



**FCC CFR47 PART 15 SUBPART C
ISED CANADA RSS-210 ISSUE 10**

CERTIFICATION TEST REPORT

FOR

WIRELESS LED/FLUORESCENT LIGHT CONTROLLER

MODEL NUMBER: RMJS-5T-347, RMJS-5T-347-EM

**FCC ID: JPZ0130
IC: 2851A-JPZ0130**

REPORT NUMBER: R13424287-E1

ISSUE DATE: 2020-09-03

**Prepared for
LUTRON ELECTRONICS CO. INC.
7200 SUTER ROAD
COOPERSBURG, PA 18036-1249, USA**

**Prepared by
UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709 USA
TEL: (919) 549-1400**



REVISION HISTORY

Ver.	Issue Date	Revisions	Revised By
1	2020-08-29	Initial Issue	Brian T. Kiewra
2	2020-09-01	Corrected FCC and ISED IDs and models	Lariah Ijames
3	2020-09-03	Updated test dates in Section 7.1	Brian T. Kiewra
4	2020-09-03	Updated test dates in Section 1	Brian T. Kiewra

TABLE OF CONTENTS

REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. DESCRIPTION OF AVAILABLE ANTENNAS	7
5.3. SOFTWARE AND FIRMWARE	7
5.4. WORST-CASE CONFIGURATION AND MODE	7
5.5. MODIFICATIONS	7
5.6. DESCRIPTION OF TEST SETUP	7
6. TEST AND MEASUREMENT EQUIPMENT	9
7. ANTENNA PORT TEST RESULTS	11
7.1. 20 dB AND 99% BW	11
7.2. DUTY CYCLE	14
7.3. TRANSMISSION TIME	16
8. RADIATED EMISSION TEST RESULTS	17
8.1. TX RADIATED SPURIOUS EMISSION	17
8.1.1. FUNDAMENTAL MEASUREMENTS	20
8.1.2. TX SPURIOUS EMISSIONS (0.009-30MHz – WORST CASE)	21
8.1.3. HARMONICS AND TX SPURIOUS EMISSIONS (30 - 5000MHz)	22
9. AC MAINS LINE CONDUCTED EMISSIONS	34
10. SETUP PHOTOS	37
END OF TEST REPORT	42

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Lutron Electronics Co. Inc.
7200 Suter Road
Coopersburg, PA 18036-1249, USA

EUT DESCRIPTION: Wireless LED/Fluorescent Light Controller

MODEL: RMJS-5T-347, RMJS-5T-347-EM

SERIAL NUMBER: 02EB289D, 02EB28A0

DATE TESTED: 2020-06-16 to 2020-08-28

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Complies
ISED CANADA RSS-210 Issue 10, Annex A	Complies
ISED CANADA RSS-GEN Issue 5	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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, or any agency of the U.S. government.

Approved & Released
For UL LLC By:



Bob Delisi
Principal Engineer
UL – Consumer Technology Division

Prepared By:



Brian T. Kiewra
Project Engineer
UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 5, and RSS-210 Issue 10.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
<input type="checkbox"/> Chamber A	<input checked="" type="checkbox"/> Chamber North
<input type="checkbox"/> Chamber C	<input checked="" type="checkbox"/> Chamber South

The above test sites and facilities are covered under FCC Test Firm Registration # 703469.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0.

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

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Final Voltage (dBuV)} &= \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor} \\ &\text{(dB)} + \text{LISN Insertion Loss.} \\ 36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} &= 46.6 \text{ dBuV}\end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	2.00%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
RF output power, radiated (SAC)	4.52 dB
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	3.05 dB
All emissions, radiated	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless lighting control product.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a loop antenna, with a nominal gain of -9dBd.

5.3. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 0798934 8.02.

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT fundamental was investigated in two orientations, X and Y. It was determined that Y-Axis was worst-case orientation. Therefore, all radiated testing was performed with the EUT in the Y-Axis.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DESCRIPTION OF TEST SETUP

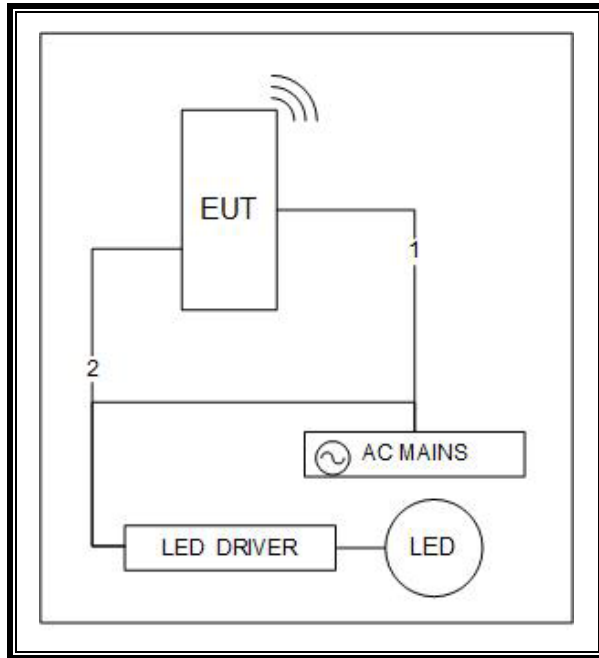
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
LED	Cree	LMH020-2000-30G0-00001TW	1LN112B06429	NA
LED Power Supply	OSRAM	OTi 50/347/1A4 DIM-1 L	20072G57651M	NA

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Mains	1	Quick connect	Mains	<3m	Connects to AC mains
2	Load out	1	Quick connect	single conductor	<3m	Connects to load (LED and driver)

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 - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0059	Active Loop Antenna	EMCO	6502	2020-08-06	2021-08-06
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
1-18 GHz					
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
Gain-Loss Chains					
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-04-24	2021-04-24
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-04-24	2021-04-24
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-03-15	2021-03-15
Receiver & Software					
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2020-03-27	2021-03-27
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
MM0168	Multimeter	Agilent	U1232A	2019-08-23	2020-08-23
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA

Test Equipment Used – Occupied Bandwidth (Morrisville - North Chamber Control Room)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
MM0168	Multimeter	Agilent	U1232A	2020-08-19	2021-08-19
PS214	AC Power Source	Elgar	CW2501M	NA	NA

Test Equipment Used - Timing Test Equipment (Morrisville - South Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2020-03-27	2021-03-27
PS215	AC Power Source	Elgar	CW2501M	NA	NA
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

Test Equipment Used RTP - Conducted Disturbance Emissions – Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Equipment – Ground Plane E					
85496	EMI Test Receiver 9kHz-3.6GHz	Rohde & Schwarz	ESR3	2020-08-18	2021-08-18
CBL004	Coaxial cable, 20 ft., BNC-male to BNC-male	UL	RG-223	2020-07-23	2021-07-23
HI0085	Temp/Humid/Pressure Meter	Extech	SD700	2020-04-20	2021-04-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Transient Limiter					
ATA508	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM 7600	2020-07-21	2021-07-21
LISN (FCC & CISPR testing)					
LISN002	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2020-08-17	2021-08-17

Note: All equipment within calibration at time of use.

7. ANTENNA PORT TEST RESULTS

7.1. 20 dB AND 99% BW

LIMITS

FCC §15.231 (c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

RSS-210 A1.3

The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the center frequency.

TEST PROCEDURE

99% BW: Per ANSI C63.10, Section 6.9.3

The transmitter output is coupled to the spectrum analyzer via an antenna connected to the spectrum analyzer.

The RBW is set to 1% to 5% of the 99 % bandwidth. The VBW is set to approximately 3 times the RBW. The sweep time is coupled. The detection mode is set to peak and the trace mode to max hold as allowed by the RSS-Gen standard for devices that do not transmit continuously. The spectrum analyzer's internal 99% bandwidth function is utilized.

20dB BW: Per ANSI C63.10, Section 6.9.2

The transmitter output is coupled to the spectrum analyzer via an antenna connected to the spectrum analyzer.

The RBW is set to 1% to 5% of the 20dB bandwidth. The VBW is set to approximately 3 times the RBW. The sweep time is coupled. The detection mode is set to peak and the trace mode to max hold. The spectrum analyzer's internal 20dB bandwidth function is utilized.

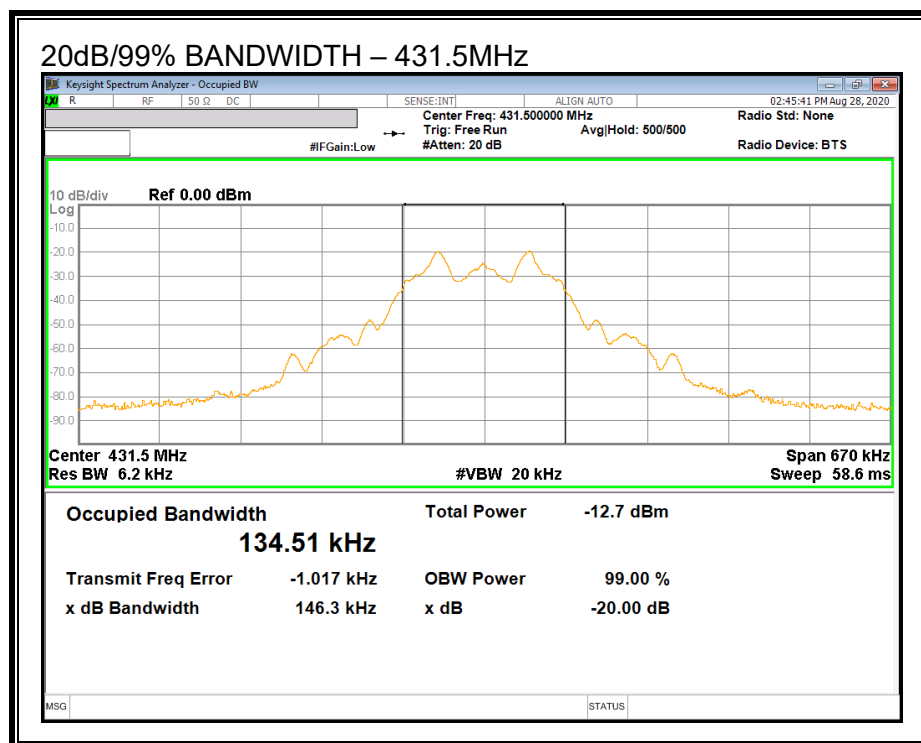
ID:	17051	Test Date:	2020-08-28
-----	-------	------------	------------

