

TEST REPORT

Report Number. : R14558600-E1

Applicant : Lutron Electronics CO INC
7200 Suter Rd
Coopersburg, PA, 18036-1249, US

Model : A-WN-D01-OCC/A-WN-D01-RF

Brand : Lutron

FCC ID : JPZ0146

IC : 2851A-JPZ0146

EUT Description : Low voltage lighting control interface

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2022
ISED RSS-247 ISSUE 2: 2017
ISED RSS-GEN ISSUE 5 + A2: 2021

Date Of Issue:
2022-12-29

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REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|---|--------------|
| V1 | 2022-11-17 | Initial Issue | Noah Bennett |
| V2 | 2022-11-23 | Corrected DC equation in Section 9.1. | Brian Kiewra |
| V3 | 2022-12-02 | Corrected typos in section 9.1 and firmware version in section 6.4 | Brian Kiewra |
| V4 | 2022-12-15 | Added attenuator to antenna port equipment list in section 8. Added additional model on cover page and sections 1 and 6.1. Writeup of model descriptions added to section 6.1 | Brian Kiewra |
| V5 | 2022-12-29 | Addressed TCB Feedback. | Noah Bennett |

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Lutron Electronics CO INC
7200 Suter Rd
Coopersburg, PA, 18036-1249, US

EUT DESCRIPTION: Low voltage lighting control interface

MODEL: A-WN-D01-OCC/A-WN-D01-RF

BRAND: Lutron

SERIAL NUMBER: Non-Serialized

SAMPLE RECEIPT DATE: 2022-11-07

DATE TESTED: 2022-11-07 TO 2022-11-10

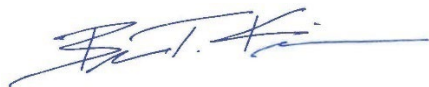
| APPLICABLE STANDARDS | |
|--------------------------------|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Complies |
| ISED RSS-247 Issue 2 | Complies |
| ISED RSS-GEN Issue 5 + A1 + A2 | Complies |

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.

Approved & Released For
UL LLC. By:



Brian Kiewra
Project Engineer
Consumer Technology Division
UL LLC.

Prepared By:



Noah Bennett
Electrical Engineer
Consumer Technology Division
UL LLC.

2. TEST RESULTS SUMMARY

This report contains data/info provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer. Below is a list of the data/info provided by the customer:

1. Antenna Gain and Type (Section 6.3)
2. Cable Loss (Section 9.4, 9.5)
3. Worst-Case data rates. (Section 6.5)
4. Operational Duty Cycle (Section 9.1)

| FCC Clause | ISED Clause | Requirement | Result | Comment |
|----------------|-------------------|------------------------------|-------------------------|--------------------------------------|
| See Comment | | Duty Cycle | Reporting purposes only | ANSI C63.10 Section 11.6. |
| - | RSS-GEN 6.7 | 99% OBW | Reporting purposes only | ANSI C63.10 Section 6.9.3. |
| 15.247 (a) (2) | RSS-247 5.2 (a) | 6dB BW | Complies | None. |
| 15.247 (b) (3) | RSS-247 5.4 (d) | Output Power | Complies | None. |
| See Comment | | Average power | Reporting purposes only | Per ANSI C63.10, Section 11.9.2.3.2. |
| 15.247 (e) | RSS-247 5.2 (b) | PSD | Complies | None. |
| 15.247 (d) | RSS-247 5.5 | Conducted Spurious Emissions | Complies | None. |
| 15.209, 15.205 | RSS-GEN 8.9, 8.10 | Radiated Emissions | Complies | None. |
| 15.207 | RSS-Gen 8.8 | AC Mains Conducted Emissions | Complies | None. |

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

| | Address | ISED CABID | ISED Company Number | FCC Registration |
|-------------------------------------|---|------------|---------------------|------------------|
| <input checked="" type="checkbox"/> | Building 2800 Suite Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A | US0067 | 27265 | 825374 |

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER | U _{Lab} |
|--|-----------------------------|
| Radio Frequency (Spectrum Analyzer) | 141.2 Hz |
| Occupied Channel Bandwidth | 1.22% |
| RF output power, conducted | 1.3 dB (PK) 0.45 dB (AV) |
| Power Spectral Density, conducted | 2.47 dB |
| Unwanted Emissions, conducted | 1.94 dB |
| All emissions, radiated | 6.01 dB |
| Conducted Emissions (0.150-30MHz) - LISN | 3.40 dB |
| Temperature | 0.57°C |
| Humidity | 3.39% |
| DC Supply voltages | 1.70% |

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

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)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a low voltage lighting control interface with integrated wireless communication. It contains a RF transceiver and antenna that cannot be changed by the user. The device is used as part of an integrated lighting system. The purpose of the wireless communication is to receive commands and transmit status back to the control system.

Model A-WN-D01-OCC (tested model) includes an onboard PIR Occupancy Sensor so the device can support native room occupancy scanning. The model number A-WN-D01-RF utilizes the same PCB and wireless circuitry but the PIR circuit is not populated in manufacturing. Testing on the A-WN-D01-OCC device covers the evaluation of the A-WN-D01-RF.

6.2. MAXIMUM OUTPUT POWER

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

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|-----------------------|------|--------------------|-------------------|
| 2402 - 2480 | BLE | 18.61 | 72.61 |

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:
The radio utilizes a permanently attached dipole antenna, with a maximum gain of 1.0 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 07910266.
The test utility software used during testing was Lutron Radio Certification GUI v1.2.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel and data rate with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

The EUT supports 2 data rates, 1Mbps and 2Mbps.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| Support Equipment List | | | | |
|------------------------|--------------|-------------|---------------|---------------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Laptop | HP | 14-dk1003dx | 5CG016B3DL | TX2-RTL8821CE |
| EUT Power Supply | Lutron | DFC-OEM-DBI | N/A | N/A |

I/O CABLES

| I/O Cable List | | | | | | |
|----------------|----------|----------------------|--------------------|------------------------|------------------|--|
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC Power | 1 | Type B (NEMA 5-15) | Unshielded Copper Wire | <3m | Used to connect EUT power supply to AC Mains |

TEST SETUP

The EUT is connected to a test laptop before the tests. Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R14558600-EP1 for setup diagrams

7. MEASUREMENT METHOD

On time and Duty Cycle: ANSI C63.10 subclause 11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

Radiated Spurious Emissions ANSI C63.10-2013 Section 6.3 - 6.6.

AC Power-line conducted emissions ANSI C63.10-2013 Section 6.2

8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------|---|-----------------------|-------------------|------------|------------|
| HI0090 | Environmental Meter | Fisher Scientific | 15-077-963 | 2022-07-20 | 2023-07-20 |
| SA0025 | Spectrum Analyzer | Keysight Technologies | N9030A | 2022-05-02 | 2023-05-02 |
| PWM003 | RF Power Meter | Keysight Technologies | N1911A | 2022-09-10 | 2023-09-10 |
| PWS002 | Wideband Power Sensor 50MHz-18GHz | Keysight Technologies | N1921A | 2022-09-27 | 2023-09-27 |
| 226559 | SMA Coaxial 10dB Attenuator 25MHz-18GHz | CentricRF | C18S2-10 | 2022-05-03 | 2023-05-03 |
| SOFTEMI | Antenna Port Software | UL | Version 2022.8.16 | | |

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------------|---|----------------------|----------------------------|------------|------------|
| 0.009-30MHz | | | | | |
| AT0079 | Active Loop Antenna | ETS-Lindgren | 6502 | 2022-09-12 | 2023-09-12 |
| | 30-1000 MHz | | | | |
| AT0066 | Hybrid Broadband Antenna | Sunol Sciences Corp. | JB1 | 2022-03-01 | 2023-03-01 |
| | 1-18 GHz | | | | |
| AT0072 | Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz | ETS Lindgren | 3117 | 2022-05-11 | 2023-05-11 |
| | 18-40 GHz | | | | |
| 204704 | Horn Antenna, 18-26.5GHz | Com-Power | AH-626 | 2022-07-11 | 2023-07-11 |
| | Gain-Loss Chains | | | | |
| C1-SAC01 | Gain-loss string: 0.009-30MHz | Various | Various | 2022-05-05 | 2023-05-05 |
| C1-SAC02 | Gain-loss string: 25-1000MHz | Various | Various | 2022-05-05 | 2023-05-05 |
| C1-SAC03 | Gain-loss string: 1-18GHz | Various | Various | 2022-05-05 | 2023-05-05 |
| C1-SAC04 | Gain-loss string: 18-40GHz | Various | Various | 2022-05-05 | 2023-05-05 |
| | Receiver & Software | | | | |
| 197954 | Spectrum Analyzer | Rohde & Schwarz | ESW44 | 2022-04-14 | 2023-04-14 |
| SA0026 | Spectrum Analyzer | Agilent | N9030A | 2022-08-02 | 2023-08-02 |
| SOFTEMI | EMI Software | UL | Version 9.5 (18 Oct 2021) | | |
| | Additional Equipment used | | | | |
| 200539 | Environmental Meter | Fisher Scientific | 15-077-963 s/n 18474341 | 2022-10-05 | 2023-10-05 |

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------|---|---------------------|-----------------------------|------------|------------|
| CBL087 | Coax cable, RG223, N-male to BNC-male, 20-ft. | Pasternack | PE3W06143-240 | 2022-04-05 | 2023-04-05 |
| HI0091 | Environmental Meter | Fisher Scientific | 15-077-963 | 2022-07-20 | 2023-07-20 |
| LISN003 | LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A | Fischer Custom Com. | FCC-LISN-50/250-25-2-01 | 2022-08-01 | 2023-08-01 |
| 75141 | EMI Test Receiver 9kHz-7GHz | Rohde & Schwarz | ESCI 7 | 2022-08-03 | 2023-08-03 |
| ATA222 | Transient Limiter, 0.009-100MHz | Electro-Metrics | EM-7600 | 2022-04-05 | 2023-04-05 |
| PS215 | AC Power Source | Elgar | CW2501M (s/n 1523A02397) | NA | NA |
| SOFTEMI | EMI Software | UL | Version 9.5 (18 Oct 2021) | | |

