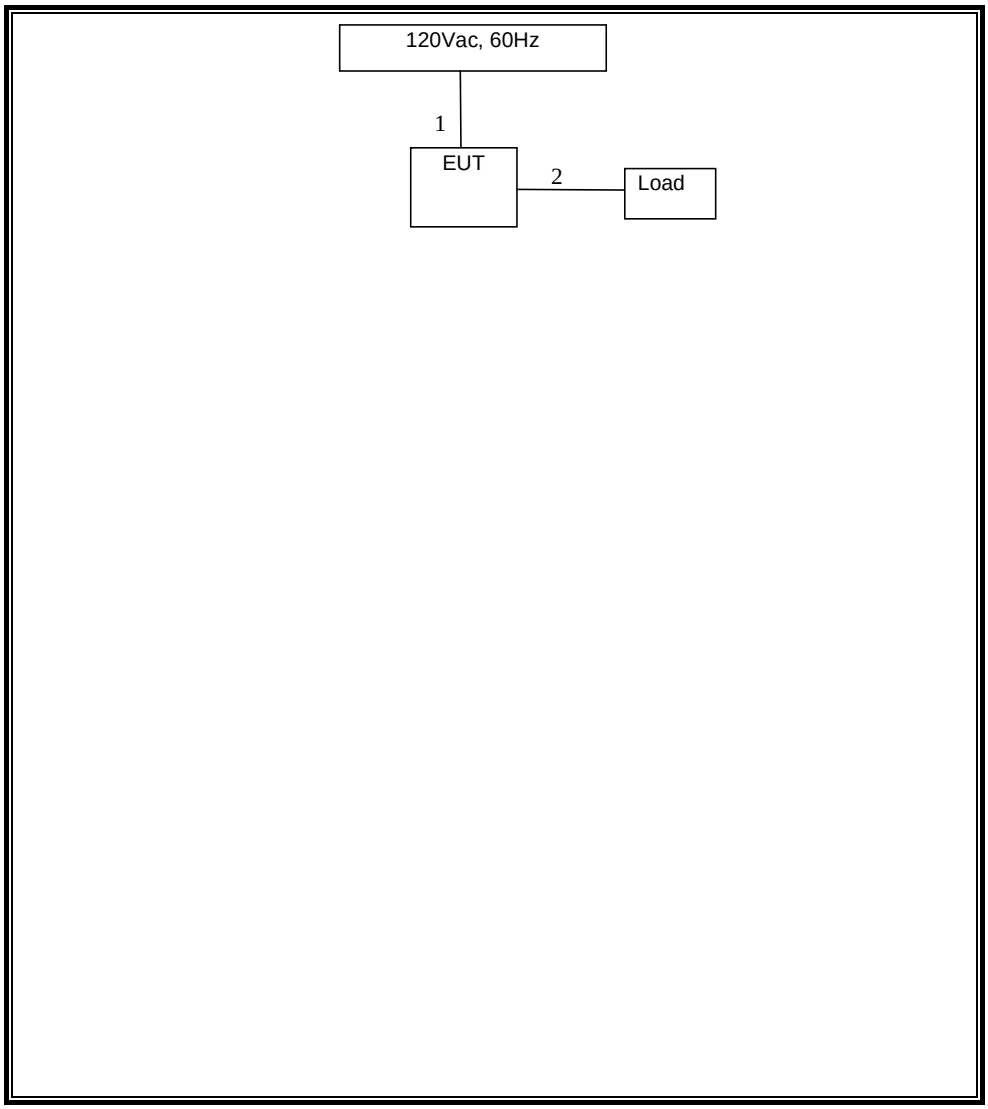
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	1	1	AC	Wire	1	None
2	2	1	Load	Wire	1.5	None

TEST SETUP

The EUT was tested as intended in a typically installation with the light Dimmer attached to AC power with an incandescent Light to simulate a typically load condition.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
Conducted Emissions – GP 1					
EMI Receiver	Rohde & Schwarz	ESR	85496	2014-05-23	2015-05-23
LISN	Solar	9252-50-R-24-BNC	ME5A-636	2014-01-28	2015-01-31
Switch Driver	HP	11713A	44397	N/A	N/A
RF Switch Box	UL	4	44404	N/A	N/A
Measurement Software	UL	Version 9.5	44736	N/A	N/A
Temp/Humidity/ Pressure Meter	Cole Parmer	99760-00	43734	2014-03-24	2016-03-24
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31

Bench Tests					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
RF Room 1					
Spectrum Analyzer	Agilent	E4446A	72823	2014-01-28	20145-01-31
Dipole Antenna	EMCO	3121C	3359	2014-01-10	2015-01-10
Temp/Humidity/ Pressure Meter	Cole Parmer	99760-00	4268	2012-12-21	2014-12-21
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31

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Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESCI 7	75141	2014-01-29	2015-01-31
Bicon Antenna	Schaffner	VBA6106A	54	2013-04-03	2014-04-03
Log-P Antenna	Schaffner	UPA6109	44067	2013-07-09	2014-07-09
Bias Tee	Miteq	AM-1523-7687	44392	N/A	N/A
Bias Tee	Miteq	AM-1523-7687	44393	N/A	N/A
Preamp	Miteq	AM-3A-000110-7687	44391	N/A	N/A
Preamp	Miteq	AM-3A-000110-7687	44394	N/A	N/A
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/ Pressure Meter	Cole Parmer	99760-00	4268	2012-12-21	2014-12-21

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31
Above 1GHz (Band Optimized System)					
Spectrum Analyzer	Agilent	E4446A	72823	2014-01-28	20145-01-31
Horn Antenna (1-2GHz)	ETS	3161-01 (26°)**	51442	2008-03-28	See * below
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07 (26°)**	8933	2008-11-24	See * below
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/ Pressure Meter	Cole Parmer	99760-00	4268	2012-12-21	2014-12-21
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31

* - Note: As allowed by the calibration standard ANSI C63.4 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration.

Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances.

** - Number in parentheses denotes antenna beam width.

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

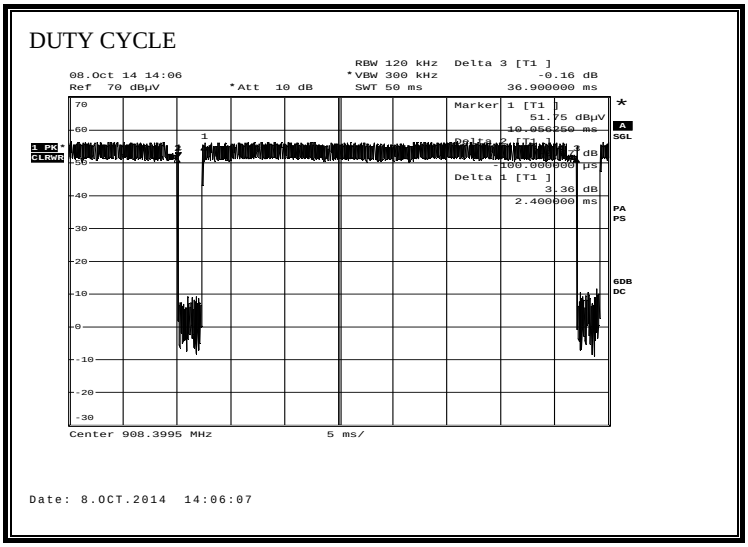
None; for reporting purposes only.

7.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
908.4MHz	36.90	39.30	0.939	93.89%	0.27	0.027

7.2. DUTY CYCLE PLOTS

908 MHz BAND



8. TEST RESULTS

8.1. 20 dB AND 99% BW

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

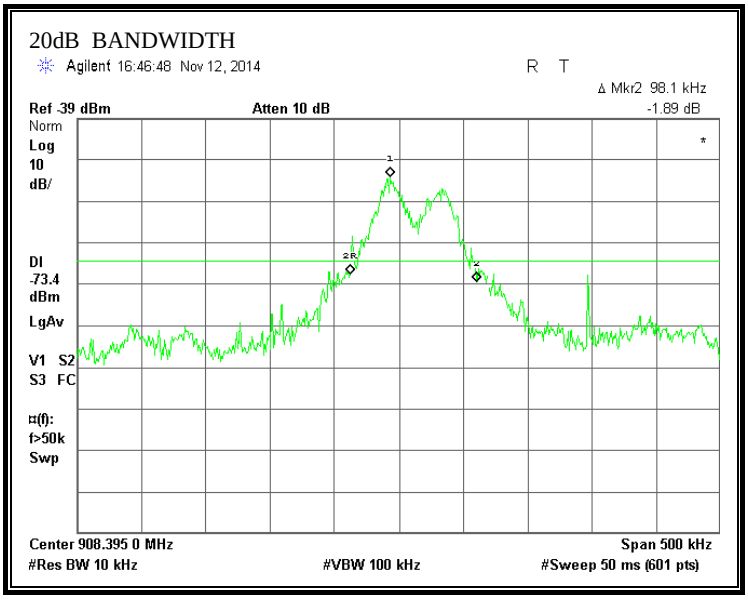
20dB Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
908.4	98.1	2271	-2172.9

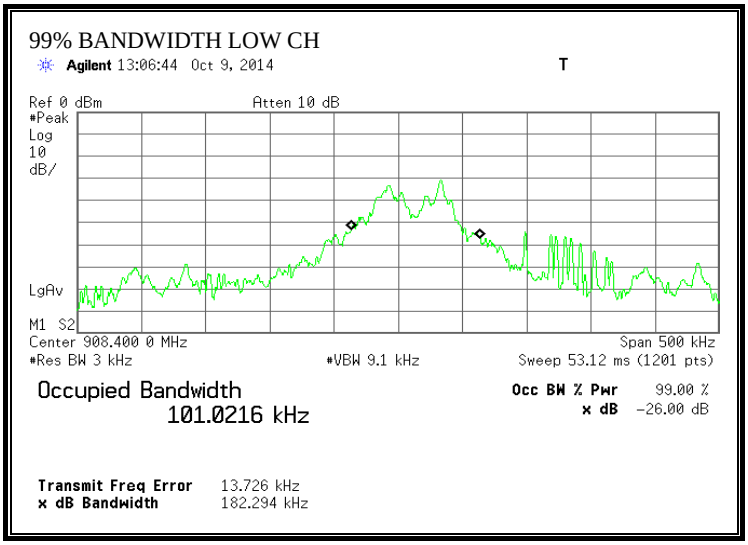
99% Bandwidth

Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
908.4	101	2271	-2170

20dB BANDWIDTH



99% BANDWIDTH



8.2 RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4:2009

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ, and 24.0–24.25 GHz.
(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