20dB Bandwidth

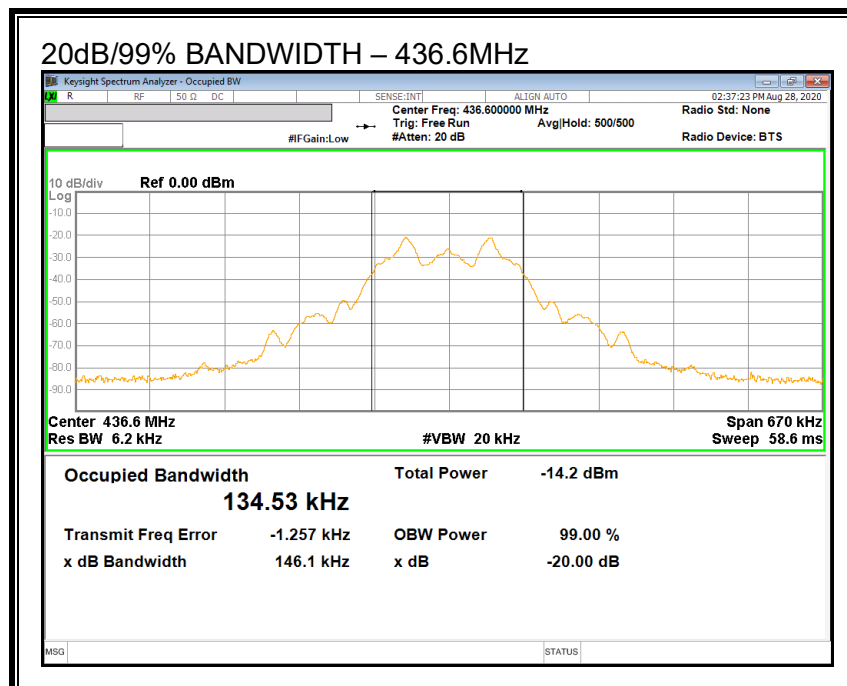
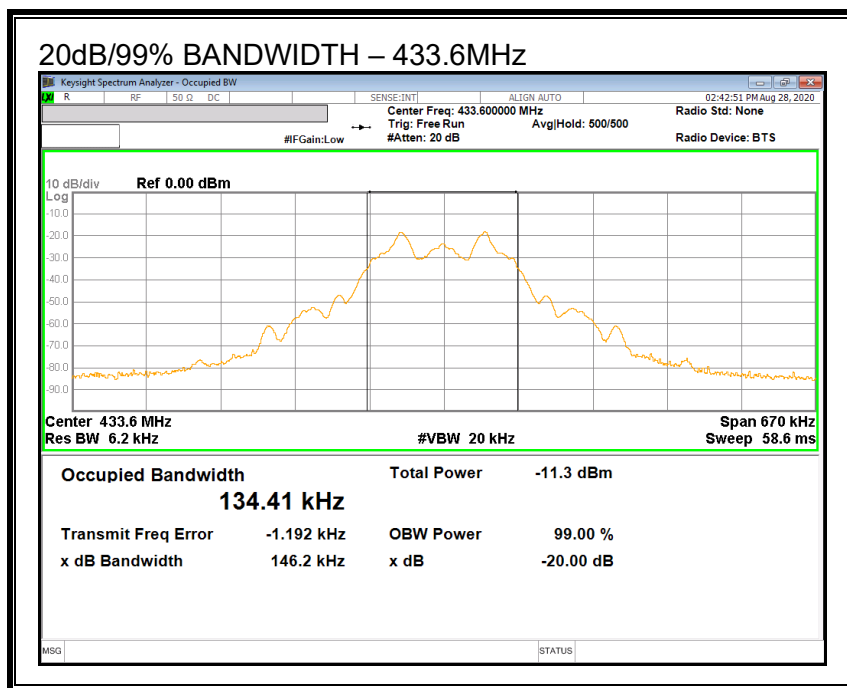
Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
431.5	146.3	1078.75	-932.45
433.6	146.2	1084	-937.8
436.6	146.1	1091.5	-945.4

99% Bandwidth

Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
431.5	134.51	1078.75	-944.24
433.6	134.41	1084	-949.59
436.6	134.53	1091.5	-956.97



ID:	17051	Test Date:	2020-08-28
-----	-------	------------	------------



7.2. DUTY CYCLE

LIMITS

FCC §15.35 (c)

The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 300 kHz and the VBW is set to 1MHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.

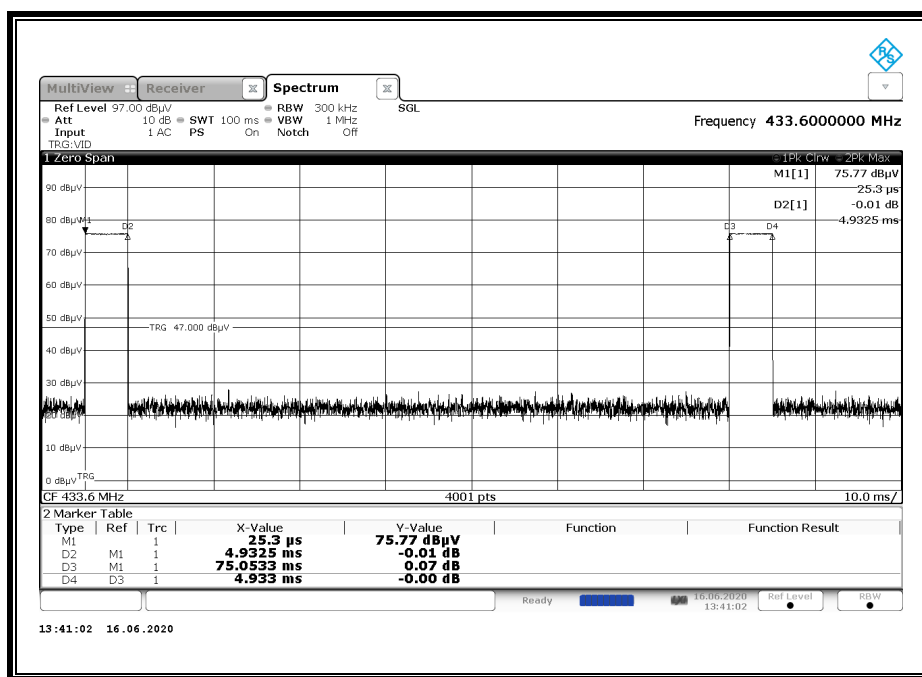
CALCULATION

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is (# of long pulses * long pulse width) + (# of short pulses * short pulse width) / 100 or T

RESULTS

Mode	One Period (ms)	Wide Pulse Width (ms)	# of Wide Pulses	Duty Cycle	20*Log Duty Cycle (dB)
Operation	100	4.933	2	0.0987	-20.11

ID:	17051	Test Date:	2020-06-16
-----	-------	------------	------------



7.3. TRANSMISSION TIME

LIMITS

FCC §15.231 (a) (2)

ISED RSS-210 A1.1

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

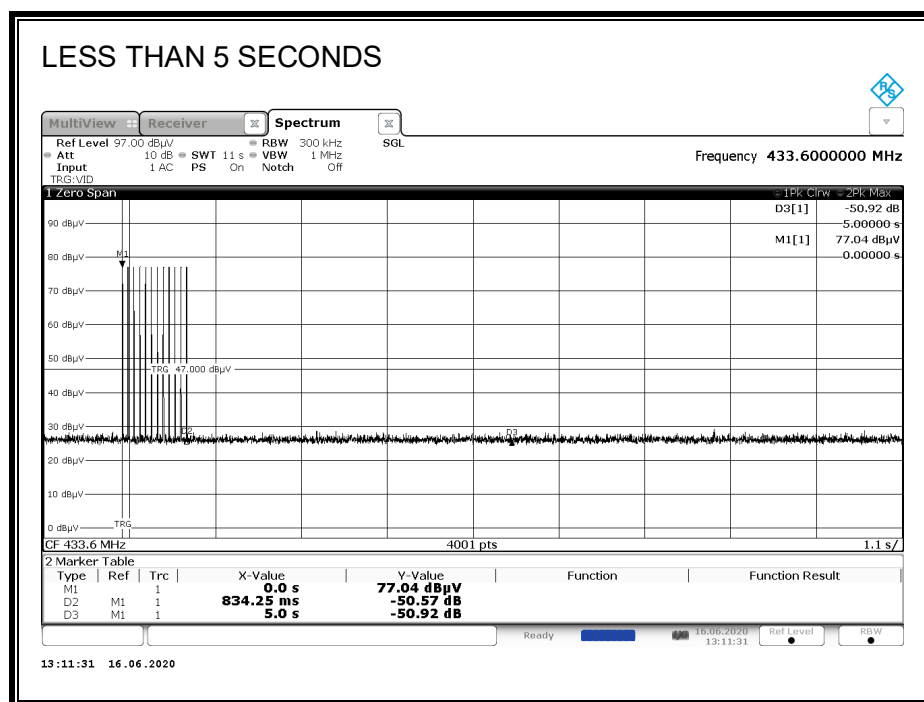
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 300 kHz and the VBW is set to 1MHz. The sweep time is set to 11 seconds and the span is set to 0 Hz.

RESULTS

No non-compliance noted.

ID:	17051	Test Date:	2020-06-16
-----	-------	------------	------------



Note: Tx stops at ~834.25ms

8. RADIATED EMISSION TEST RESULTS

8.1. TX RADIATED SPURIOUS EMISSION

LIMITS

FCC §15.231 (b)
IC RSS 210 A.1.2

In addition to the provisions of § 15.205, the field strength of emissions from Intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental Frequency (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 ¹	125 to 375 ¹
174 - 260	3,750	375
260 - 470	3,750 to 12,500 ¹	375 to 1,250 ¹
Above 470	12,500	1,250

¹ Linear interpolation

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

2 Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

RSS-GEN §8.9

Frequency	Magnetic Field Strength (μ A/m)	Measurement Distance (m)
9 – 490 kHz ^{Note 1}	6.37/F (F in kHz)	300
490 – 1705kHz	63.77/F (F in kHz)	30
1.705 – 30 MHz	0.08	30

Note 1: The emissions limits for the ranges 9-90kHz and 110-490kHz are based on measurements employing a linear average detector.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 meters above the ground plane for above 1 GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. For this test program, Average measurements of the fundamental and its associated harmonics were performed using a Peak detector and duty cycle correction by $20\log(x)$ where 'x' is the duty cycle of 9.87%, as calculated in Section 7.2 of this report. For all other spurious emissions, voltage averaging was used.

The spectrum from 9 kHz to 5 GHz was investigated with the transmitter on.