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

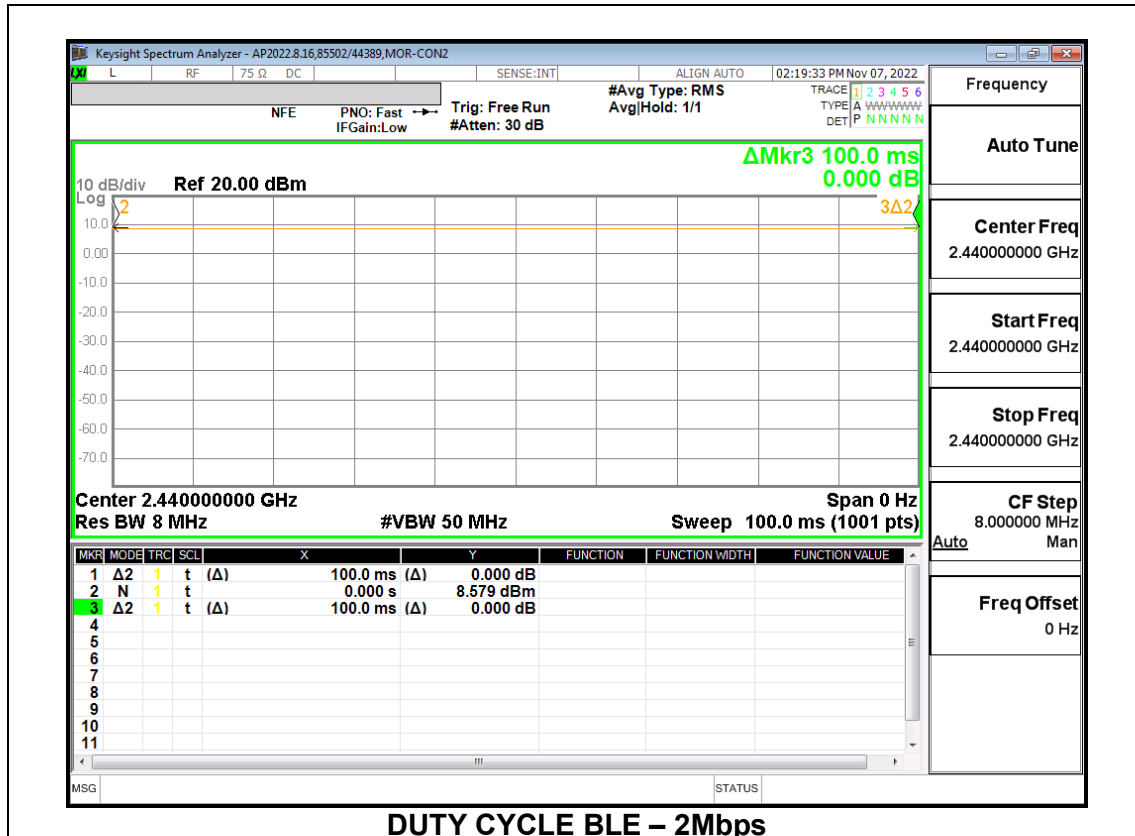
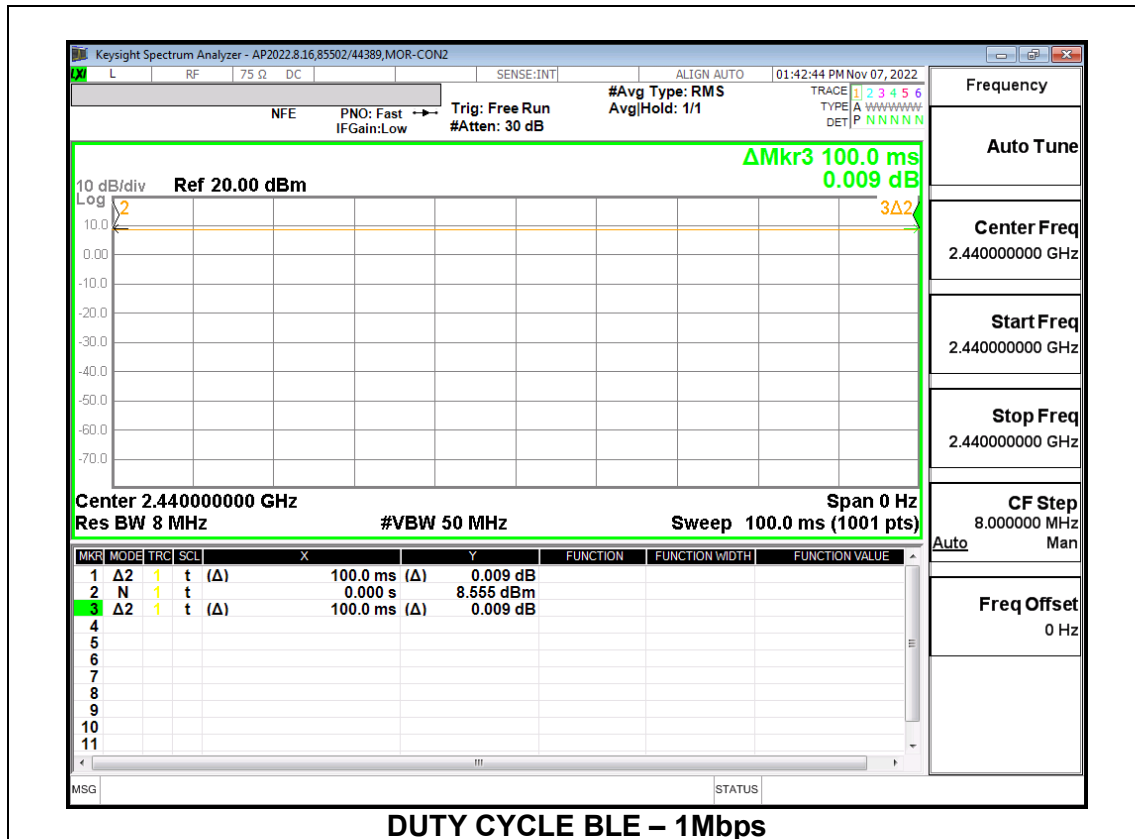
On time and Duty Cycle: ANSI C63.10 subclause 11.6

KDB 558074 Zero-Span Spectrum Analyzer Method.

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) |
|-------------|------------------------|------------------|-----------------------------|----------------------|---|-----------------------------|
| 2.4GHz Band | | | | | | |
| BLE - 1Mbps | 100.000 | 100.000 | 1.000 | 100.00% | 0.00 | 0.010 |
| BLE - 2Mbps | 100.000 | 100.000 | 1.000 | 100.00% | 0.00 | 0.010 |

Note: The manufacture has declared a real-life duty cycle of 22% over a 100ms window for BLE. The correction factor, therefore, would be $20\log(0.22) = -13.15\text{dB}$. According to KDB 558074 D01, Question 3, Answer 3, Part C), this -13.15dB can be manually subtracted from average measurements, when the duty cycle of the EUT in test mode is >98%. This correction has been performed as applicable on radiated measurements in section 10.



9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. BLE (1Mbps)

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low | 2402 | 1.0400 |
| Middle | 2440 | 1.0427 |
| High | 2480 | 1.0380 |



9.2.2. BLE (2Mbps)

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low | 2402 | 2.0777 |
| Middle | 2440 | 2.0853 |
| High | 2480 | 2.0872 |



9.3. 6 dB BANDWIDTH

LIMITS

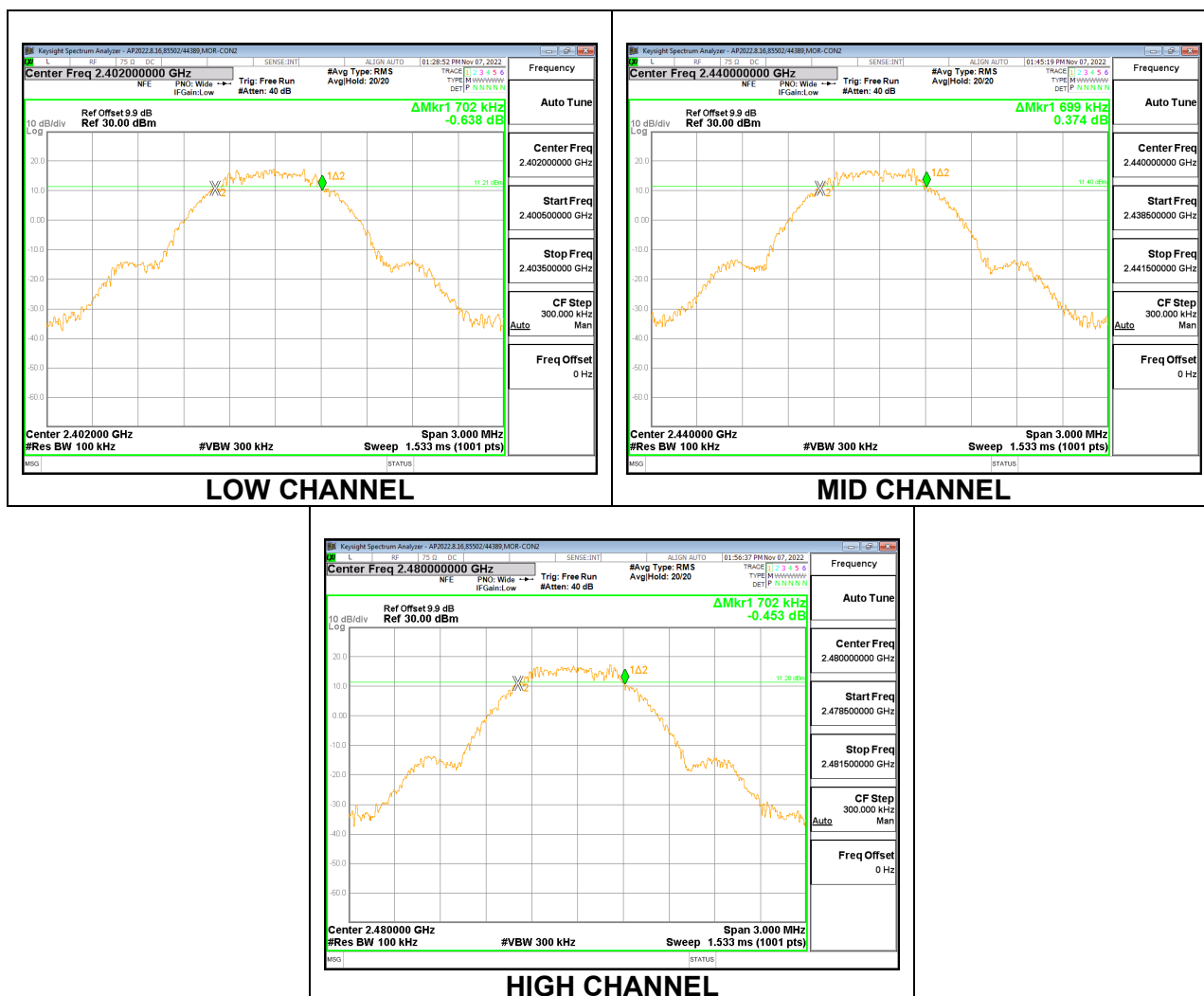
FCC §15.247 (a) (2)
RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

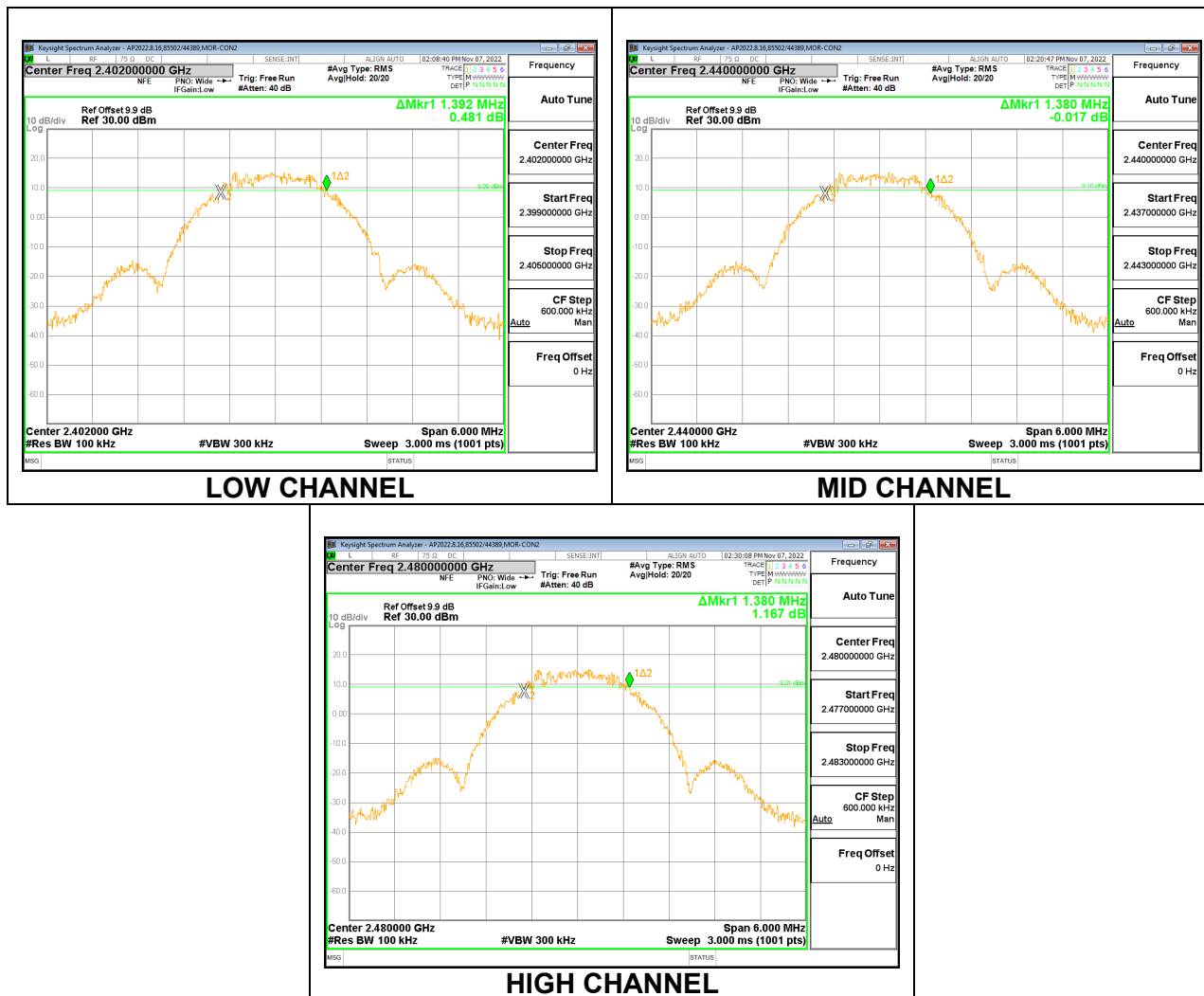
9.3.1. BLE (1Mbps)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 0.7020 | 0.5 |
| Middle | 2440 | 0.6990 | 0.5 |
| High | 2480 | 0.7020 | 0.5 |



9.3.2. BLE (2Mbps)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 1.3920 | 0.5 |
| Middle | 2440 | 1.3800 | 0.5 |
| High | 2480 | 1.3800 | 0.5 |



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 9.9 dB (including 9.65 dB pad and 0.25 dB cable) was entered as an offset in the power meter.