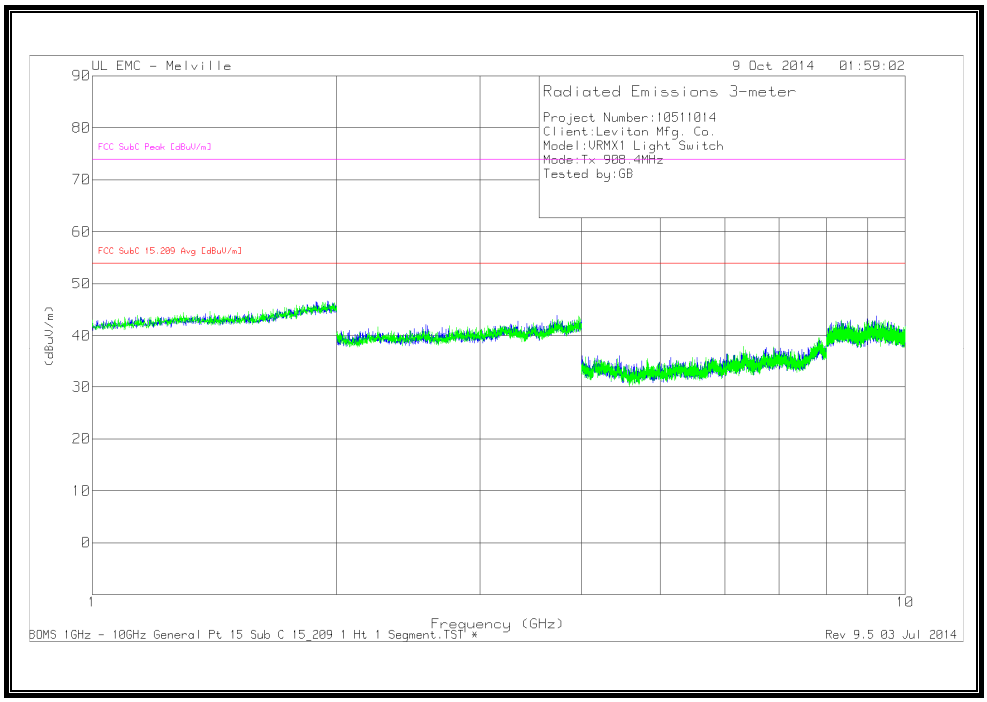
RESULTS

8.2.1 FUNDAMENTAL FREQUENCY RADIATED EMISSION

Horizontal / Vertical 200 - 1000MHz										
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	AF-84106 [dB/m]	GL [dB]	Corrected Reading (dBuV/m)	FCC Part 15 Subpart C 15.249 [dBuV/m]	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
908.3773	61.27	PK	23	4.8	89.07	94	-4.93	66	100	H
908.3773	58.02	PK	23	4.8	85.82	94	-8.18	319	111	V

PK - Peak detector

8.2.2 HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz



Note: No spurious emissions observed above the system noise floor

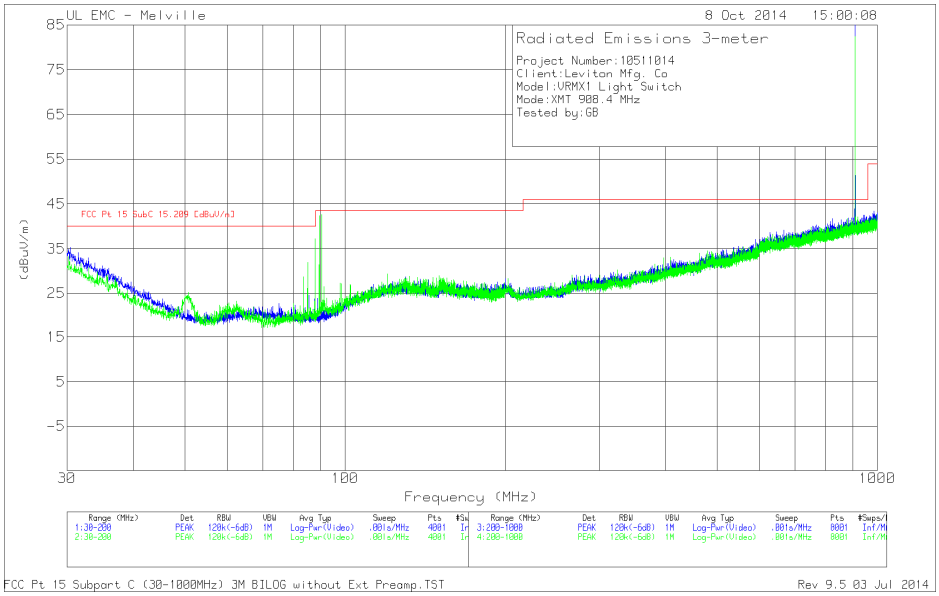
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.948	62.99	PK	27.4	-43.76	46.63	54	-7.37	74	-27.37	0-360	101	H
2.572	62.7	PK	21.3	-41.82	42.18	54	-11.82	74	-31.82	0-360	101	H
3.338	61.23	PK	22.1	-40.56	42.77	54	-11.23	74	-31.23	0-360	101	H
3.729	62.21	PK	22.3	-40.64	43.87	54	-10.13	74	-30.13	0-360	101	H
4.452	61.29	PK	27.5	-52.86	35.93	54	-18.07	74	-38.07	0-360	101	H
6.328	62.12	PK	27.9	-52.07	37.95	54	-16.05	74	-36.05	0-360	101	V