The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

8.1.1. FUNDAMENTAL MEASUREMENTS

ID:	17051	Test Date:	2020-08-12
-----	-------	------------	------------

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Pad (dB)	Filter (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Pk Limit (dBuV/m)	Margin (dB)	Avg Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
Low CH																
431.535	95.17	Pk	22.6	-27.8	10	0	0	99.97	100.75	-0.78	-	-	-	4	202	H
431.535	95.17	Pk	22.6	-27.8	10	0	-20.11	-	-	-	79.86	80.75	-0.89	4	202	H
431.533	85.21	Pk	22.6	-27.8	10	0	0	90.01	100.75	-10.74	-	-	-	240	116	V
431.533	85.21	Pk	22.6	-27.8	10	0	-20.11	-	-	-	69.9	80.75	-10.85	240	116	V
Middle CH																
433.555	95.11	Pk	22.7	-27.7	10	0	0	100.11	100.81	-0.7	-	-	-	10	202	H
433.555	95.11	Pk	22.7	-27.7	10	0	-20.11	-	-	-	80	80.81	-0.81	10	202	H
433.561	85.4	Pk	22.7	-27.7	10	0	0	90.4	100.81	-10.41	-	-	-	23	190	V
433.561	85.4	Pk	22.7	-27.7	10	0	-20.11	-	-	-	70.29	80.81	-10.52	23	190	V
High CH																
436.57	89.72	Pk	22.7	-27.6	10	0	0	94.82	100.91	-6.09	-	-	-	96	204	H
436.57	89.72	Pk	22.7	-27.6	10	0	-20.11	-	-	-	74.71	80.91	-6.2	96	204	H
436.558	81.62	Pk	22.7	-27.6	10	0	0	86.72	100.91	-14.19	-	-	-	6	100	V
436.558	81.62	Pk	22.7	-27.6	10	0	-20.11	-	-	-	66.61	80.91	-14.3	6	100	V

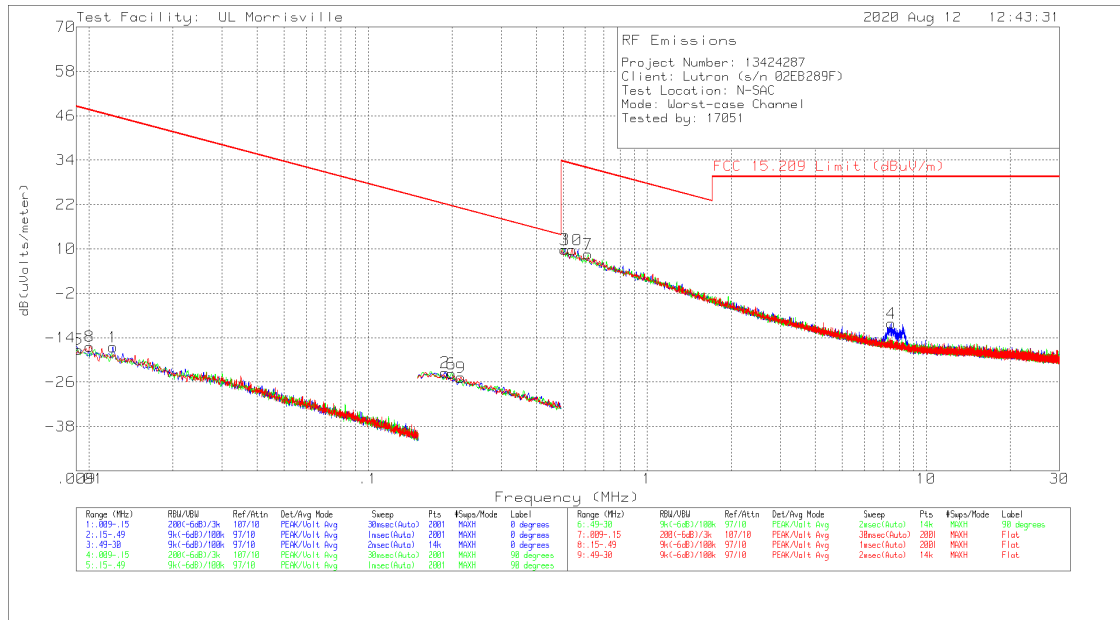
Pk - Peak detector

Note: RBW/VBW = 1MHz/3MHz

8.1.2. TX SPURIOUS EMISSIONS (0.009-30MHz – WORST CASE)

Note: All measurements were made at a test distance of 3 m. The tabular data was extrapolated from the measurement distance to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the data was 40*Log (test distance/specification distance).

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency 188.68 kHz resulted in a level of -23.34 dBuV/m, which is equivalent to $-23.34-51.5 = -74.84$ dBuA/m, which has the same margin, -45.43dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

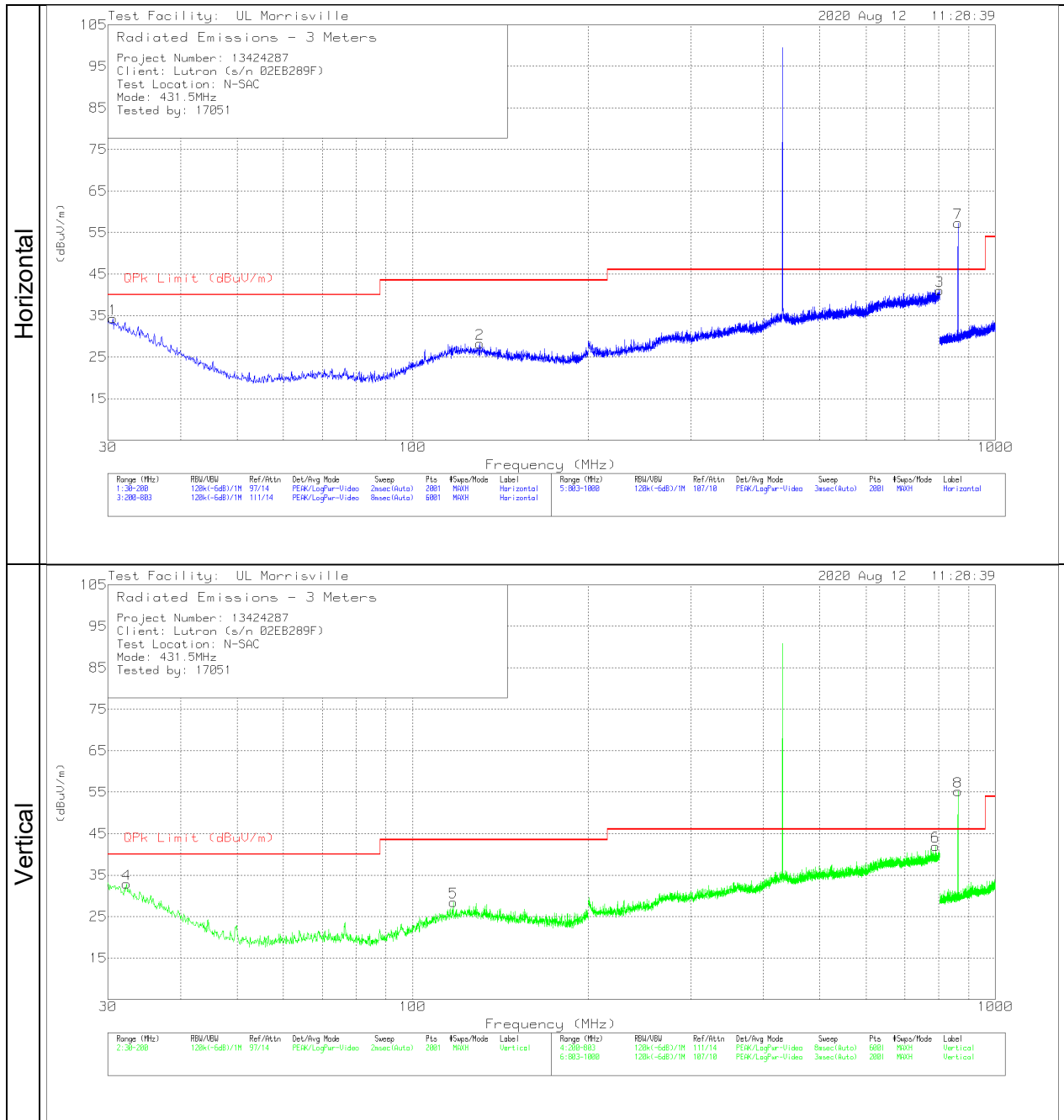


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0059 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)
Loop at 0°											
1	.0122	45.61	Pk	17.8	.1	-80	-16.49	45.88	65.88	-62.37	0-360
2	.18868	46.26	Pk	10.3	.1	-80	-23.34	22.09	42.09	-45.43	0-360
3	.50686	39.26	Pk	10.4	.2	-40	9.86	33.51	-	-23.65	0-360
4 (Ambient)	7.48856	18.6	Pk	10.7	.6	-40	-10.1	29.54	-	-39.64	0-360
Loop at 90°											
5	.00914	42.94	Pk	19.8	.1	-80	-17.16	48.38	68.38	-65.54	0-360
6	.19905	45.94	Pk	10.3	.1	-80	-23.66	21.62	41.62	-45.28	0-360
7	.61437	38.02	Pk	10.4	.2	-40	8.62	31.84	-	-23.22	0-360
Loop Flat											
8	.01007	44.63	Pk	18.9	.1	-80	-16.37	47.55	67.55	-63.92	0-360
9	.21503	44.88	Pk	10.3	.1	-80	-24.72	20.95	40.95	-45.67	0-360
10	.53848	39.18	Pk	10.4	.2	-40	9.78	32.98	-	-23.2	0-360

Pk - Peak detector

8.1.3. HARMONICS AND TX SPURIOUS EMISSIONS (30 - 5000MHz)

HARMONICS AND TX SPURIOUS EMISSIONS (30-1000MHz – 431.5MHz)



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Pad (dB)	Filter (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 130.555	28.66	Pk	19.8	-30.1	9.9	0	28.26	43.52	-15.26	0-360	399	H
1	30.595	29.26	Pk	26.5	-31.4	9.9	0	34.26	60.75	-26.49	0-360	100	H
3	802.6985	29.14	Pk	27.5	-25.6	10	0	41.04	60.75	-19.71	0-360	199	H
7	862.922	53.84	Qp	28	-25.2	0	.7	57.34	60.75	-3.41	45	100	H
5	* 117.55	29.08	Pk	19.8	-30.3	9.9	0	28.48	43.52	-15.04	0-360	100	V
4	32.295	29.06	Pk	25.3	-31.4	9.9	0	32.86	60.75	-27.89	0-360	100	V
6	789.734	30.56	Pk	27.2	-25.8	10	0	41.96	60.75	-18.79	0-360	100	V
8	862.9237	51.63	Qp	28	-25.2	0	.7	55.13	60.75	-5.62	273	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