RESULTS

9.4.1. BLE (1Mbps)

| | |
|-------------------|-------------|
| Tested By: | 85502/44389 |
| Date: | 11/7/2022 |

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|----------------|----------------|
| Low | 2402 | 18.57 | 30 | -11.430 |
| Middle | 2440 | 18.47 | 30 | -11.530 |
| High | 2480 | 18.26 | 30 | -11.740 |

9.4.2. BLE (2Mbps)

| | |
|-------------------|-------------|
| Tested By: | 85502/44389 |
| Date: | 11/7/2022 |

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|----------------|----------------|
| Low | 2402 | 18.61 | 30 | -11.390 |
| Middle | 2440 | 18.44 | 30 | -11.560 |
| High | 2480 | 18.19 | 30 | -11.810 |

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a gated average power meter.

The cable assembly insertion loss of 9.9 dB (including 9.65 dB pad and 0.25 dB cable) was entered as an offset in the power meter.

RESULTS

9.5.1. BLE (1Mbps)

| | |
|------------|-------------|
| Tested By: | 85502/44389 |
| Date: | 11/7/2022 |

| Channel | Frequency (MHz) | AV power (dBm) |
|---------|--------------------|-------------------|
| Low | 2402 | 18.47 |
| Middle | 2440 | 18.37 |
| High | 2480 | 18.15 |

9.5.2. BLE (2Mbps)

| | |
|------------|-------------|
| Tested By: | 85502/44389 |
| Date: | 11/7/2022 |

| Channel | Frequency (MHz) | AV power (dBm) |
|---------|--------------------|-------------------|
| Low | 2402 | 18.50 |
| Middle | 2440 | 18.33 |
| High | 2480 | 18.08 |

9.6. POWER SPECTRAL DENSITY

LIMITS

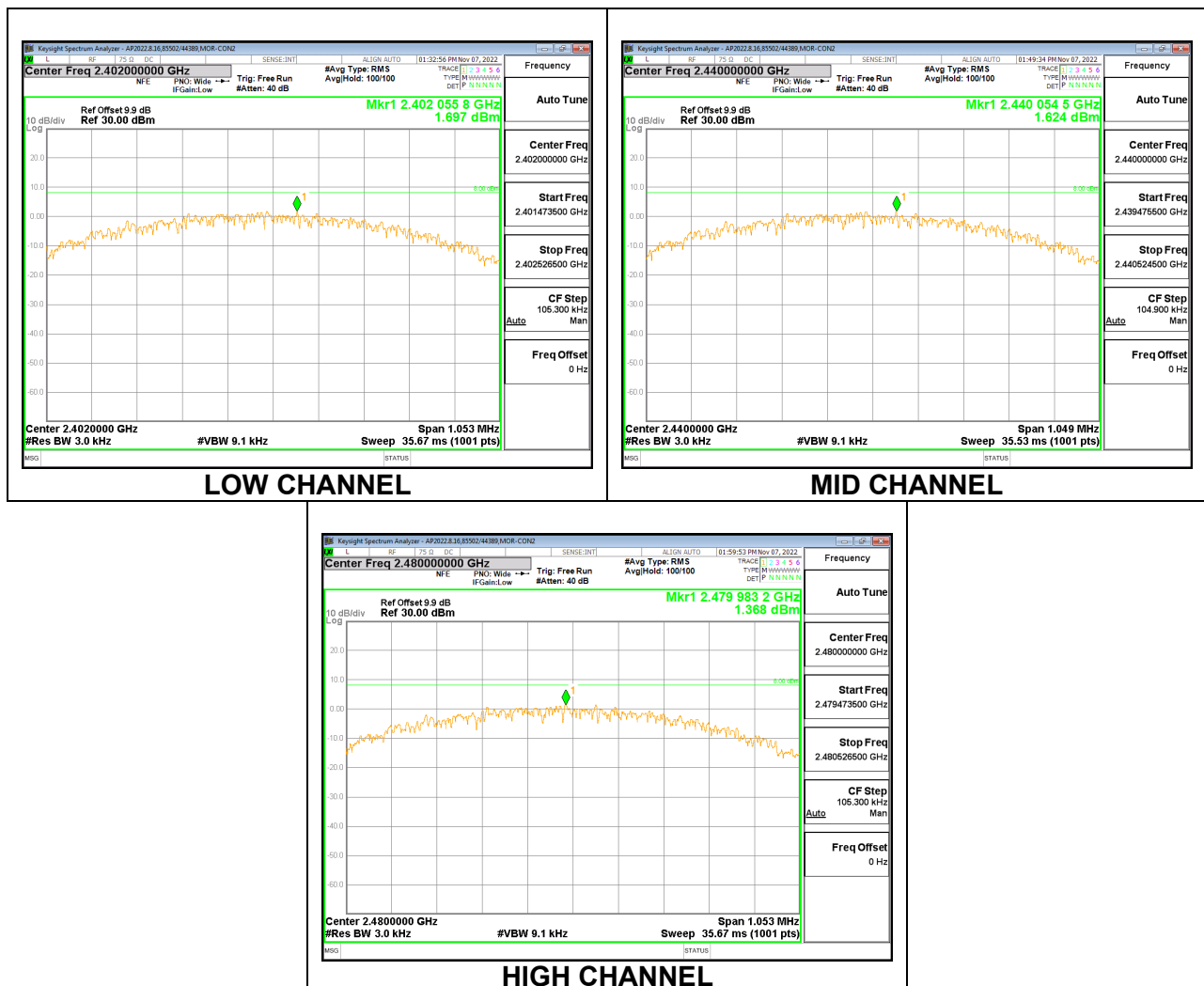
FCC §15.247 (e)
RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

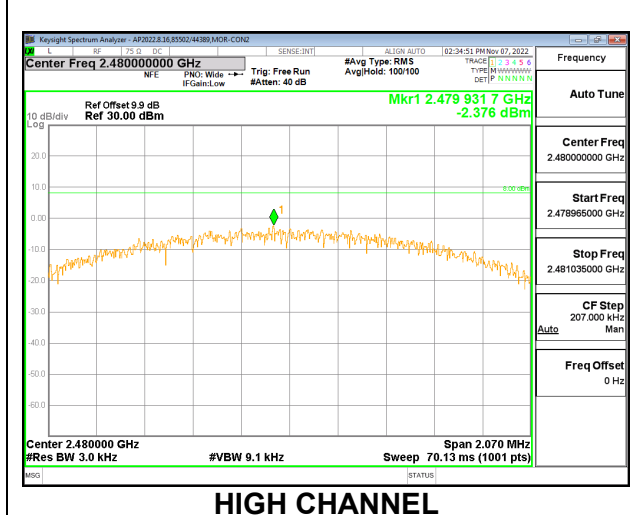
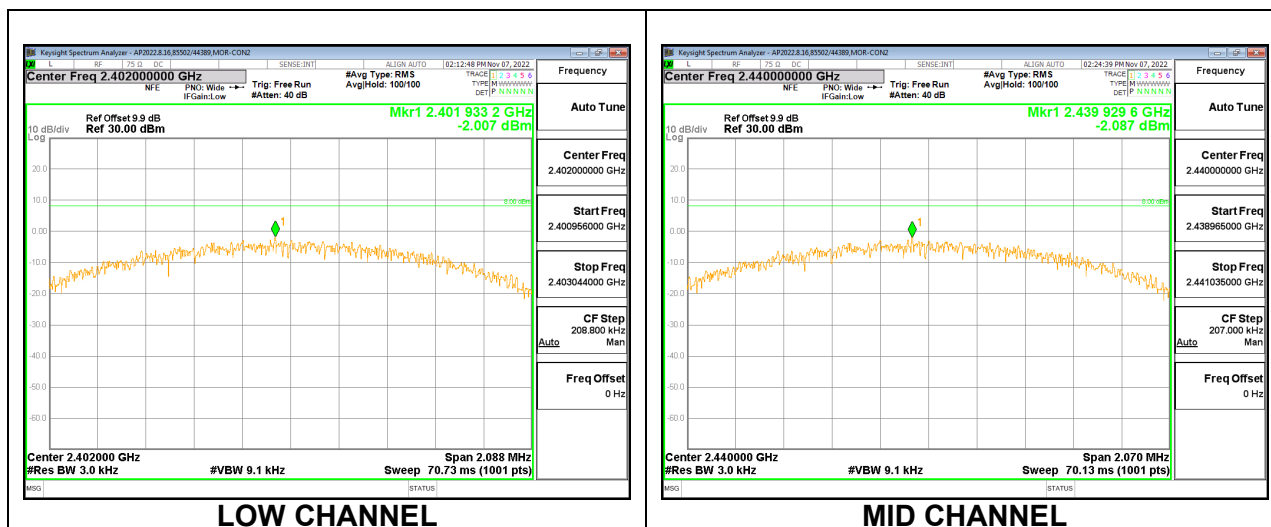
9.6.1. BLE (1Mbps)

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---------|-----------------|----------------|------------------|-------------|
| Low | 2402 | 1.697 | 8 | -6.30 |
| Middle | 2440 | 1.624 | 8 | -6.38 |
| High | 2480 | 1.368 | 8 | -6.63 |



9.6.2. BLE (2Mbps)

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---------|-----------------|----------------|------------------|-------------|
| Low | 2402 | -2.007 | 8 | -10.01 |
| Middle | 2440 | -2.087 | 8 | -10.09 |
| High | 2480 | -2.376 | 8 | -10.38 |



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

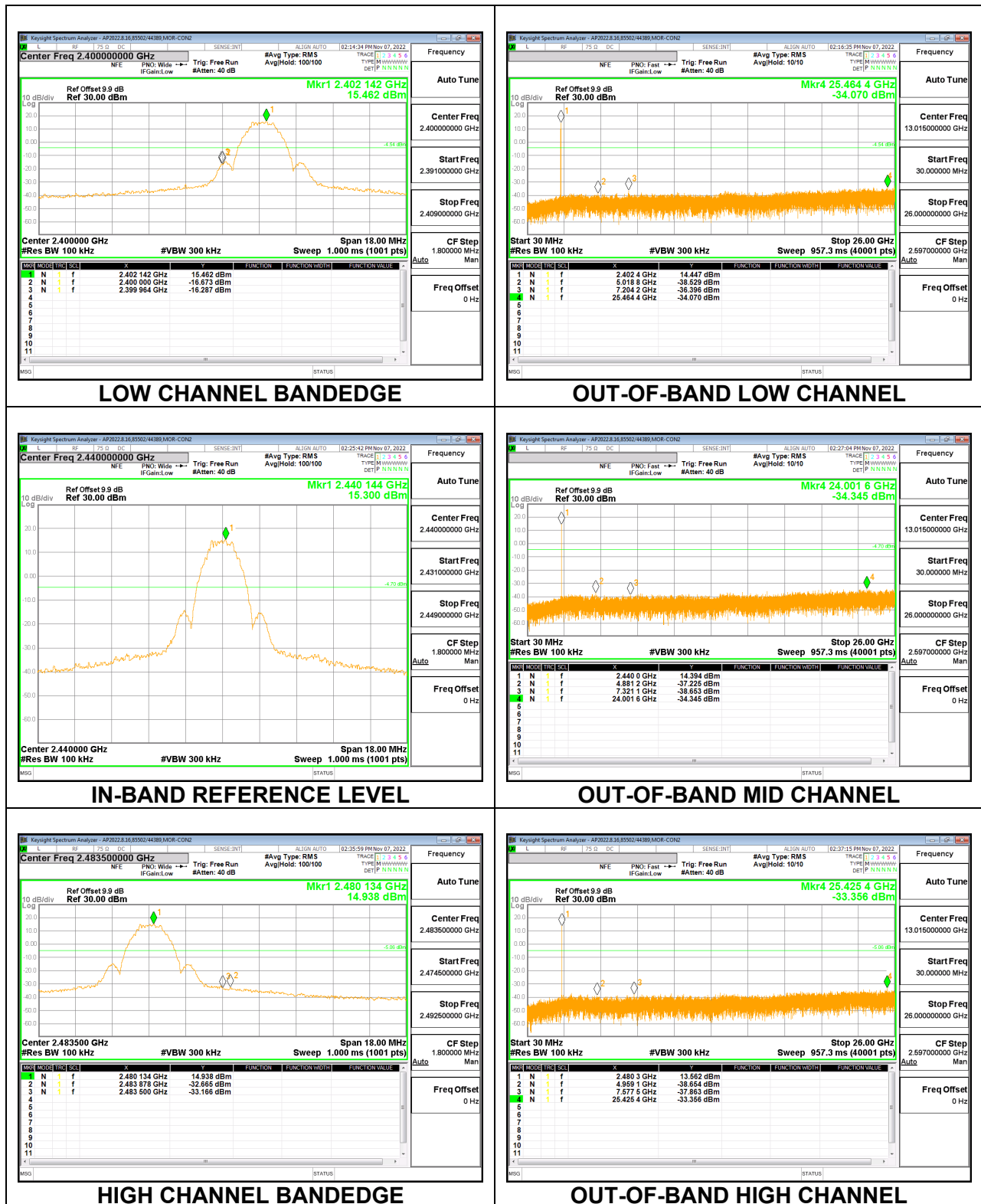
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