PK - Peak detector

8.2.3 WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (HORIZONTAL AND VERTICAL)

HORIZONTAL AND VERTICAL PLOT



Vertical and Horizontal Data

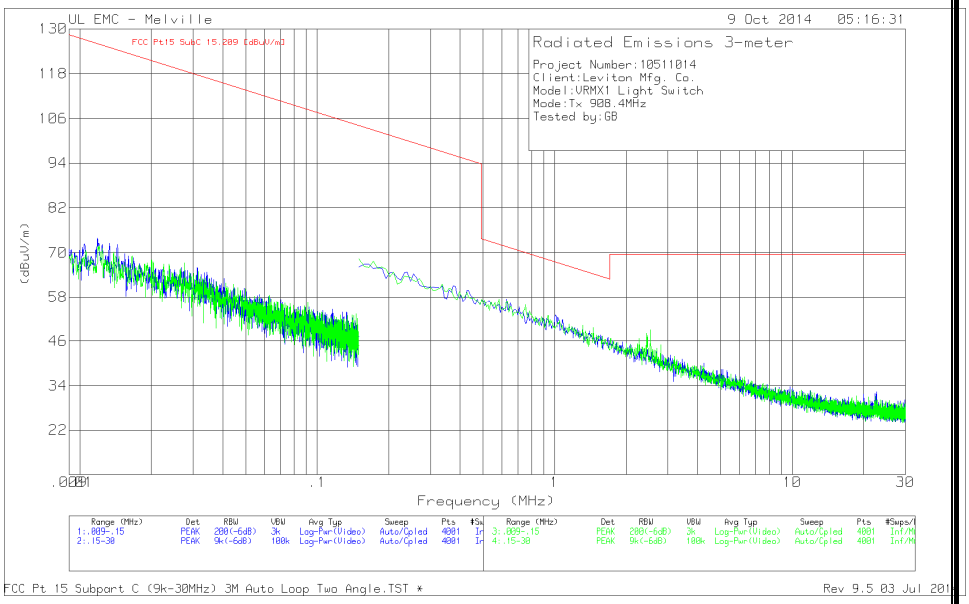
Frequency (MHz)	Meter Reading (dBuV)	Det	AF-84106 [dB/m]	GL [dB]	Corrected Reading (dBuV/m)	FCC Pt 15 SubC 15.209 [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
87.595	-1.06	QP	8.3	1.3	8.54	40	-31.46	55	183	V
89.415	-1.95	QP	8.6	1.3	7.95	43.5	-35.55	143	311	V
90.35	4.57	QP	8.9	1.3	14.77	43.5	-28.73	40	126	V
85.0375	-2.6	QP	8.1	1.3	6.8	40	-33.2	342	187	V

QP - Quasi-Peak detector

8.2.4 WORST-CASE BELOW 30 MHz

SPURIOUS EMISSIONS 9KHZ TO 30MHz

PLOT



Two Angles Data

Frequency (MHz)	Meter Reading (dBuV)	Det	AF-5A288 [dB/m]	GL-3M [dB]	Corrected Reading (dBuV/m)	FCC Pt15 SubC 15.209 [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
.01187	44.95	PK	28.8	.2	73.95	126.1	-52.15	0-360	100	H
.0313	43.62	PK	22.2	.2	66.02	117.68	-51.66	0-360	100	H
1.00825	36.2	PK	16.4	.4	53	67.53	-14.53	0-360	100	H
5.12036	21.57	PK	16.3	.5	38.37	69.5	-31.13	0-360	100	H
9.77727	16.65	PK	16.6	.5	33.75	69.5	-35.75	0-360	100	H
22.60617	14.31	PK	16.8	.6	31.71	69.5	-37.79	0-360	100	H
.02759	44.07	PK	22.9	.2	67.17	118.78	-51.61	0-360	145	H
2.5307	32.26	PK	16.3	.4	48.96	69.5	-20.54	0-360	145	H

PK - Peak detector

9. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207 (a)
IC RSS-GEN, Section 7.2.2

Frequency of emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50
* Decreases with the logarithm of the frequency.		

TEST PROCEDURE

ANSI C63.4

RESULTS

No non-compliance noted:

5 WORST EMISSIONS

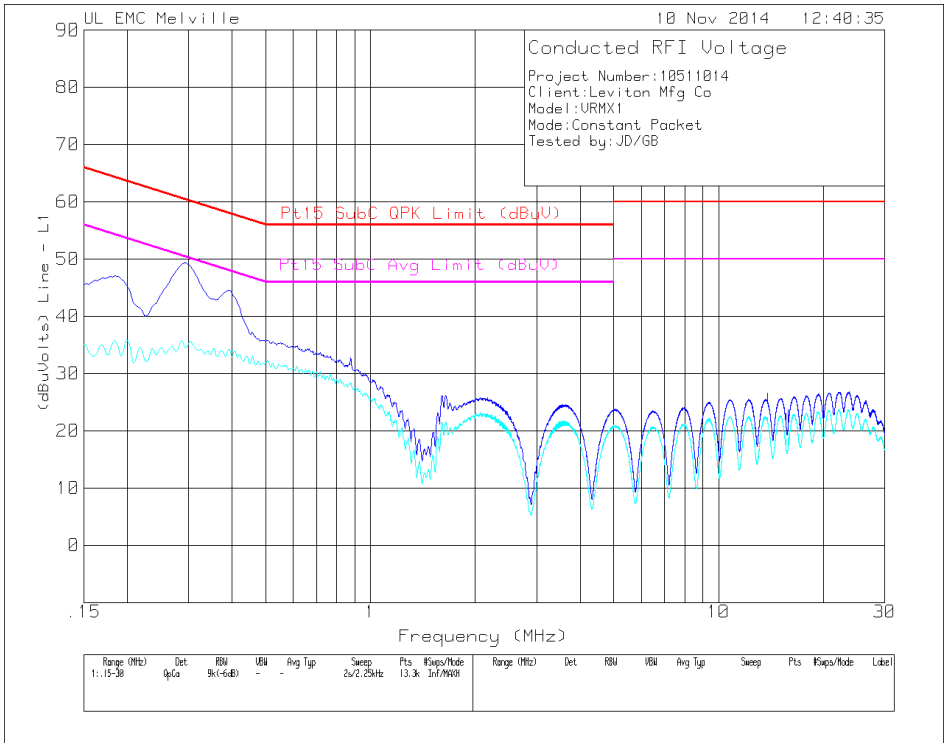
Frequency (MHz)	Meter Reading (dBuV)	Det	L1 (dB)	Corrected Reading (dBuVolts)	Pt15 SubC QPK Limit (dBuV)	QP Margin (dB)	Pt15 SubC Avg Limit (dBuV)	Av(CISPR)Margin (dB)
.18375	25.89	Ca	9.9	35.79	-	-	54.31	-18.52
.29175	24.96	Ca	9.9	34.86	-	-	50.47	-15.61
.39075	24.33	Ca	9.9	34.23	-	-	48.05	-13.82
1.63725	11.11	Ca	10	21.11	-	-	46	-24.89
2.28525	12.24	Ca	10	22.24	-	-	46	-23.76
3.651	11.47	Ca	10.1	21.57	-	-	46	-24.43
4.98975	10.74	Ca	10.1	20.84	-	-	46	-25.16
6.43425	10.4	Ca	10.2	20.6	-	-	50	-29.4
.18375	37.17	Qp	9.9	47.07	64.31	-17.24	-	-
.29288	39.41	Qp	9.9	49.31	60.44	-11.13	-	-
.39075	34.6	Qp	9.9	44.5	58.05	-13.55	-	-
1.63725	15.83	Qp	10	25.83	56	-30.17	-	-
2.28525	14.78	Qp	10	24.78	56	-31.22	-	-
3.65213	14.35	Qp	10.1	24.45	56	-31.55	-	-
4.98975	13.56	Qp	10.1	23.66	56	-32.34	-	-
6.43425	13.23	Qp	10.2	23.43	60	-36.57	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

Frequency (MHz)	Meter Reading (dBuV)	Det	Neutral (dB)	Corrected Reading (dBuVolts)	Pt15 SubC QPK Limit (dBuV)	QP Margin (dB)	Pt15 SubC Avg Limit (dBuV)	Av(CISPR)Margin (dB)
.18375	25.14	Ca	9.9	35.04	-	-	54.31	-19.27
.2895	24.61	Ca	9.9	34.51	-	-	50.54	-16.03
.393	23.63	Ca	9.9	33.53	-	-	48	-14.47
.8745	18.12	Ca	10	28.12	-	-	46	-17.88
1.62375	10.41	Ca	10	20.41	-	-	46	-25.59
2.15025	14.58	Ca	10	24.58	-	-	46	-21.42
3.61725	13.11	Ca	10.1	23.21	-	-	46	-22.79
5.03925	12.05	Ca	10.1	22.15	-	-	50	-27.85
6.43425	10.9	Ca	10.2	21.1	-	-	50	-28.9
.18375	37.83	Qp	9.9	47.73	64.31	-16.58	-	-
.29288	38.93	Qp	9.9	48.83	60.44	-11.61	-	-
.393	34.63	Qp	9.9	44.53	58	-13.47	-	-
.8745	22.42	Qp	10	32.42	56	-23.58	-	-
1.62825	15.41	Qp	10	25.41	56	-30.59	-	-
2.148	17.32	Qp	10	27.32	56	-28.68	-	-
3.61725	16.07	Qp	10.1	26.17	56	-29.83	-	-
5.037	14.91	Qp	10.1	25.01	60	-34.99	-	-
6.43425	13.77	Qp	10.2	23.97	60	-36.03	-	-