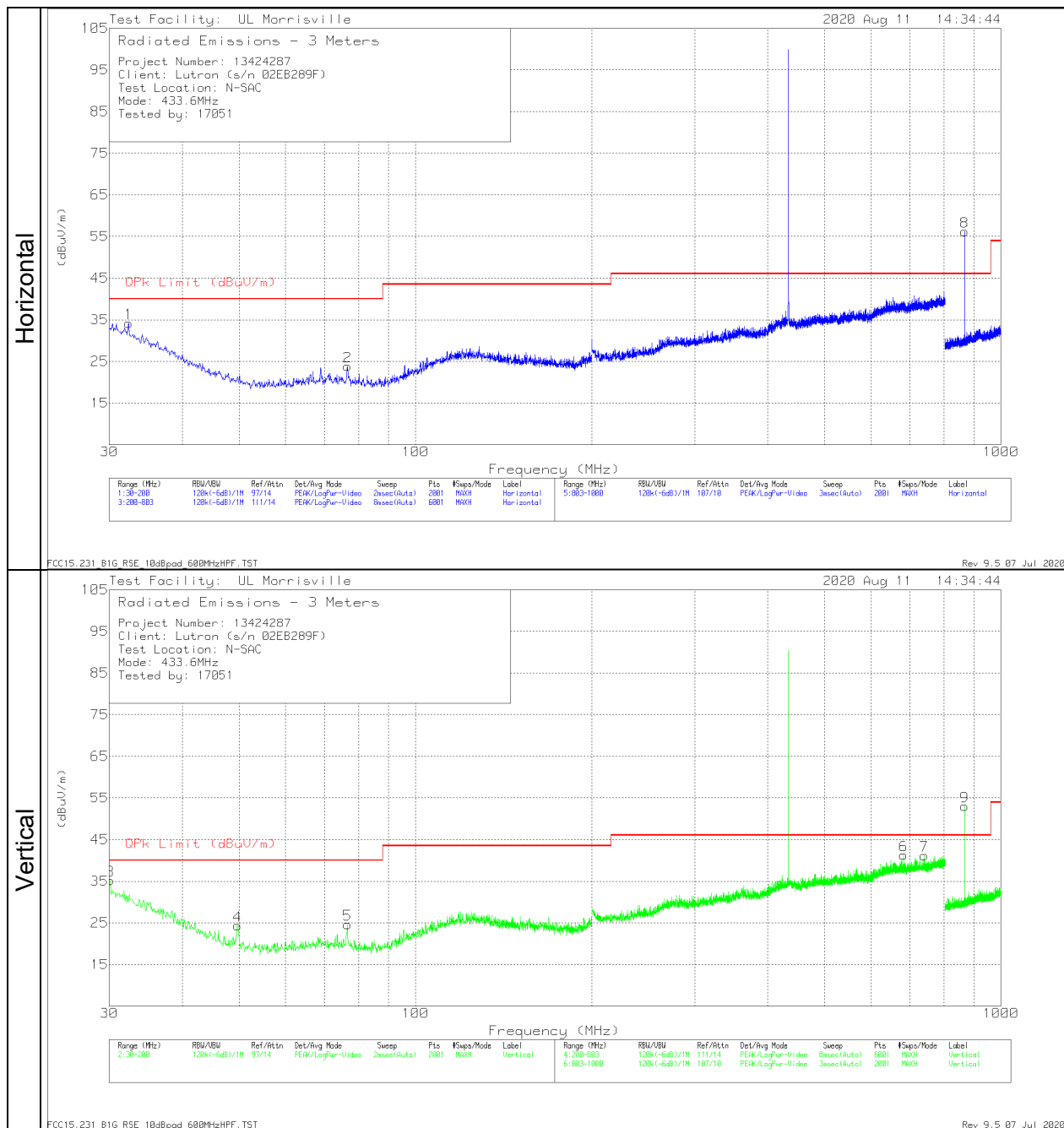
Pk - Peak detector

Qp - Quasi-Peak detector

Notes:

- (1) Quasi-Peak measurement is used to satisfy the limits given in §15.231(b).
- (2) Peak measurement without a duty-cycle correction factor is used to satisfy the §15.209 limits in the §15.205 restricted bands or the limits given in §15.231(b) outside of the restricted bands.
- (3) The more restrictive average §15.231(b) limit is presented in the above table where applicable. Given that the peak limit is 20dB higher than the average, the data presented above demonstrates compliance to the peak limit as well.

HARMONICS AND TX SPURIOUS EMISSIONS(30-1000MHz – 433.6MHz)



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Pad (dB)	Filter (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	32.38	30.4	Pk	25.3	-31.4	9.9	0	34.2	60.81	-26.61	0-360	199	H
2	76.58	30.83	Pk	13.9	-30.8	9.9	0	23.83	60.81	-36.98	0-360	199	H
8	867.2972	52.16	Qp	28.1	-25.2	0	.7	55.76	60.81	-5.05	45	100	H
3	30.085	29.9	Pk	26.8	-31.4	9.9	0	35.2	60.81	-25.61	0-360	100	V
4	49.72	31.44	Pk	14.1	-31.1	9.9	0	24.34	60.81	-36.47	0-360	100	V
5	76.58	31.62	Pk	13.9	-30.8	9.9	0	24.62	60.81	-36.19	0-360	100	V
6	681.8975	31.9	Pk	25.9	-26.5	10	0	41.3	60.81	-19.51	0-360	301	V
7	739.7855	30.59	Pk	26.7	-26.1	10	0	41.19	60.81	-19.62	0-360	197	V
9	867.2957	48.8	Qp	28.1	-25.2	0	.7	52.4	60.81	-8.41	270	101	V

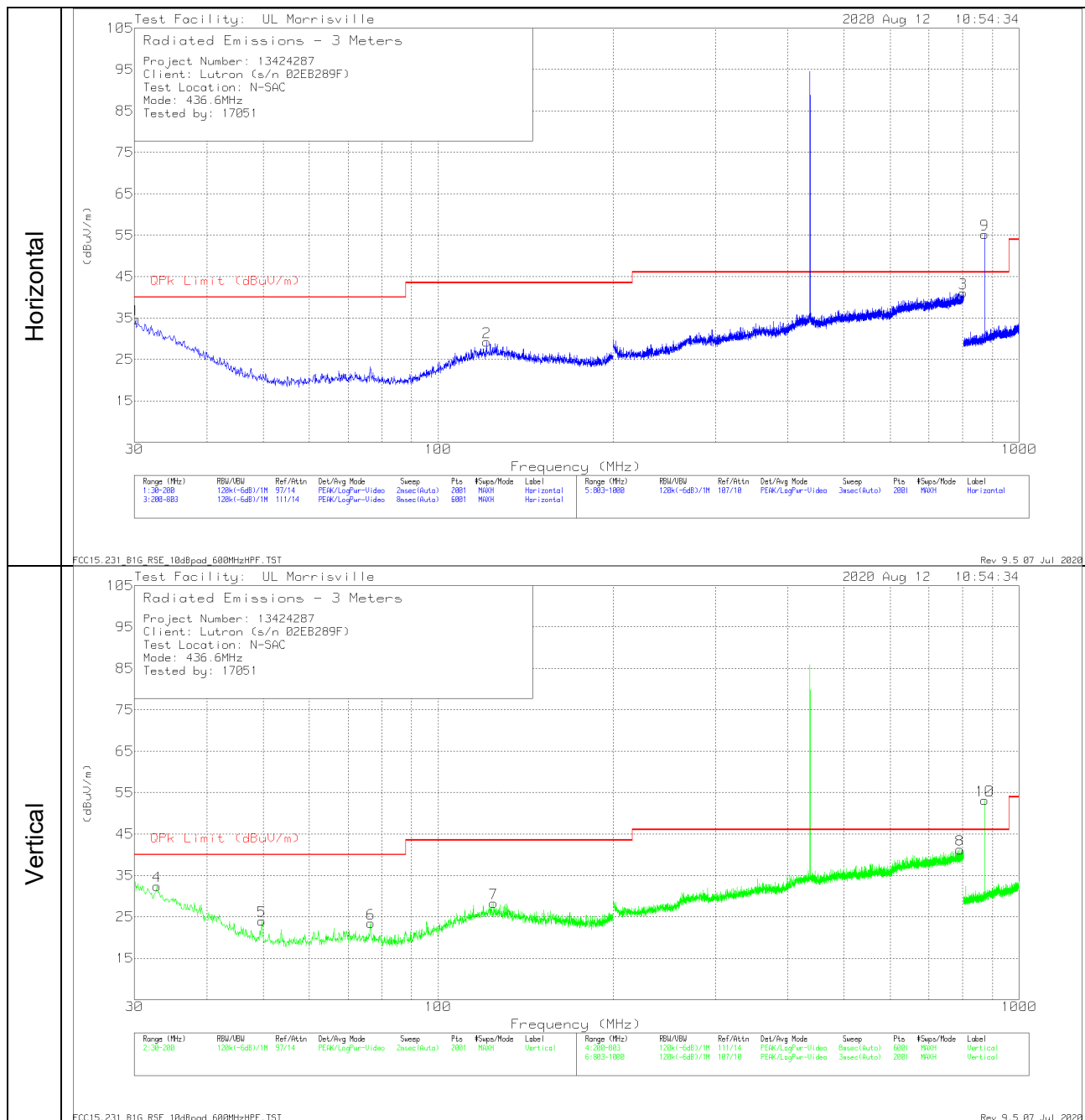
Pk - Peak detector

Qp - Quasi-Peak detector

Notes:

- (1) Quasi-Peak measurement is used to satisfy the limits given in §15.231(b).
- (2) Peak measurement without a duty-cycle correction factor is used to satisfy the §15.209 limits in the §15.205 restricted bands or the limits given in §15.231(b) outside of the restricted bands.
- (3) The more restrictive average §15.231(b) limit is presented in the above table where applicable. Given that the peak limit is 20dB higher than the average, the data presented above demonstrates compliance to the peak limit as well.