9.7.1. BLE (1Mbps)



9.7.2. BLE (2Mbps)



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 0.009-0.490 | 2400/F(kHz) @ 300 m | - |
| 0.490-1.705 | 24000/F(kHz) @ 30 m | - |
| 1.705 - 30 | 30 @ 30m | - |
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

RSS-GEN, Section 8.9 and 8.10

| Frequency Range (MHz) | Field Strength Limit (uA/m) at 3 m | Field Strength Limit (dBuA/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 0.009-0.490 | 6.37/F(kHz) @ 300 m | - |
| 0.490-1.705 | 6.37/F(kHz) @ 30 m | - |
| 1.705 - 30 | .08 @ 30m | - |
| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements. Linear Voltage Averaging was used.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. 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.

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

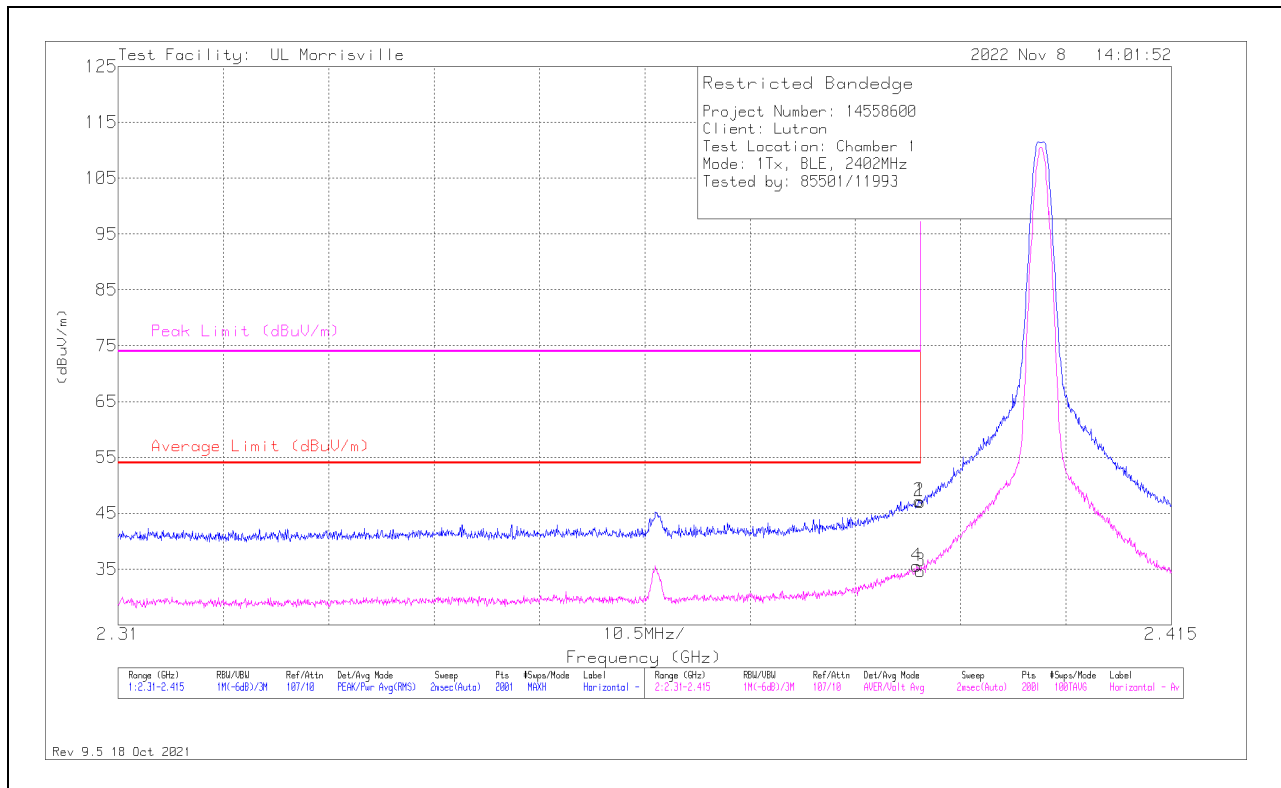
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.38996 | 39.88 | Pk | 32 | -24.8 | 0 | 47.08 | - | - | 74 | -26.92 | 131 | 218 | H |
| 2 | *** 2.38985 | 39.98 | Pk | 32 | -24.8 | 0 | 47.18 | - | - | 74 | -26.82 | 131 | 218 | H |
| 3 | *** 2.38996 | 27.45 | ADV | 32 | -24.8 | -13.15 | 21.50 | 54 | -32.50 | - | - | 131 | 218 | H |
| 4 | *** 2.38959 | 28.38 | ADV | 32 | -24.8 | -13.15 | 22.43 | 54 | -31.57 | - | - | 131 | 218 | H |

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

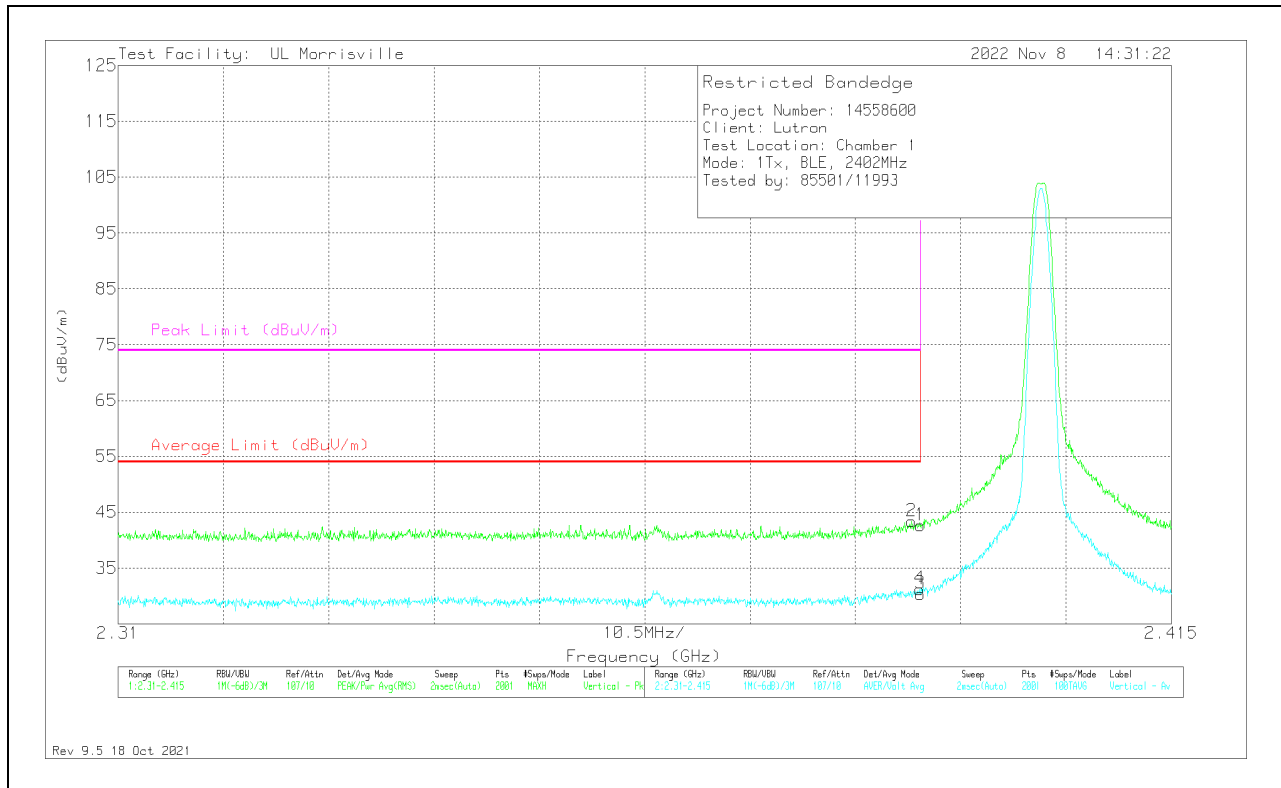
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.38996 | 35.43 | Pk | 32 | -24.8 | 0 | 42.63 | - | - | 74 | -31.37 | 65 | 290 | V |
| 2 | *** 2.38912 | 36.07 | Pk | 32 | -24.7 | 0 | 43.37 | - | - | 74 | -30.63 | 65 | 290 | V |
| 3 | *** 2.38996 | 23.2 | ADV | 32 | -24.8 | -13.15 | 17.25 | 54 | -36.75 | - | - | 65 | 290 | V |
| 4 | *** 2.38991 | 24.03 | ADV | 32 | -24.8 | -13.15 | 18.08 | 54 | -35.92 | - | - | 65 | 290 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

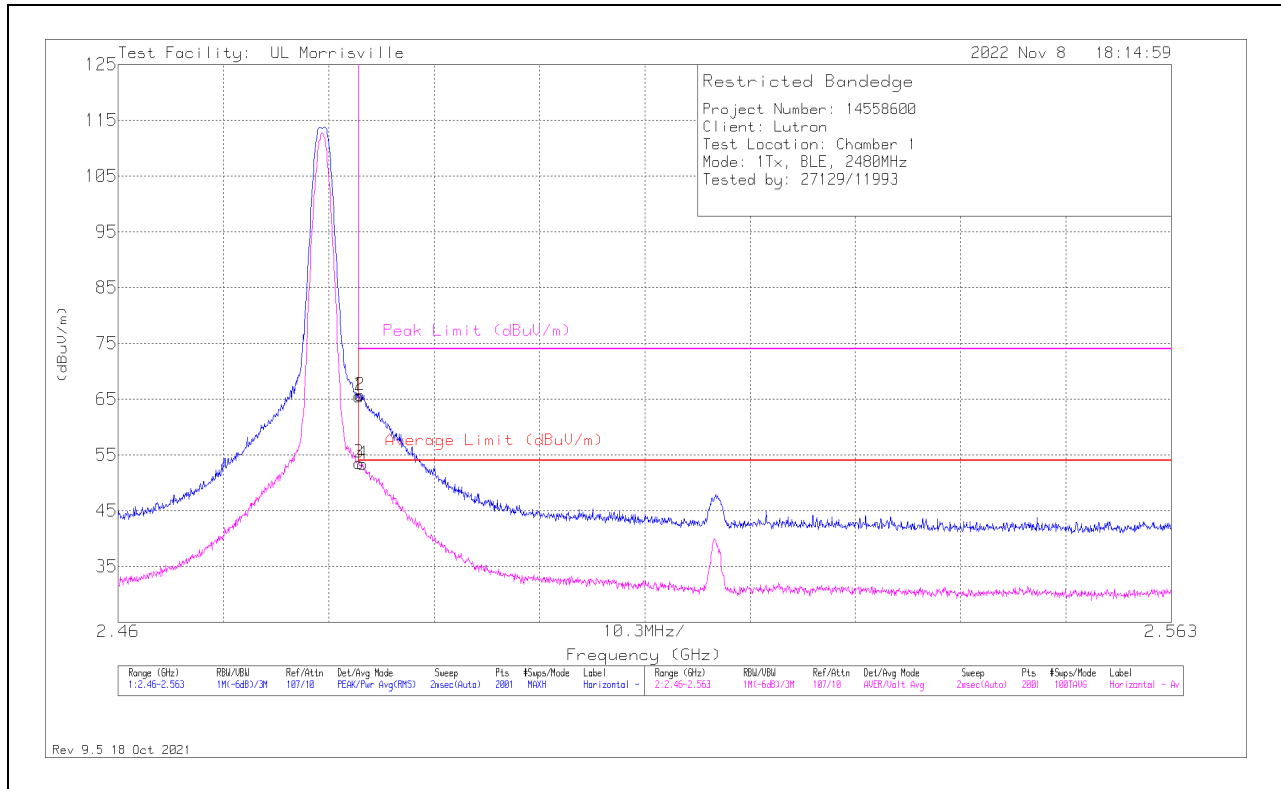
Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.48354 | 57.47 | Pk | 32.5 | -24.4 | 0 | 65.57 | - | - | 74 | -8.43 | 125 | 138 | H |
| 2 | *** 2.48369 | 57.62 | Pk | 32.5 | -24.4 | 0 | 65.72 | - | - | 74 | -8.28 | 125 | 138 | H |
| 3 | *** 2.48354 | 45.49 | ADV | 32.5 | -24.4 | -13.15 | 40.44 | 54 | -13.56 | - | - | 125 | 138 | H |
| 4 | *** 2.4839 | 45.29 | ADV | 32.5 | -24.4 | -13.15 | 40.24 | 54 | -13.76 | - | - | 125 | 138 | H |