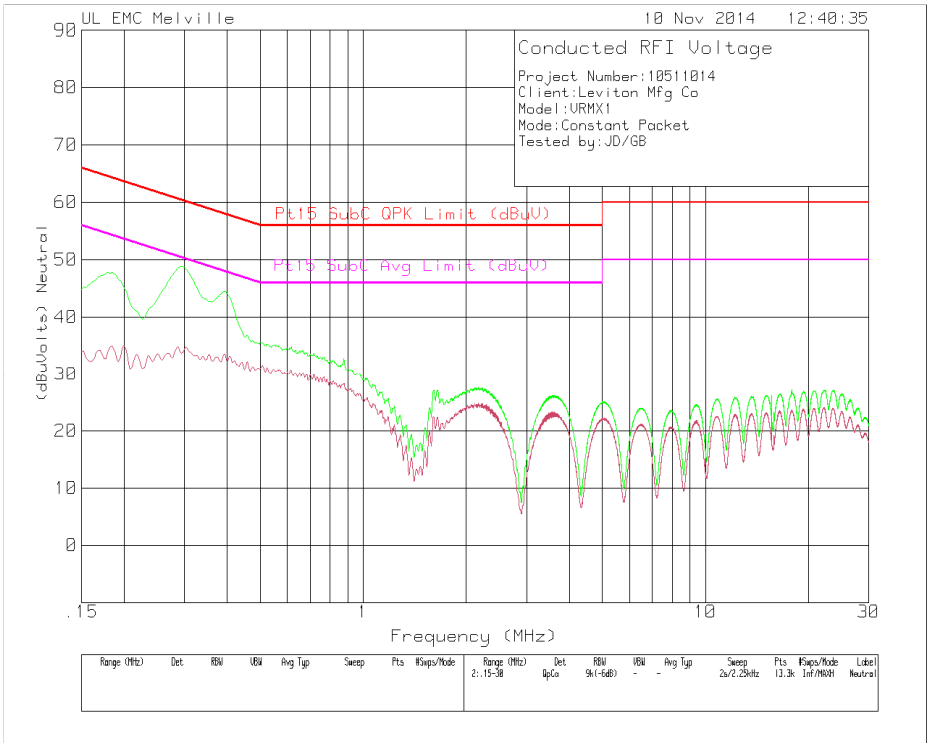
Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS



Blue-QP; Cyan-CISPR Avg.

LINE 2 RESULTS

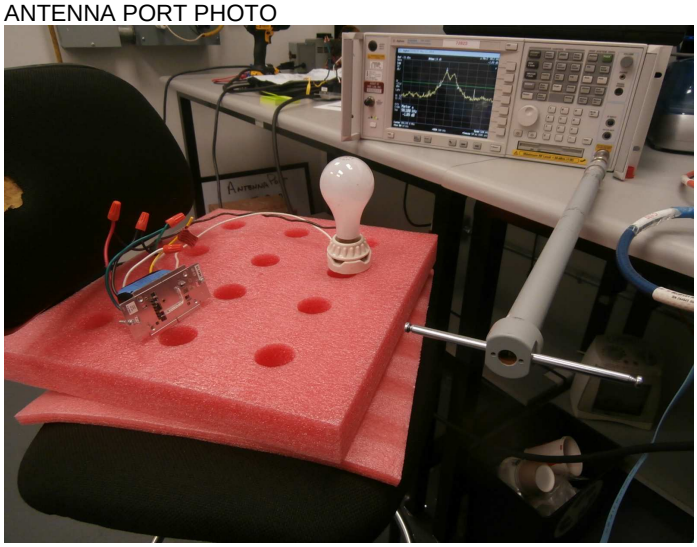


Green-QP; Red-CISPR Avg.

10. SETUP PHOTOS

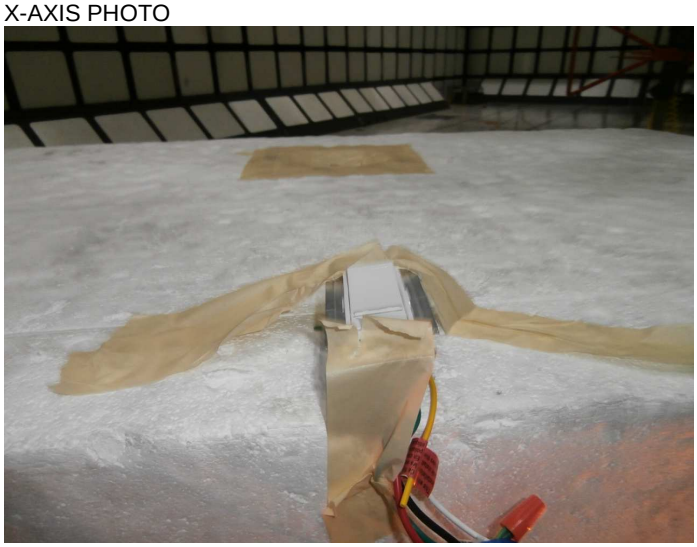
ANTENNA PORT MEASUREMENT SETUP

ANTENNA PORT PHOTO



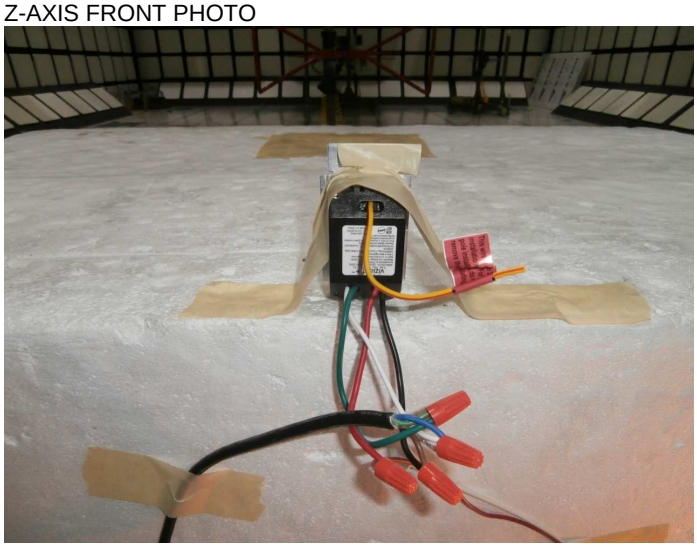
RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION

X-AXIS PHOTO



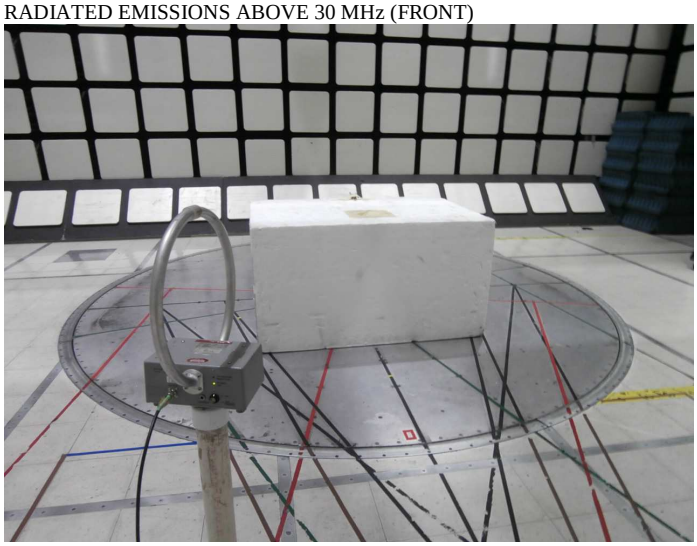
Y-AXIS PHOTO

Z-AXIS FRONT PHOTO

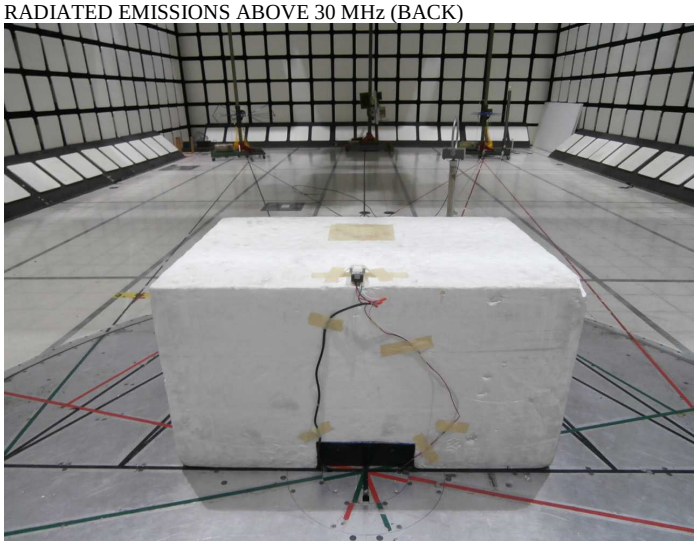


RADIATED EMISSION BELOW 30 MHz

RADIATED EMISSIONS ABOVE 30 MHz (FRONT)

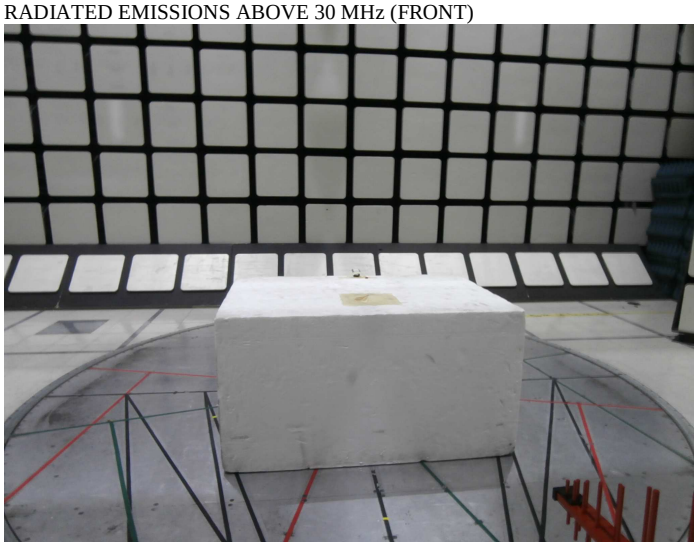


RADIATED EMISSIONS ABOVE 30 MHz (BACK)

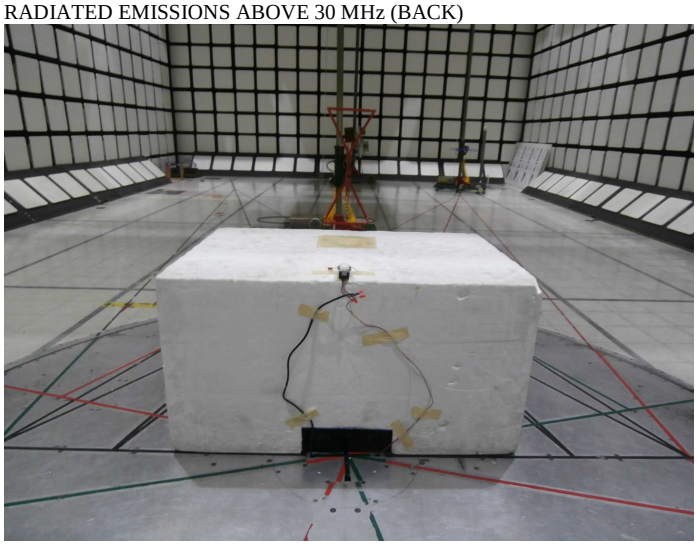


RADIATED EMISSION ABOVE 30 MHz

RADIATED EMISSIONS ABOVE 30 MHz (FRONT)