HARMONICS AND TX SPURIOUS EMISSIONS(30-1000MHz – 436.6MHz)



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Pad (dB)	Filter (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 121.205	29.51	Pk	20	-30.2	9.9	0	29.21	43.52	-14.31	0-360	100	H
1	30.17	29.44	Pk	26.7	-31.4	9.9	0	34.64	60.91	-26.27	0-360	100	H
3	800.8895	29.18	Pk	27.5	-25.6	10	0	41.08	60.91	-19.83	0-360	100	H
9	873.2755	51.1	Qp	28.2	-25.1	0	.7	54.9	60.91	-6.01	45	100	H
7	* 124.605	28.55	Pk	20	-30.1	9.9	0	28.35	43.52	-15.17	0-360	100	V
4	32.805	28.94	Pk	25	-31.4	9.9	0	32.44	60.91	-28.47	0-360	100	V
5	49.72	31.14	Pk	14.1	-31.1	9.9	0	24.04	60.91	-36.87	0-360	100	V
6	76.58	30.46	Pk	13.9	-30.8	9.9	0	23.46	60.91	-37.45	0-360	100	V
8	791.744	29.75	Pk	27.2	-25.7	10	0	41.25	60.91	-19.66	0-360	400	V
10	873.2755	49.15	Qp	28.2	-25.1	0	.7	52.95	60.91	-7.96	276	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

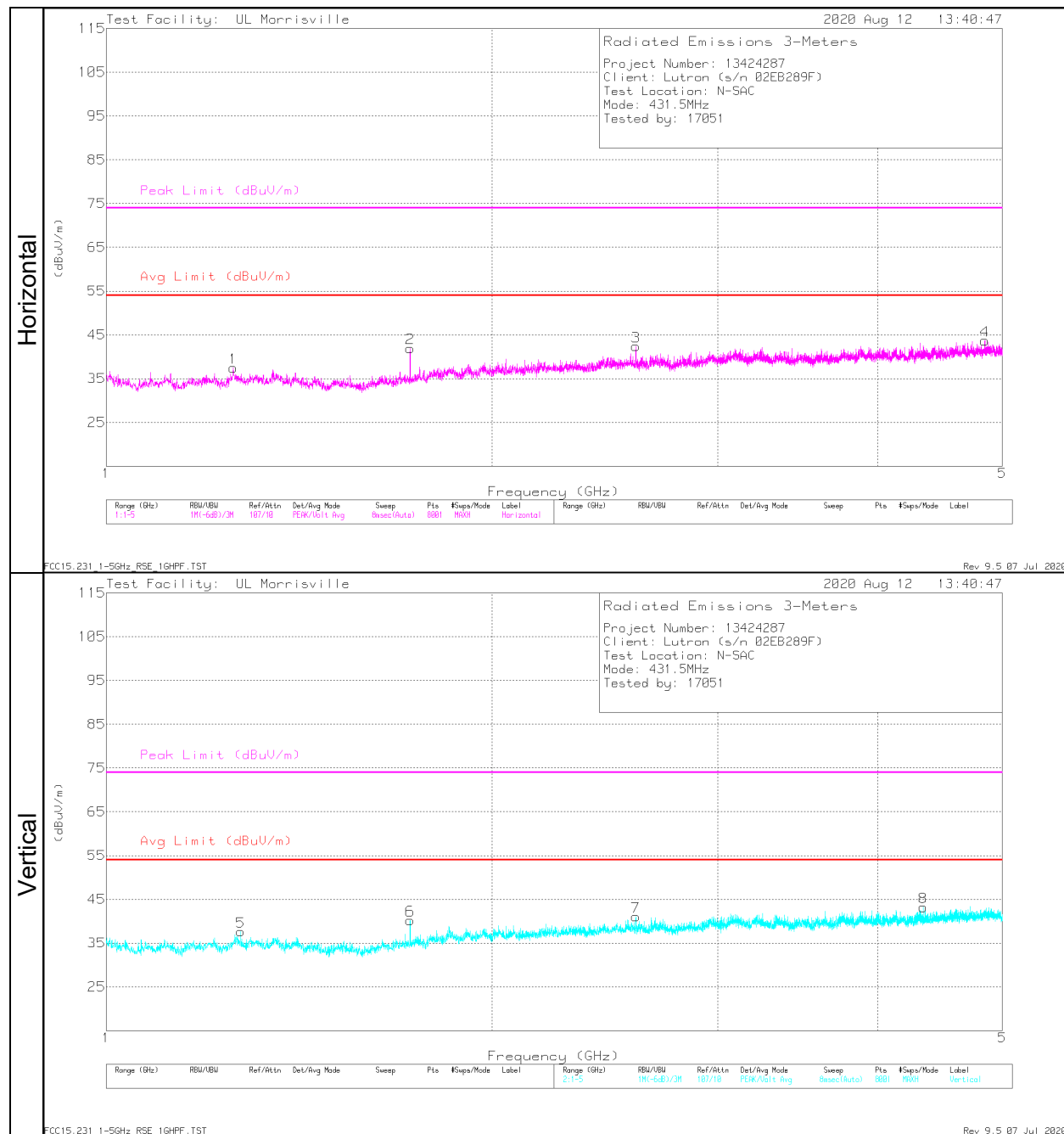
Pk - Peak detector

Qp - Quasi-Peak detector

Notes:

- (1) Quasi-Peak measurement is used to satisfy the limits given in §15.231(b).
- (2) Peak measurement without a duty-cycle correction factor is used to satisfy the §15.209 limits in the §15.205 restricted bands or the limits given in §15.231(b) outside of the restricted bands.
- (3) The more restrictive average §15.231(b) limit is presented in the above table where applicable. Given that the peak limit is 20dB higher than the average, the data presented above demonstrates compliance to the peak limit as well.

HARMONICS AND TX SPURIOUS EMISSIONS (>1GHz – 431.5MHz)



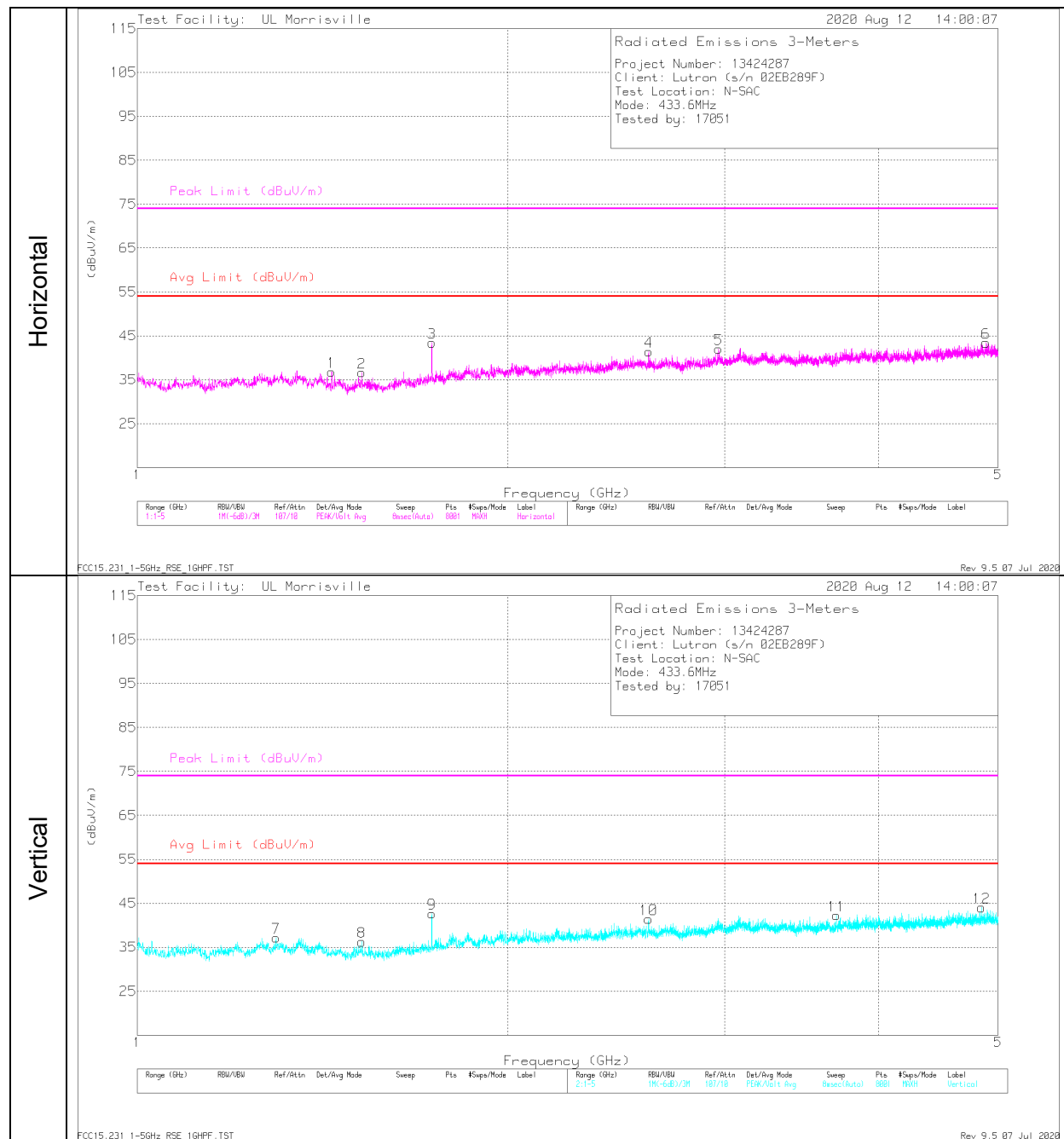
Marker	Frequency (GHz)	Meter Reading (dBUV)	Det	AT0072 dB(m)	Amp/Cbl/Filtr/Pad (dB)	Filter (dB)	Corrected Reading (dBUV/m)	Avg Limit (dBUV/m)	Margin (dB)	Peak Limit (dBUV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.2565	44.17	Pk	29.1	-36.8	1	37.47	54	-16.53	74	-36.53	0-360	200	H
2	1.726	47.96	Pk	29.4	-35.8	.4	41.96	54	-12.04	74	-32.04	0-360	200	H
3	2.589	43.96	Pk	32.3	-34.3	.4	42.36	54	-11.64	74	-31.64	0-360	101	H
4	* 4.846	41.38	Pk	34.2	-32.2	.3	43.68	54	-10.32	74	-30.32	0-360	299	H
5	* 1.273	43.82	Pk	29.5	-36.7	1	37.62	54	-16.38	74	-36.38	0-360	200	V
6	1.726	46.24	Pk	29.4	-35.8	.4	40.24	54	-13.76	74	-33.76	0-360	200	V
7	2.589	42.65	Pk	32.3	-34.3	.4	41.05	54	-12.95	74	-32.95	0-360	200	V
8	* 4.337	42.11	Pk	33.6	-32.8	.3	43.21	54	-10.79	74	-30.79	0-360	400	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Note: The more conservative §15.209 limits were used against all spurious emissions to demonstrate compliance to both the §15.209 and §15.231(b) spurious emission requirements.