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

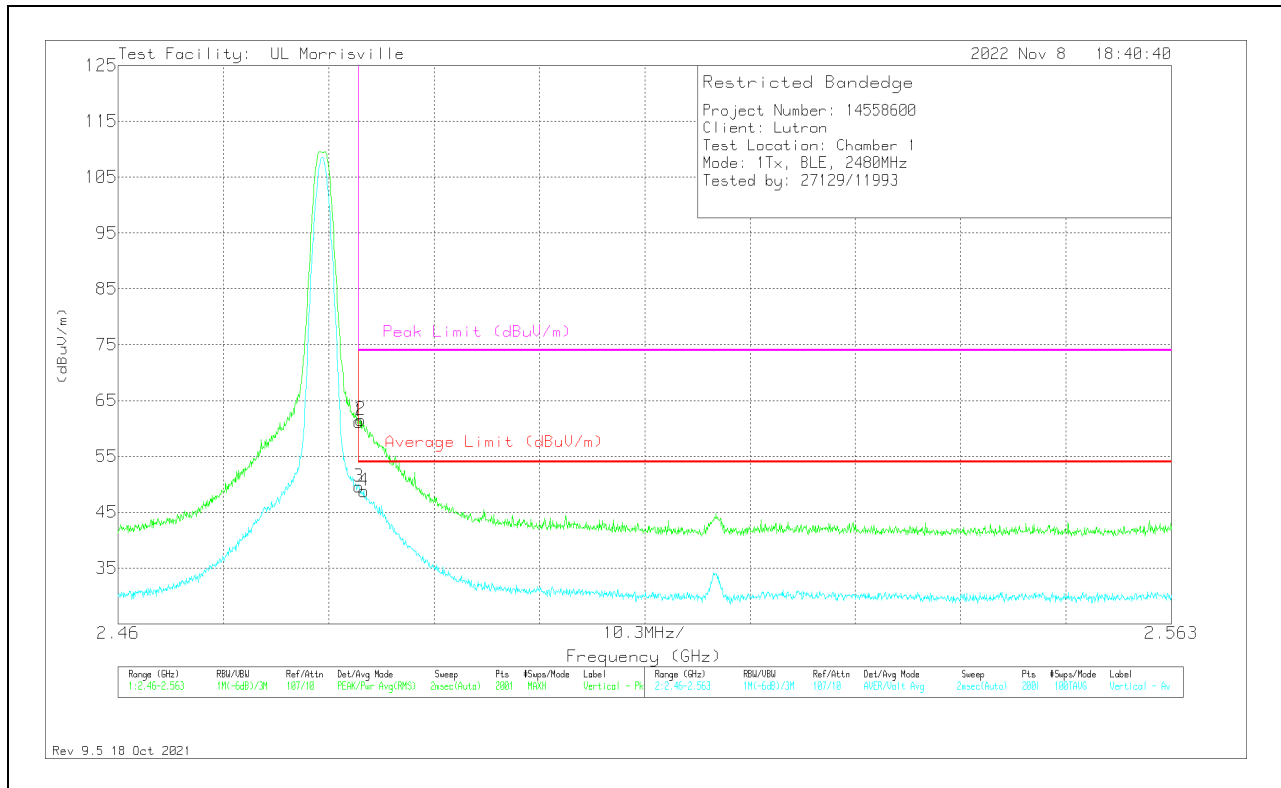
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 2.48354 | 53.14 | Pk | 32.5 | -24.4 | 0 | 61.24 | - | - | 74 | -12.76 | 111 | 331 | V |
| 3 | * ** 2.48354 | 41.46 | ADV | 32.5 | -24.4 | -13.15 | 36.44 | 54 | -17.56 | - | - | 111 | 331 | V |
| 2 | * ** 2.48374 | 53.45 | Pk | 32.5 | -24.4 | 0 | 61.55 | - | - | 74 | -12.45 | 111 | 331 | V |
| 4 | * ** 2.48405 | 40.61 | ADV | 32.5 | -24.3 | -13.15 | 35.66 | 54 | -18.34 | - | - | 111 | 331 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

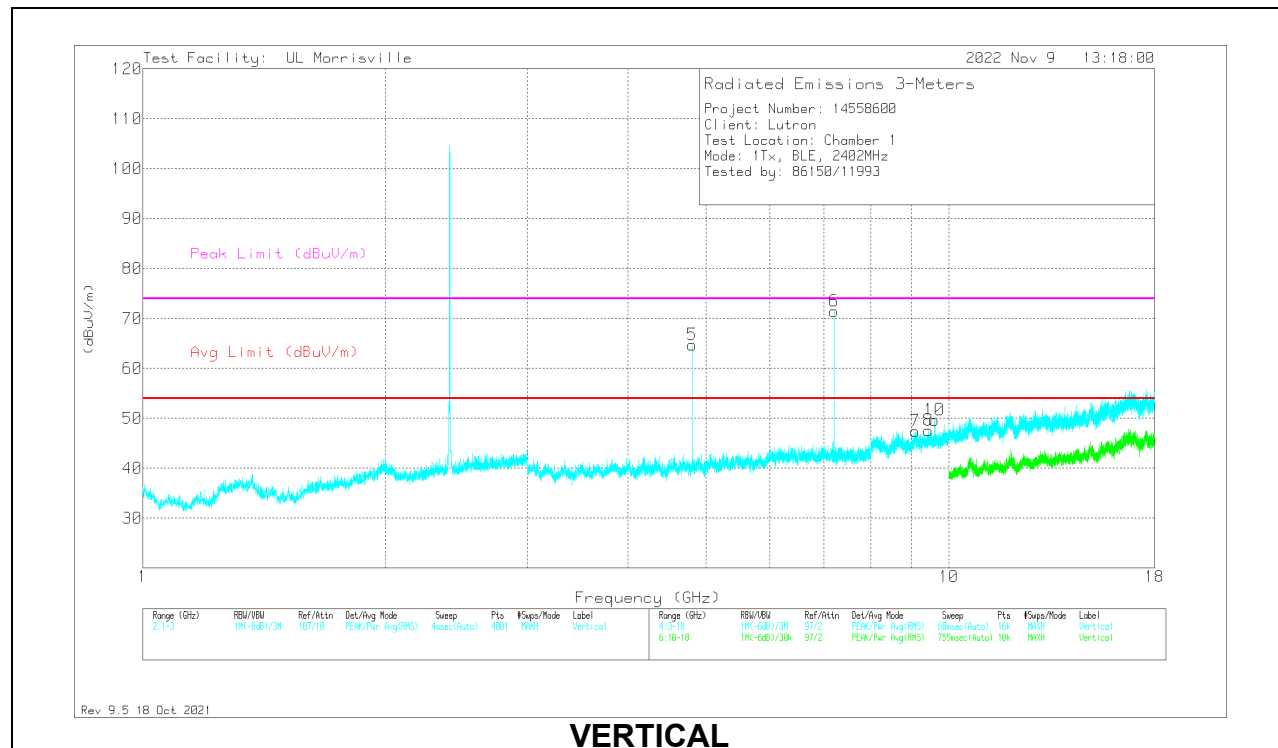
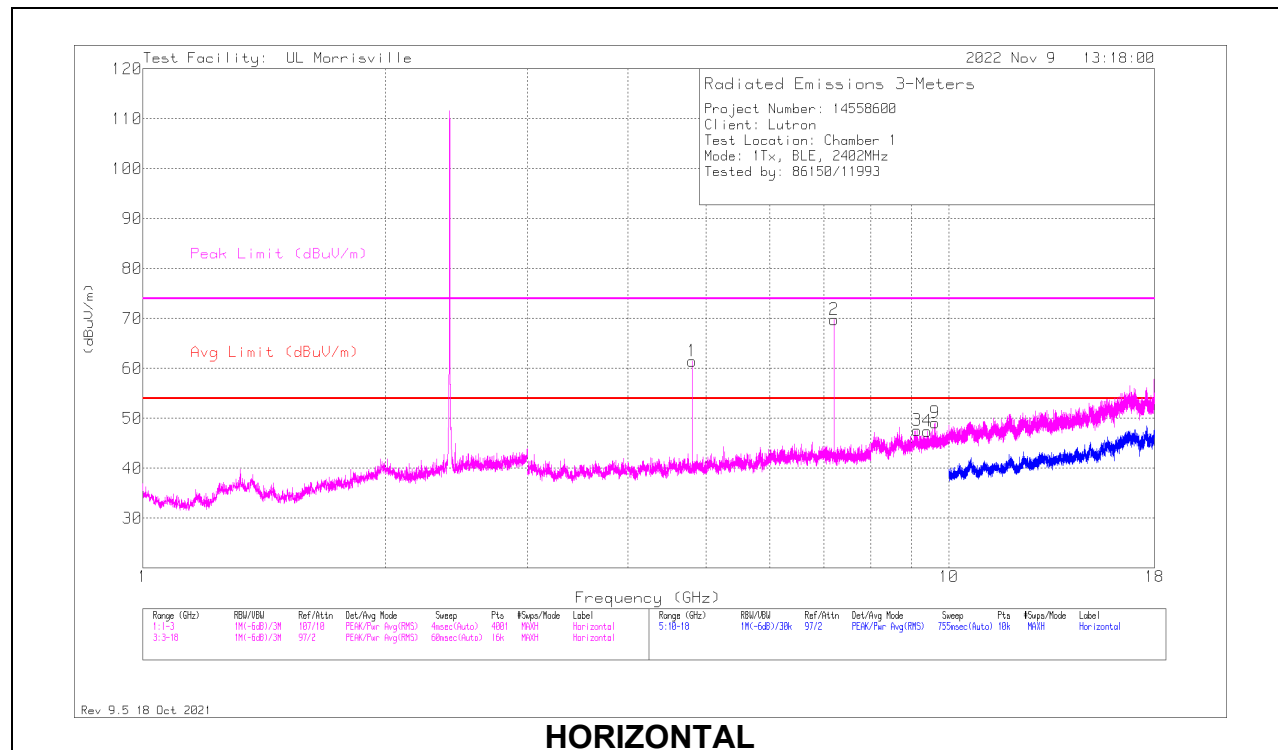
Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 4.80435 | 60.41 | PK2 | 34.1 | -32 | 0 | 62.51 | - | - | 74 | -11.49 | 204 | 350 | H |
| | * ** 4.80411 | 56.67 | ADV | 34.1 | -32 | -13.15 | 45.62 | 54 | -8.38 | - | - | 204 | 350 | H |
| 3 | * ** 9.13969 | 39.53 | Pk | 36.3 | -28.2 | 0 | 47.63 | 54 | -6.37 | 74 | -26.37 | 0-360 | 200 | H |
| 4 | * ** 9.405 | 39.3 | Pk | 36.6 | -28.4 | 0 | 47.5 | 54 | -6.5 | 74 | -26.5 | 0-360 | 200 | H |
| 5 | * ** 4.80343 | 61.26 | PK2 | 34.1 | -32 | 0 | 63.36 | - | - | 74 | -10.64 | 10 | 320 | V |
| | * ** 4.80388 | 57.62 | ADV | 34.1 | -32 | -13.15 | 46.57 | 54 | -7.43 | - | - | 10 | 320 | V |
| 7 | * ** 9.08625 | 39.23 | Pk | 36.3 | -28.1 | 0 | 47.43 | 54 | -6.57 | 74 | -26.57 | 0-360 | 200 | V |
| 8 | * ** 9.43688 | 39.48 | Pk | 36.6 | -28.5 | 0 | 47.58 | 54 | -6.42 | 74 | -26.42 | 0-360 | 101 | V |
| 2 | 7.20656 | 64.36 | Pk | 35.7 | -30.3 | 0 | 69.76 | - | - | - | - | 0-360 | 101 | H |
| 6 | 7.20656 | 66.09 | Pk | 35.7 | -30.3 | 0 | 71.49 | - | - | - | - | 0-360 | 101 | V |
| 10 | 9.60656 | 41.02 | Pk | 36.8 | -28.1 | 0 | 49.72 | - | - | - | - | 0-360 | 101 | V |
| 9 | 9.60844 | 40.59 | Pk | 36.8 | -28.2 | 0 | 49.19 | - | - | - | - | 0-360 | 101 | H |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