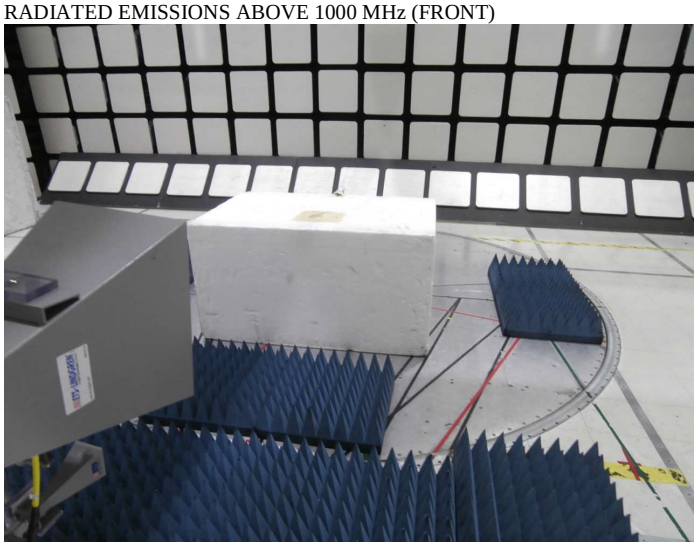


RADIATED EMISSIONS ABOVE 30 MHz (BACK)

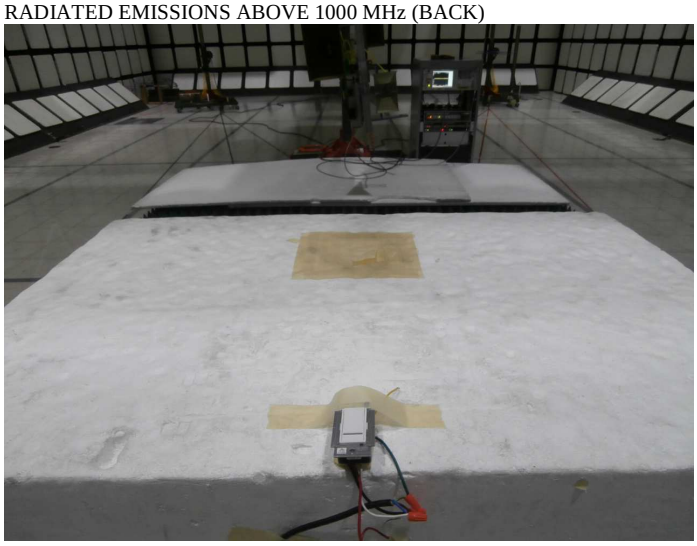


RADIATED EMISSION ABOVE 1000MHz

RADIATED EMISSIONS ABOVE 1000 MHz (FRONT)

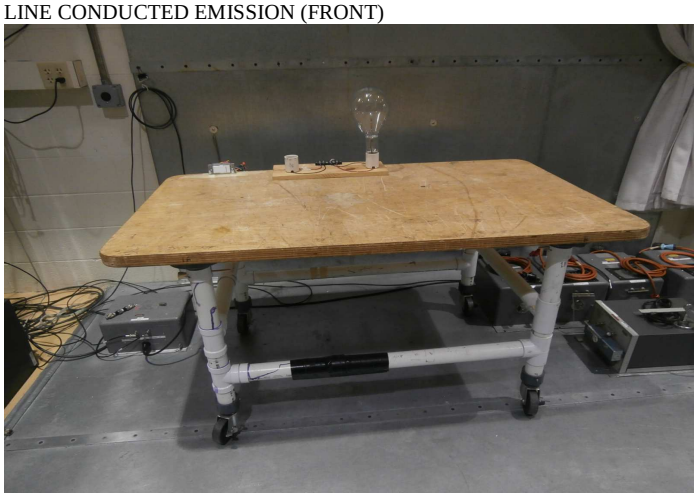


RADIATED EMISSIONS ABOVE 1000 MHz (BACK)

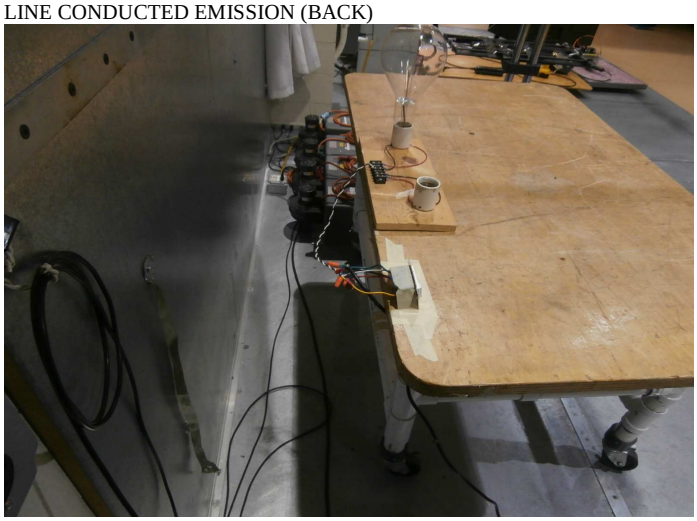


AC MAINS LINE CONDUCTED EMISSION

LINE CONDUCTED EMISSION (FRONT)



LINE CONDUCTED EMISSION (BACK)



END OF REPORT