HARMONICS AND TX SPURIOUS EMISSIONS (>1GHz – 433.6MHz)

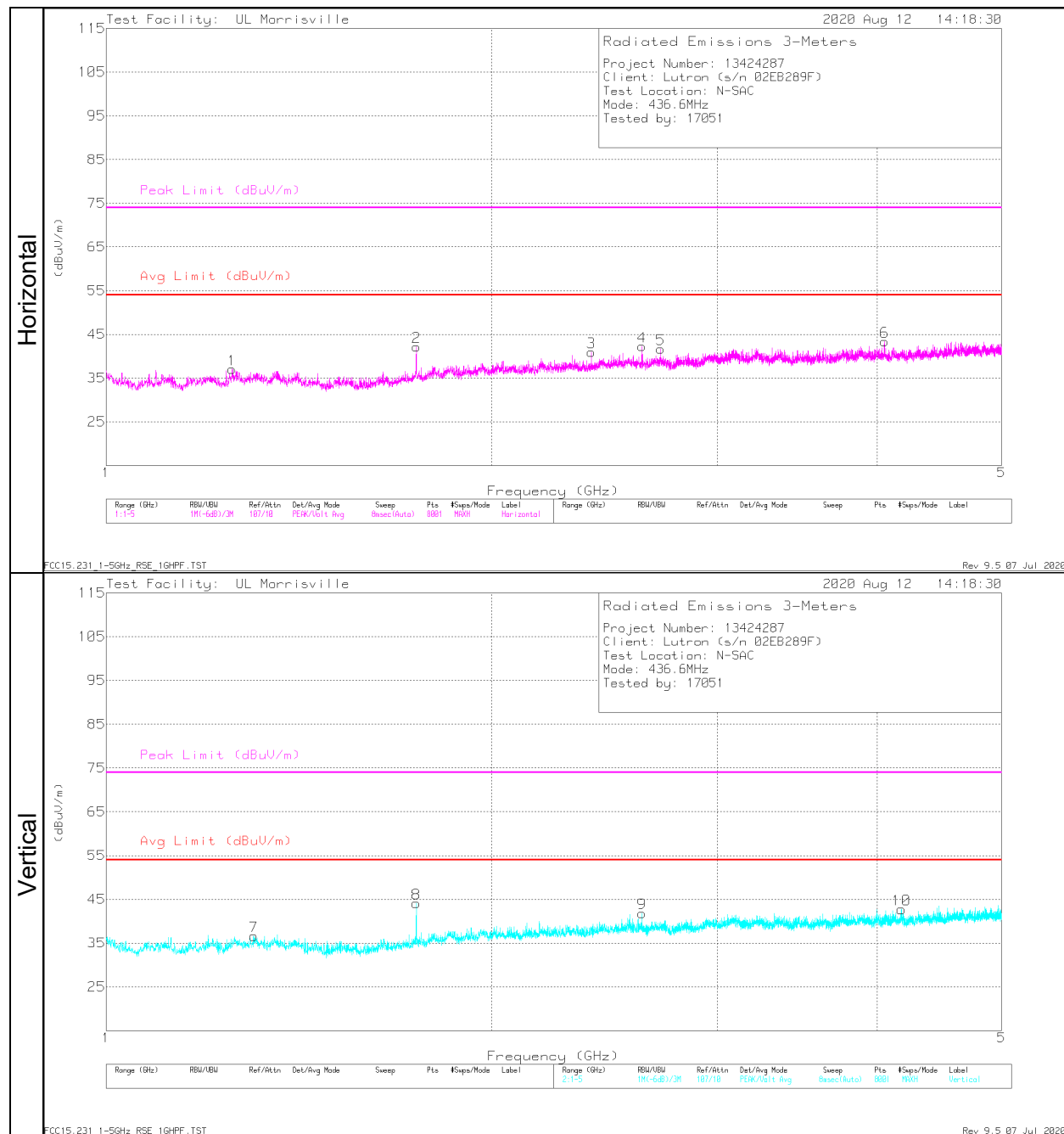


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB/(m)	Amp/Cbl/Filtr/Pad (dB)	Filter (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.438	44.21	Pk	28.3	-36.5	.8	36.81	54	-17.19	74	-37.19	0-360	400	H
2	* 1.5215	44.25	Pk	27.9	-36.2	.7	36.65	54	-17.35	74	-37.35	0-360	101	H
3	1.7345	49.25	Pk	29.6	-35.8	.4	43.45	54	-10.55	74	-30.55	0-360	200	H
4	2.602	42.93	Pk	32.3	-34.3	.5	41.43	54	-12.57	74	-32.57	0-360	299	H
5	2.966	42.56	Pk	32.7	-33.8	.6	42.06	54	-11.94	74	-31.94	0-360	101	H
6	* 4.88825	41.25	Pk	34	-32.1	.3	43.45	54	-10.55	74	-30.55	0-360	299	H
7	* 1.296	43.76	Pk	29.3	-36.8	.9	37.16	54	-16.84	74	-36.84	0-360	101	V
8	* 1.522	43.85	Pk	27.9	-36.2	.7	36.25	54	-17.75	74	-37.75	0-360	300	V
9	1.7345	48.44	Pk	29.6	-35.8	.4	42.64	54	-11.36	74	-31.36	0-360	101	V
10	2.6015	42.92	Pk	32.3	-34.3	.5	41.42	54	-12.58	74	-32.58	0-360	400	V
11	* 3.696	41.86	Pk	33.1	-33.1	.4	42.26	54	-11.74	74	-31.74	0-360	400	V
12	* 4.849	41.95	Pk	34.1	-32.3	.3	44.05	54	-9.95	74	-29.95	0-360	400	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

Note: The more conservative §15.209 limits were used against all spurious emissions to demonstrate compliance to both the §15.209 and §15.231(b) spurious emission requirements.

HARMONICS AND TX SPURIOUS EMISSIONS (>1GHz – 436.6MHz)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Filtr/Pad (dB)	Filter (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.254	43.7	Pk	29.1	-36.8	1	37	54	-17	74	-37	0-360	299	H
2	1.7465	47.97	Pk	29.6	-35.8	.4	42.17	54	-11.83	74	-31.83	0-360	400	H
3	2.3925	43.35	Pk	31.8	-34.6	.4	40.95	54	-13.05	74	-33.05	0-360	101	H
4	2.6195	43.77	Pk	32.4	-34.4	.5	42.27	54	-11.73	74	-31.73	0-360	400	H
5	* 2.709	42.89	Pk	32.4	-34.1	.5	41.69	54	-12.31	74	-32.31	0-360	299	H
6	* 4.0515	42.57	Pk	33.6	-33.1	.3	43.37	54	-10.63	74	-30.63	0-360	101	H
7	* 1.3035	43.41	Pk	29.1	-36.8	.9	36.61	54	-17.39	74	-37.39	0-360	400	V
8	1.746	50	Pk	29.5	-35.8	.4	44.1	54	-9.9	74	-29.9	0-360	101	V
9	2.6195	43.34	Pk	32.4	-34.4	.5	41.84	54	-12.16	74	-32.16	0-360	300	V
10	* 4.177	41.71	Pk	33.4	-32.7	.3	42.71	54	-11.29	74	-31.29	0-360	400	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Note: The more conservative §15.209 limits were used against all spurious emissions to demonstrate compliance to both the §15.209 and §15.231(b) spurious emission requirements.

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.		

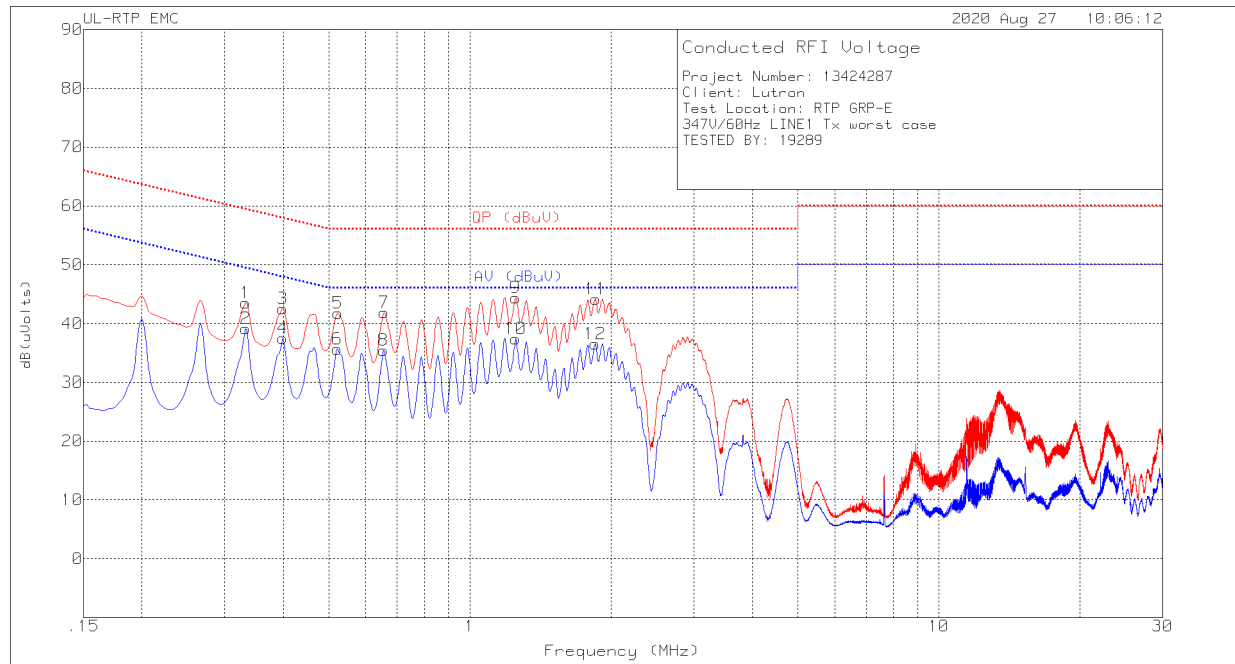
TEST PROCEDURE

ANSI C63.4

RESULTS

No non-compliance noted:

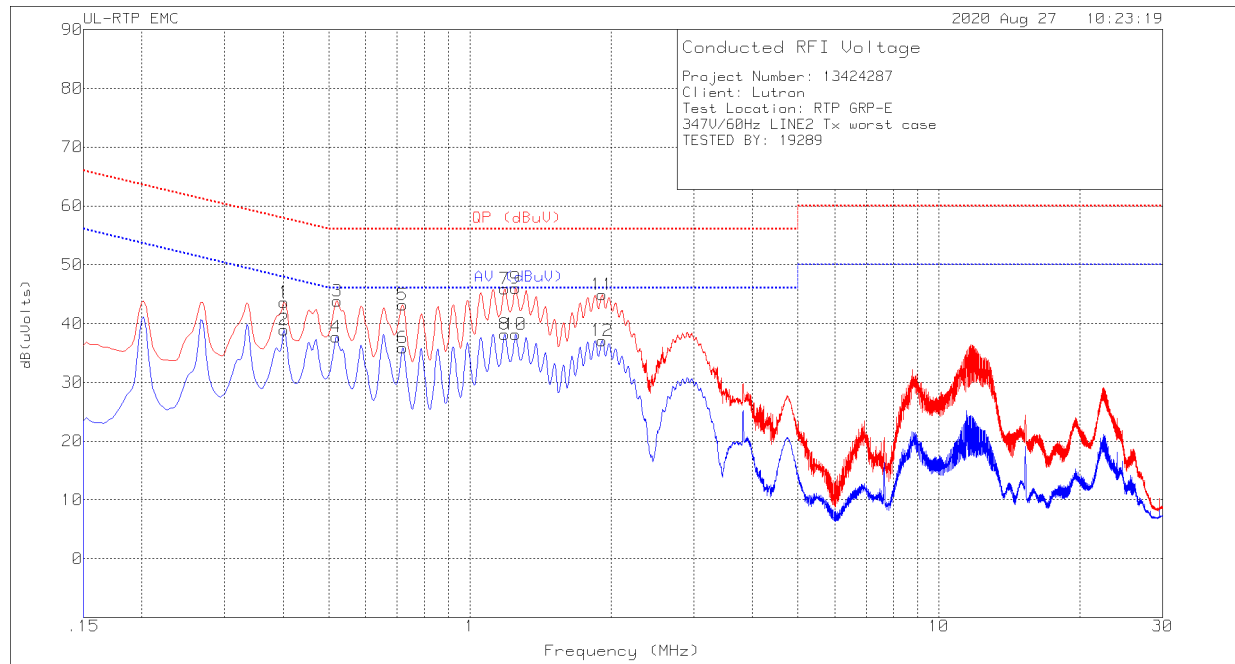
LINE 1 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN002 (dB)	CBL004_ATA508 (dB)	Corrected Reading dB(uVolts)	QP (dBuV)	Margin (dB)	AV (dBuV)	Margin (dB)
1	.33225	34.13	Qp	.1	9.3	43.53	59.39	-15.86	-	-
2	.33225	29.75	Ca	.1	9.3	39.15	-	-	49.39	-10.24
3	.39975	33.12	Qp	.1	9.3	42.52	57.86	-15.34	-	-
4	.39975	28.07	Ca	.1	9.3	37.47	-	-	47.86	-10.39
5	.5235	32.33	Qp	.1	9.3	41.73	56	-14.27	-	-
6	.52125	26.25	Ca	.1	9.3	35.65	-	-	46	-10.35
7	.65625	32.37	Qp	.1	9.4	41.87	56	-14.13	-	-
8	.654	25.89	Ca	.1	9.4	35.39	-	-	46	-10.61
9	1.2525	34.98	Qp	0	9.4	44.38	56	-11.62	-	-
10	1.2525	28	Ca	0	9.4	37.4	-	-	46	-8.6
11	1.85325	34.78	Qp	0	9.4	44.18	56	-11.82	-	-
12	1.851	27.17	Ca	0	9.4	36.57	-	-	46	-9.43

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS

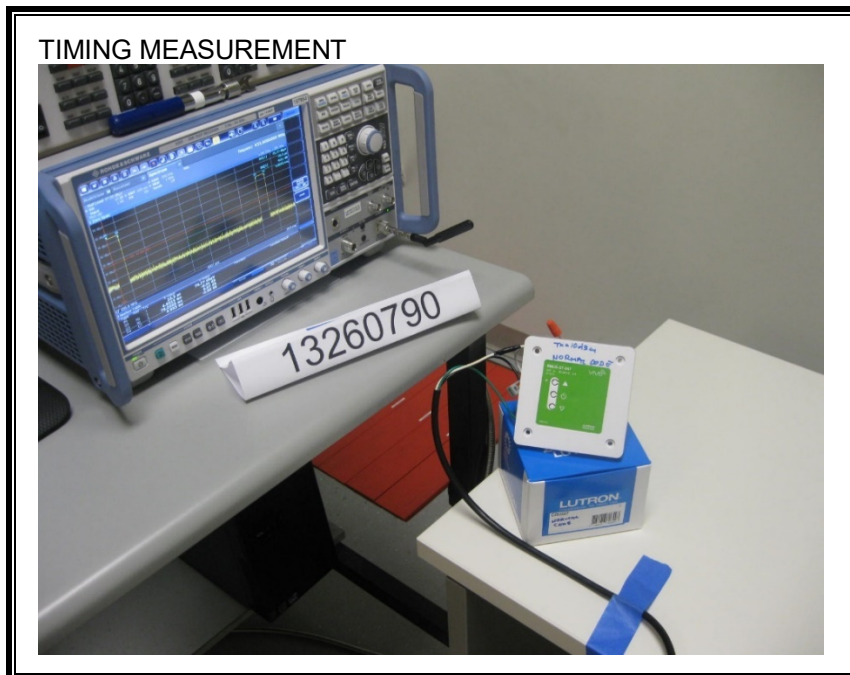


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN002 (dB)	CBL004_ATA508 (dB)	Corrected Reading dB(uVolts)	QP (dBuV)	Margin (dB)	AV (dBuV)	Margin (dB)
2	.402	29.51	Ca	.1	9.3	38.91	-	-	47.81	-8.9
4	.519	28.36	Ca	.1	9.3	37.76	-	-	46	-8.24
6	.71925	26.37	Ca	.1	9.4	35.87	-	-	46	-10.13
8	1.18725	28.8	Ca	0	9.4	38.2	-	-	46	-7.8
10	1.2525	28.73	Ca	0	9.4	38.13	-	-	46	-7.87
12	1.914	27.69	Ca	0	9.4	37.09	-	-	46	-8.91
1	.402	34.24	Qp	.1	9.3	43.64	57.81	-14.17	-	-
3	.52125	34.41	Qp	.1	9.3	43.81	56	-12.19	-	-
5	.71925	33.66	Qp	.1	9.4	43.16	56	-12.84	-	-
7	1.18725	36.48	Qp	0	9.4	45.88	56	-10.12	-	-
9	1.2525	36.6	Qp	0	9.4	46	56	-10	-	-
11	1.914	35.52	Qp	0	9.4	44.92	56	-11.08	-	-

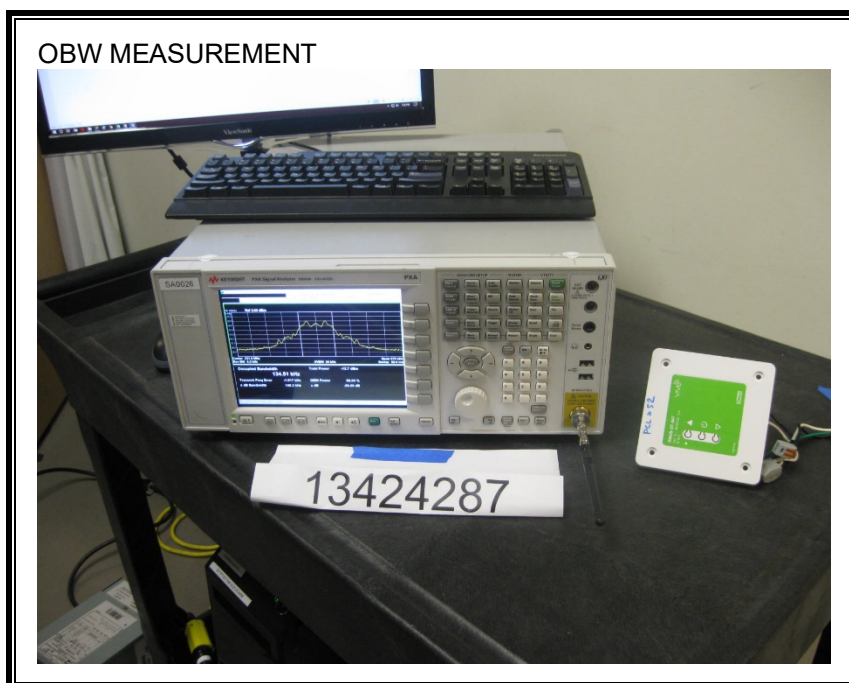
Qp - Quasi-Peak detector
Ca - CISPR average detection

10. SETUP PHOTOS

OBW/TIMING MEASUREMENT

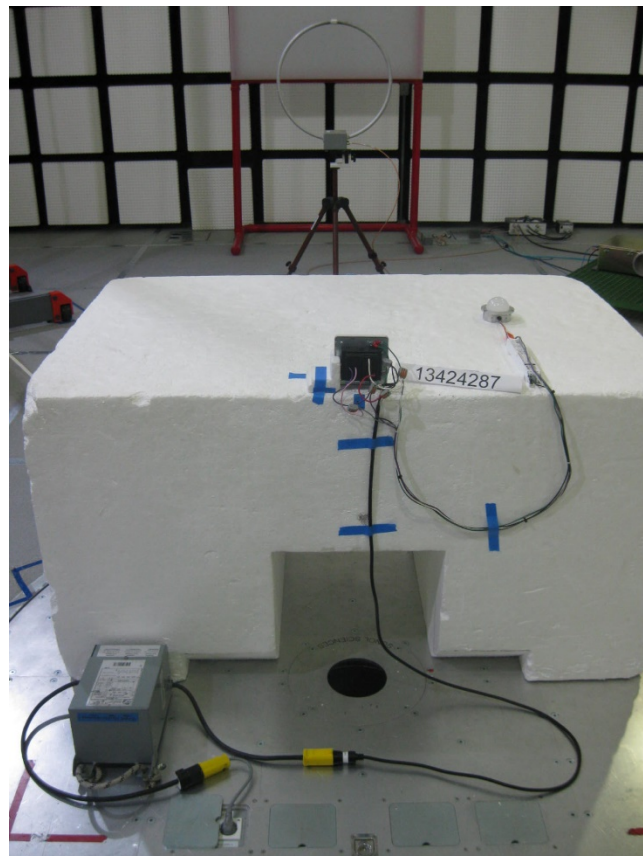
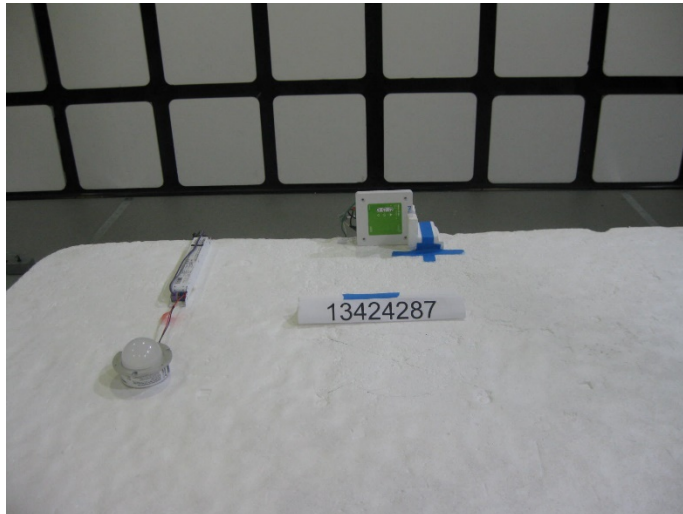