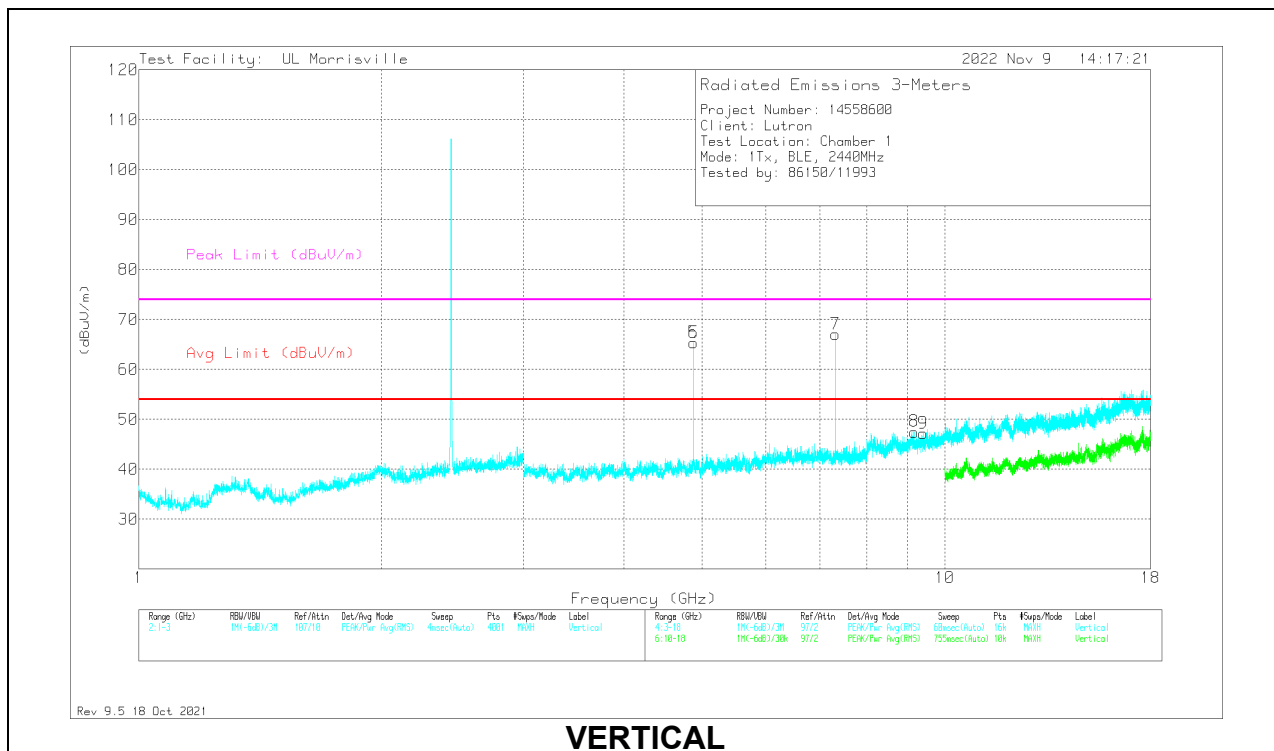
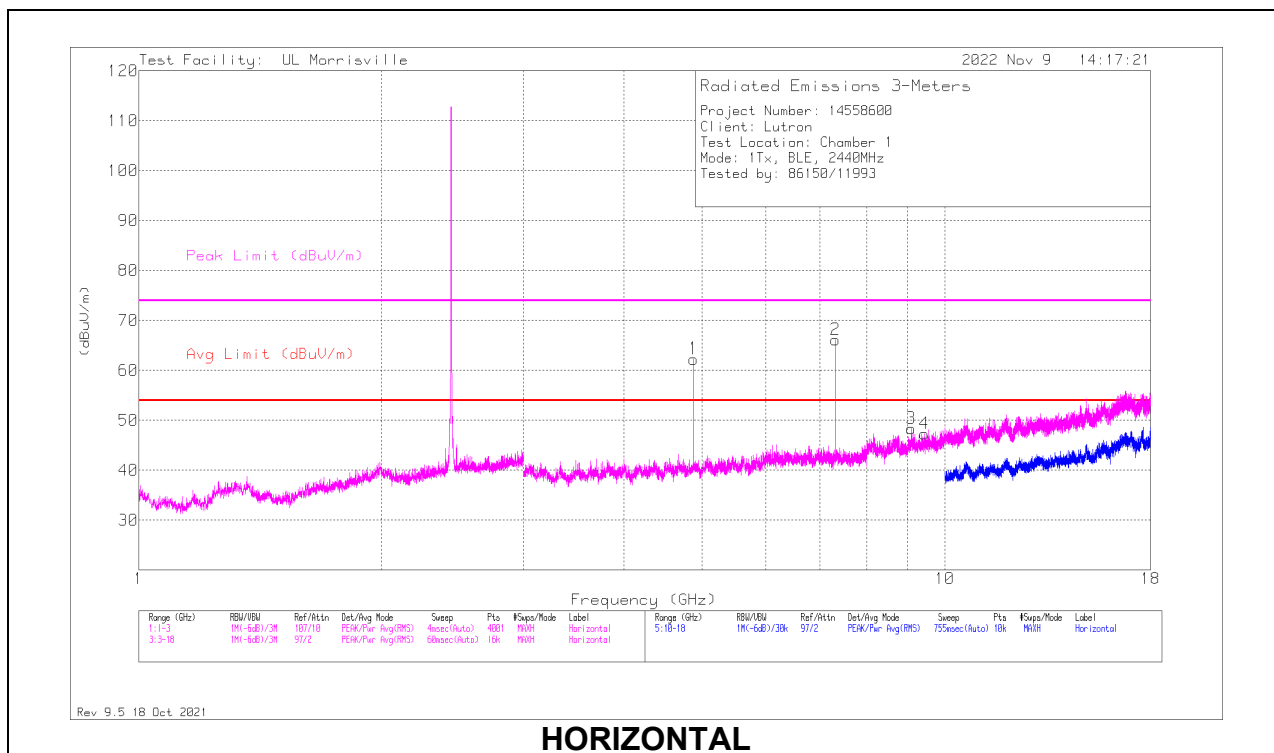
Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

MID CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 4.88042 | 60.2 | PK2 | 34 | -31.4 | 0 | 62.8 | - | - | 74 | -11.2 | 185 | 102 | H |
| | * ** 4.87965 | 56.28 | ADV | 34 | -31.4 | -13.15 | 45.73 | 54 | -8.27 | - | - | 185 | 102 | H |
| 2 | * ** 7.3191 | 60.83 | PK2 | 35.6 | -29.5 | 0 | 66.93 | - | - | 74 | -7.07 | 312 | 101 | H |
| | * ** 7.31918 | 55.56 | ADV | 35.6 | -29.5 | -13.15 | 48.51 | 54 | -5.49 | - | - | 312 | 101 | H |
| 3 | * ** 9.08984 | 40.26 | PK2 | 36.3 | -28.2 | 0 | 48.36 | - | - | 74 | -25.64 | 0 | 157 | H |
| | * ** 9.09264 | 27.72 | ADV | 36.3 | -27.9 | -13.15 | 22.97 | 54 | -31.03 | - | - | 0 | 157 | H |
| 4 | * ** 9.44063 | 39.06 | Pk | 36.6 | -28.3 | 0 | 47.36 | 54 | -6.64 | 74 | -26.64 | 0-360 | 199 | H |
| 5 | * ** 4.88045 | 63.23 | PK2 | 34 | -31.4 | 0 | 65.83 | - | - | 74 | -8.17 | 89 | 111 | V |
| | * ** 4.87997 | 59.78 | ADV | 34 | -31.4 | -13.15 | 49.23 | 54 | -4.77 | - | - | 89 | 111 | V |
| 6 | * ** 4.87947 | 63.24 | PK2 | 34 | -31.3 | 0 | 65.94 | - | - | 74 | -8.06 | 90 | 109 | V |
| | * ** 4.87995 | 59.67 | ADV | 34 | -31.4 | -13.15 | 49.12 | 54 | -4.88 | - | - | 90 | 109 | V |
| 7 | * ** 7.31911 | 61.4 | PK2 | 35.6 | -29.5 | 0 | 67.5 | - | - | 74 | -6.5 | 358 | 111 | V |
| | * ** 7.31924 | 56.46 | ADV | 35.6 | -29.5 | -13.15 | 49.41 | 54 | -4.59 | - | - | 358 | 111 | V |
| 8 | * ** 9.16219 | 39.22 | Pk | 36.3 | -28 | 0 | 47.52 | 54 | -6.48 | 74 | -26.48 | 0-360 | 101 | V |
| 9 | * ** 9.40125 | 39.05 | Pk | 36.6 | -28.4 | 0 | 47.25 | 54 | -6.75 | 74 | -26.75 | 0-360 | 200 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

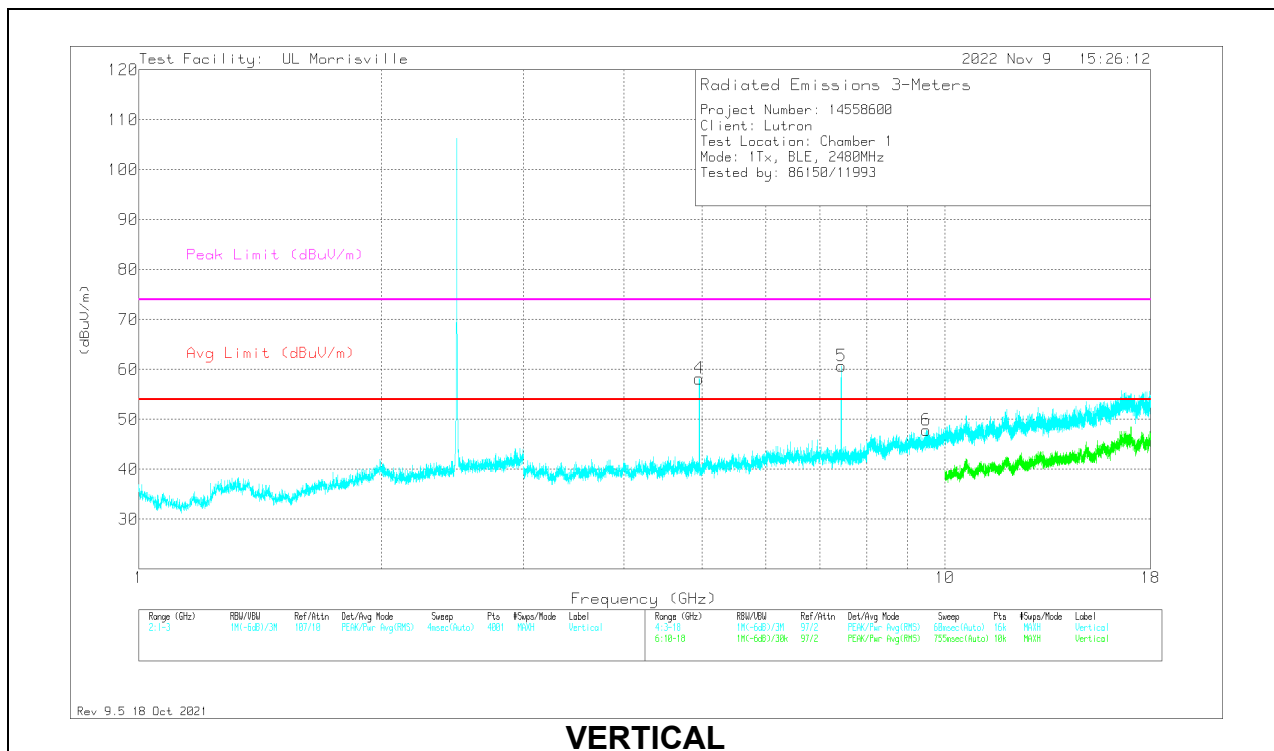
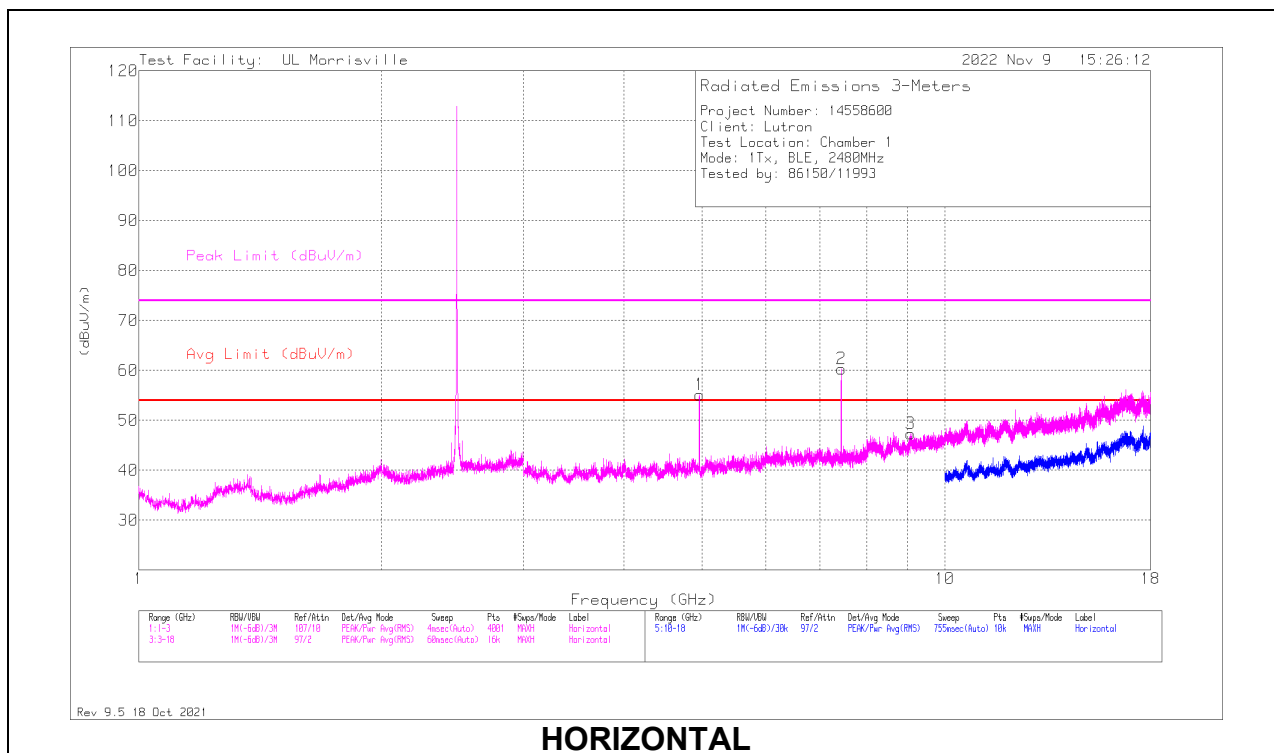
Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 4.95945 | 55.07 | PK2 | 34 | -32.8 | 0 | 56.27 | - | - | 74 | -17.73 | 181 | 101 | H |
| | * ** 4.9598 | 50.45 | ADV | 34 | -32.8 | -13.15 | 38.50 | 54 | -15.50 | - | - | 181 | 101 | H |
| 2 | * ** 7.43914 | 55.39 | PK2 | 35.6 | -29.6 | 0 | 61.39 | - | - | 74 | -12.61 | 314 | 112 | H |
| | * ** 7.44054 | 50.04 | ADV | 35.6 | -29.5 | -13.15 | 42.99 | 54 | -11.01 | - | - | 314 | 112 | H |
| 3 | * ** 9.07219 | 39.7 | Pk | 36.2 | -28.6 | 0 | 47.3 | 54 | -6.7 | 74 | -26.7 | 0-360 | 200 | H |
| 4 | * ** 4.95942 | 57.7 | PK2 | 34 | -32.8 | 0 | 58.9 | - | - | 74 | -15.1 | 85 | 121 | V |
| | * ** 4.95967 | 53.7 | ADV | 34 | -32.8 | -13.15 | 41.75 | 54 | -12.25 | - | - | 85 | 121 | V |
| 5 | * ** 7.44066 | 53.93 | PK2 | 35.6 | -29.5 | 0 | 60.03 | - | - | 74 | -13.97 | 74 | 381 | V |
| | * ** 7.43926 | 48.06 | ADV | 35.6 | -29.6 | -13.15 | 40.91 | 54 | -13.09 | - | - | 74 | 381 | V |
| 6 | * ** 9.48938 | 39.29 | Pk | 36.7 | -28.1 | 0 | 47.89 | 54 | -6.11 | 74 | -26.11 | 0-360 | 101 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

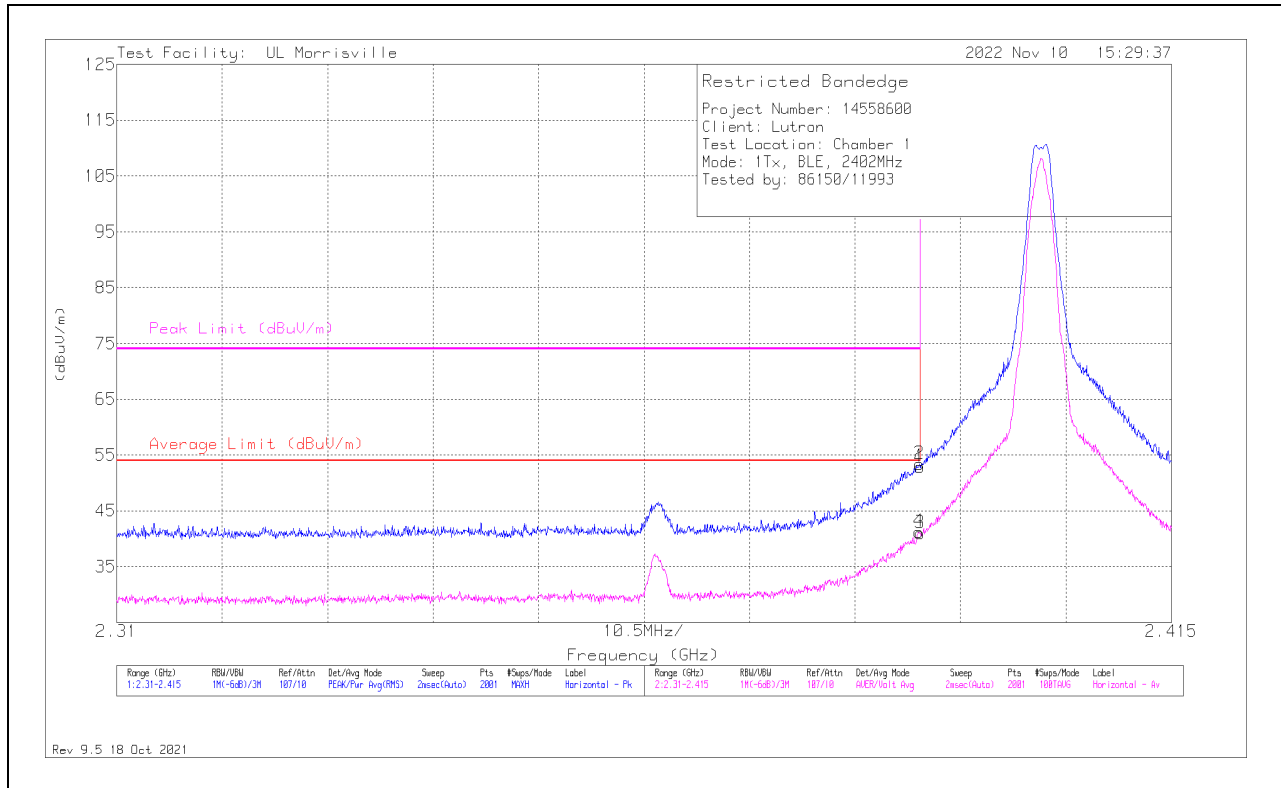
Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

10.2.2. BLE (2Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.38996 | 45.68 | Pk | 32 | -24.8 | 0 | 52.88 | - | - | 74 | -21.12 | 136 | 195 | H |
| 2 | *** 2.38991 | 46.15 | Pk | 32 | -24.8 | 0 | 53.35 | - | - | 74 | -20.65 | 136 | 195 | H |
| 3 | *** 2.38996 | 33.8 | ADV | 32 | -24.8 | -13.15 | 27.85 | 54 | -26.15 | - | - | 136 | 195 | H |
| 4 | *** 2.38985 | 34.06 | ADV | 32 | -24.8 | -13.15 | 28.11 | 54 | -25.89 | - | - | 136 | 195 | H |

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

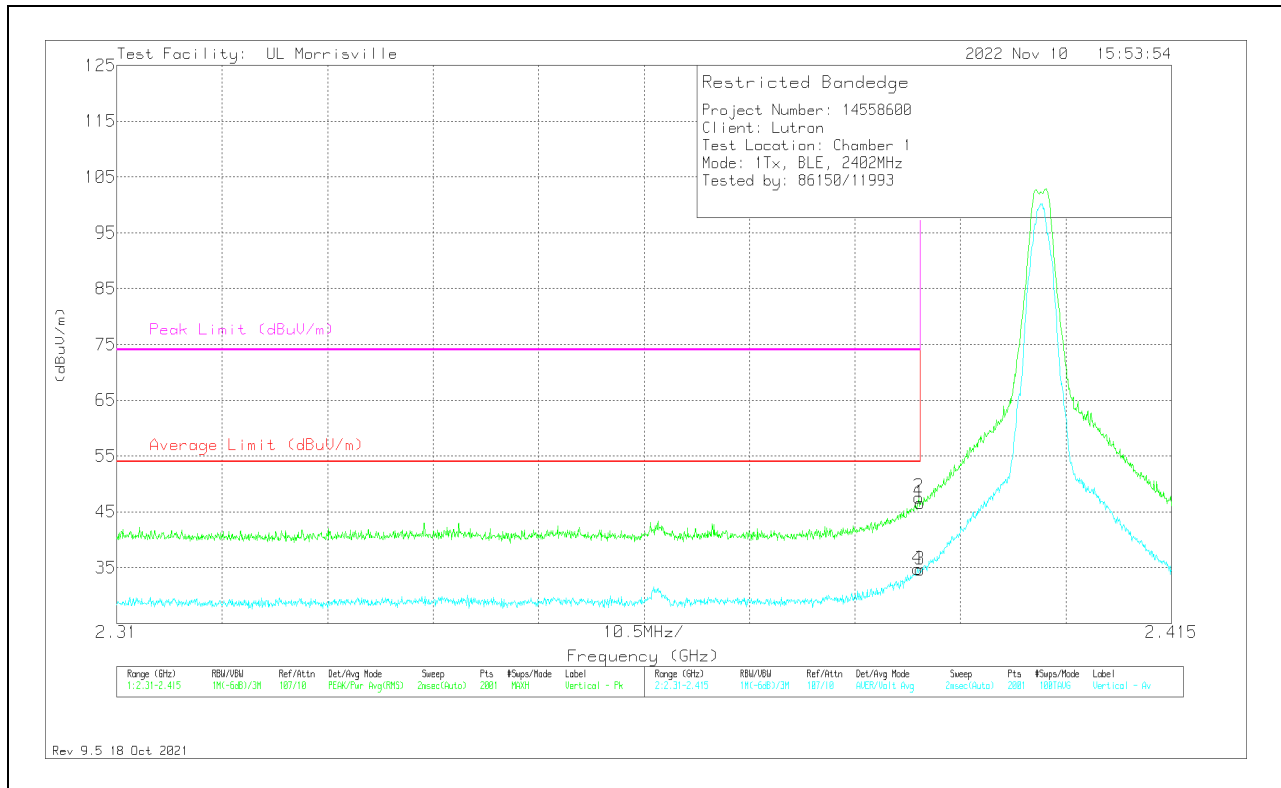
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.38996 | 39.4 | Pk | 32 | -24.8 | 0 | 46.6 | - | - | 74 | -27.4 | 117 | 275 | V |
| 2 | *** 2.38985 | 40.42 | Pk | 32 | -24.8 | 0 | 47.62 | - | - | 74 | -26.38 | 117 | 275 | V |
| 3 | *** 2.38996 | 27.43 | ADV | 32 | -24.8 | -13.15 | 21.48 | 54 | -32.52 | - | - | 117 | 275 | V |
| 4 | *** 2.38975 | 27.52 | ADV | 32 | -24.8 | -13.15 | 21.57 | 54 | -32.43 | - | - | 117 | 275 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