Note: Project number placard incorrect in above photo. Should be 13424287

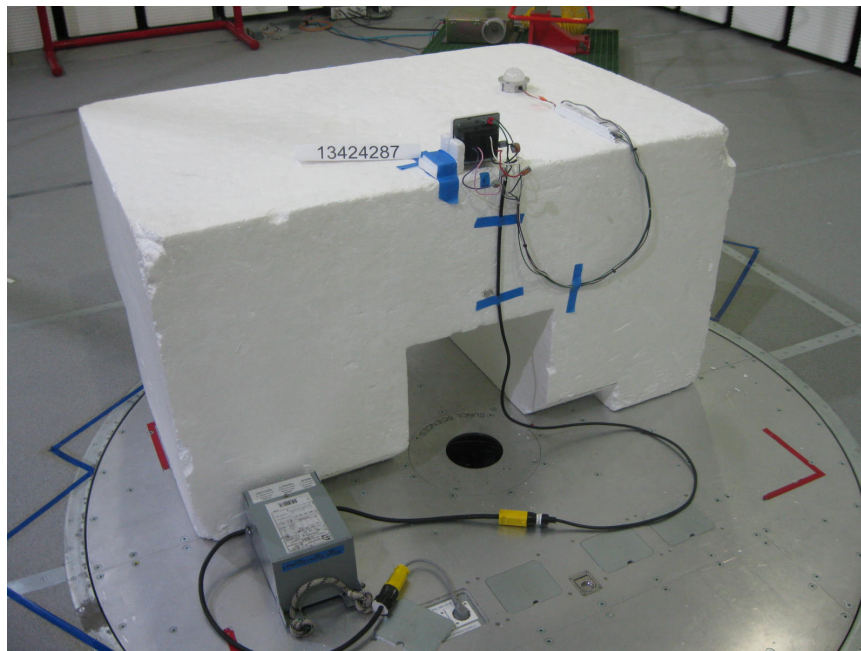
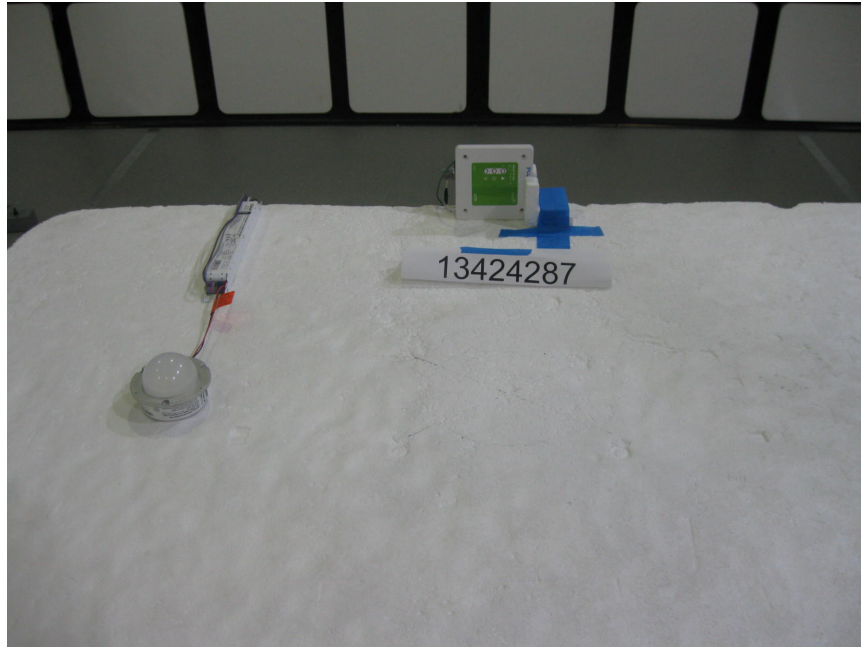


RADIATED EMISSIONS

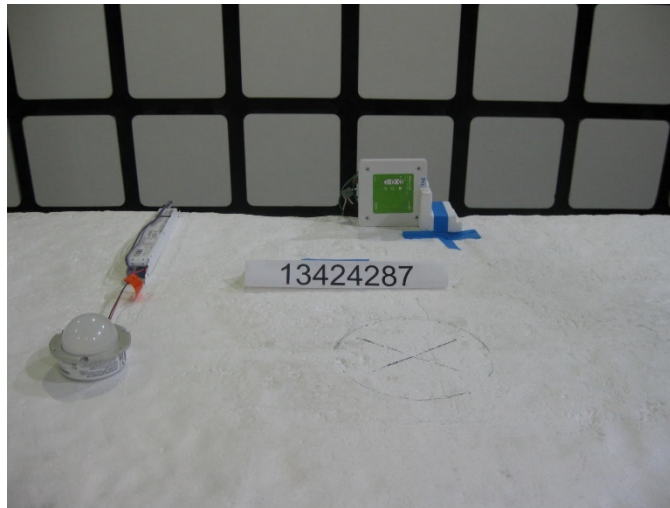
RADIATED EMISSIONS BELOW 30MHz



RADIATED EMISSIONS 30 to 1000MHz



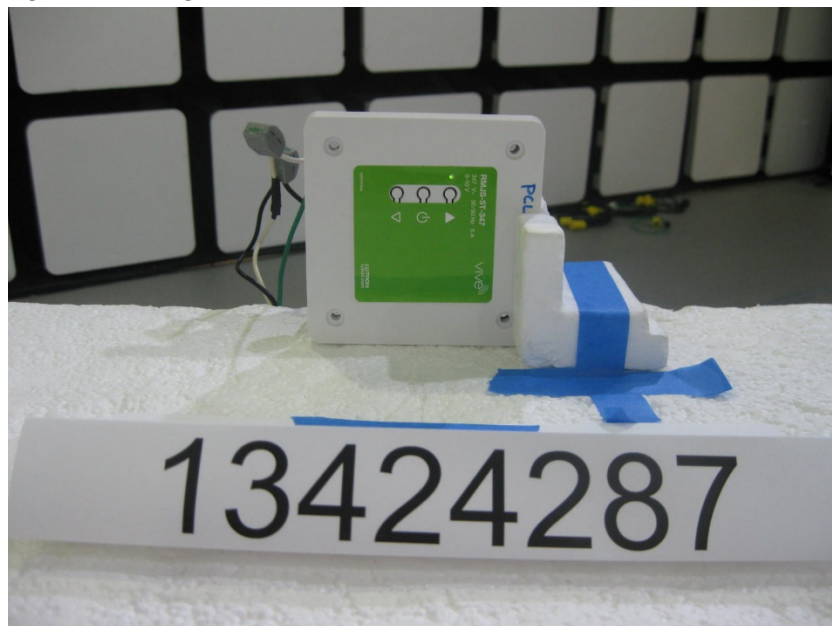
RADIATED EMISSIONS ABOVE 1000MHz



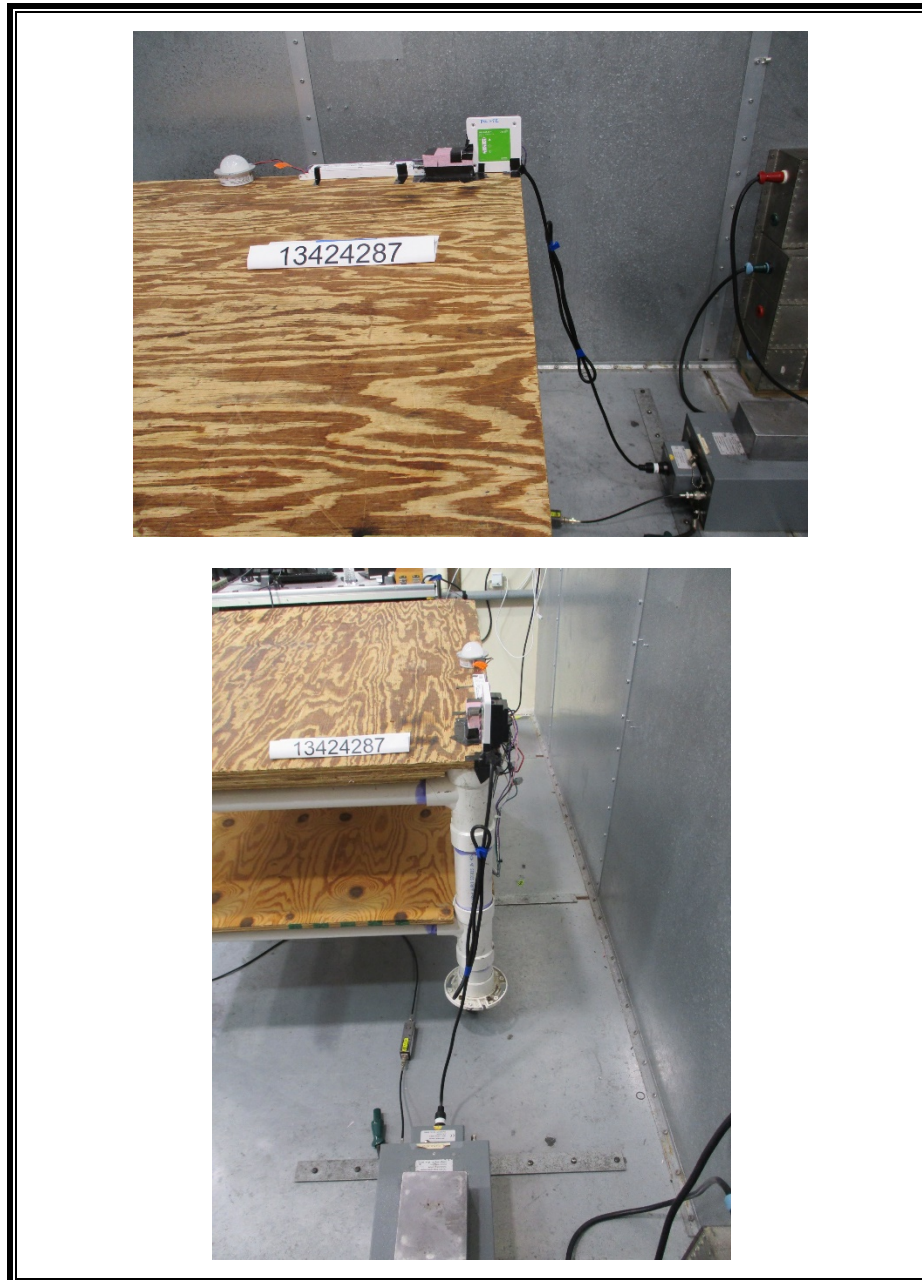
X ORIENTATION



Y ORIENTATION



AC MAINS EMISSIONS



END OF TEST REPORT