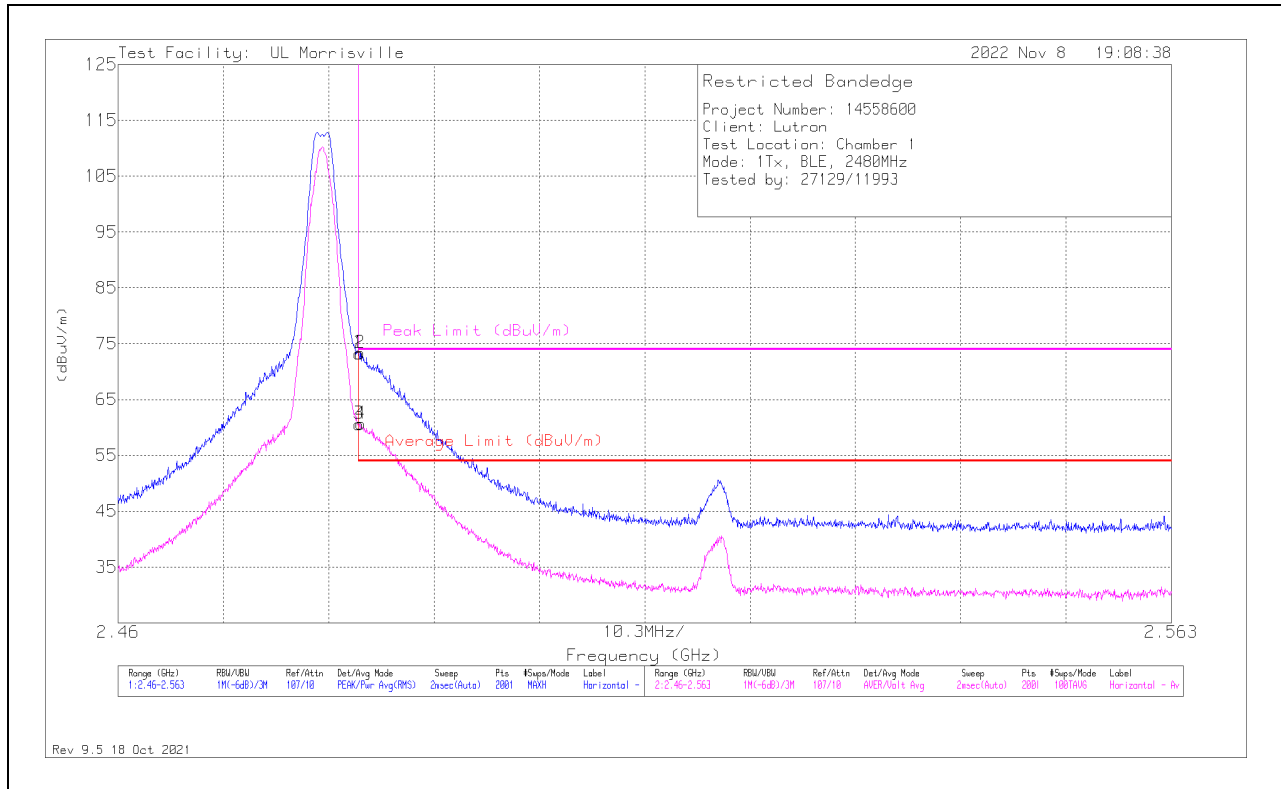
Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 2.48354 | 65.17 | Pk | 32.5 | -24.4 | 0 | 73.27 | - | - | 74 | -7.3 | 325 | 238 | H |
| 2 | * ** 2.48369 | 65.2 | Pk | 32.5 | -24.4 | 0 | 73.3 | - | - | 74 | -7 | 325 | 238 | H |
| 3 | * ** 2.48354 | 52.51 | ADV | 32.5 | -24.4 | -13.15 | 47.46 | 54 | -6.54 | - | - | 325 | 238 | H |
| 4 | * ** 2.48374 | 52.56 | ADV | 32.5 | -24.4 | -13.15 | 47.51 | 54 | -6.49 | - | - | 325 | 238 | H |

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

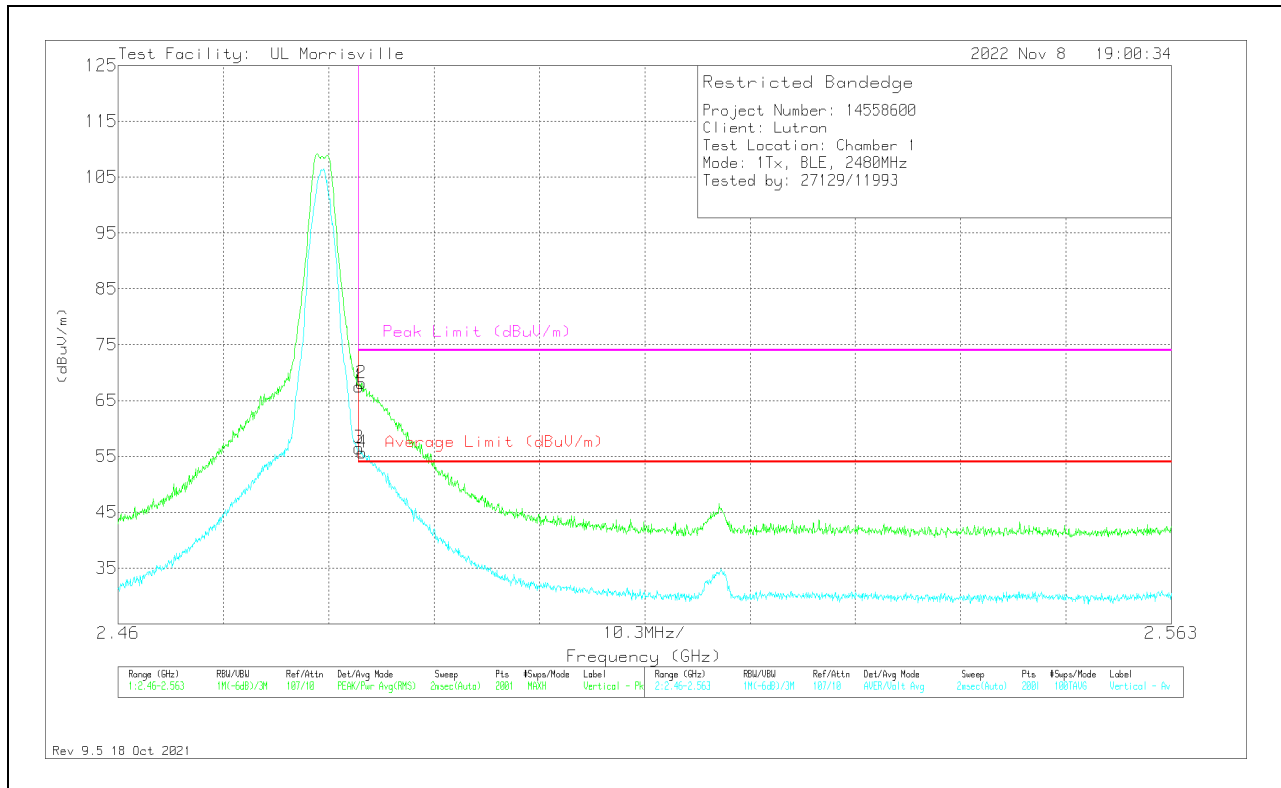
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * ** 2.48354 | 59.4 | Pk | 32.5 | -24.4 | 0 | 67.5 | - | - | 74 | -6.5 | 113 | 330 | V |
| 2 | * ** 2.48379 | 59.98 | Pk | 32.5 | -24.4 | 0 | 68.08 | - | - | 74 | -5.92 | 113 | 330 | V |
| 3 | * ** 2.48354 | 48.38 | ADV | 32.5 | -24.4 | -13.15 | 43.33 | 54 | -10.67 | - | - | 113 | 330 | V |
| 4 | * ** 2.48384 | 47.57 | ADV | 32.5 | -24.4 | -13.15 | 42.52 | 54 | -11.48 | - | - | 113 | 330 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

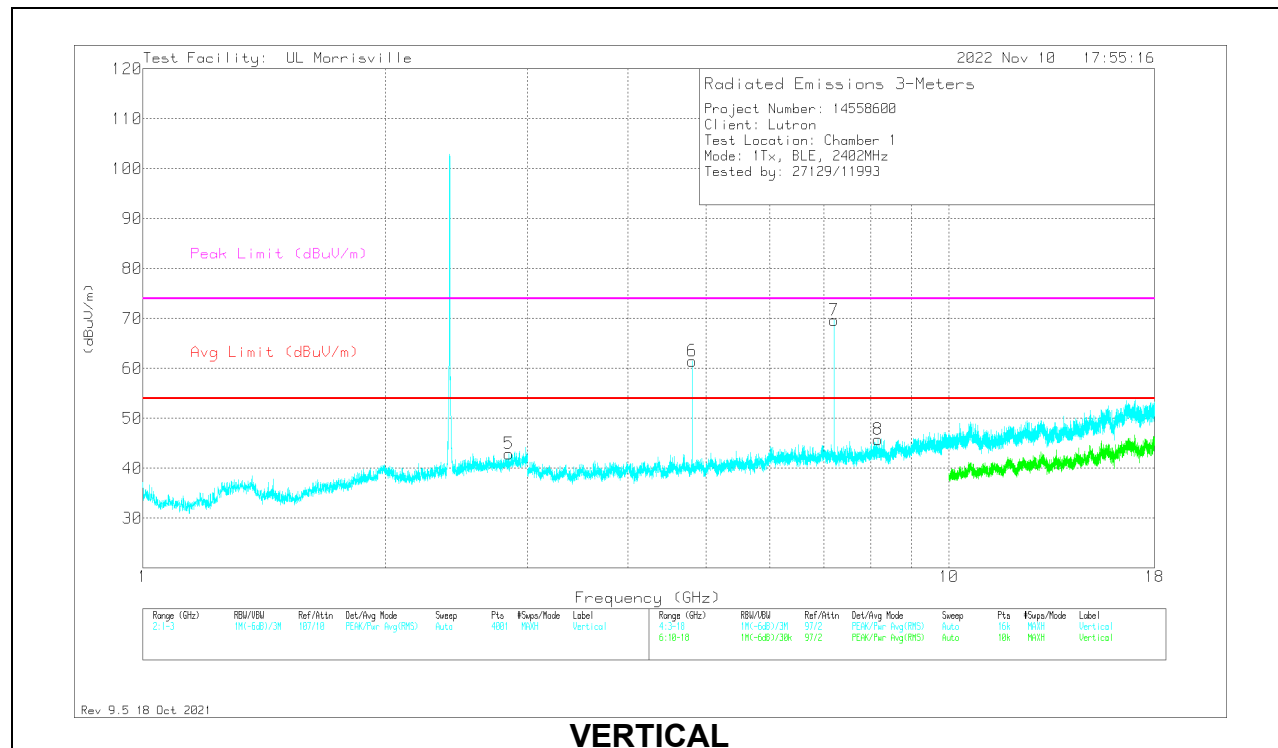
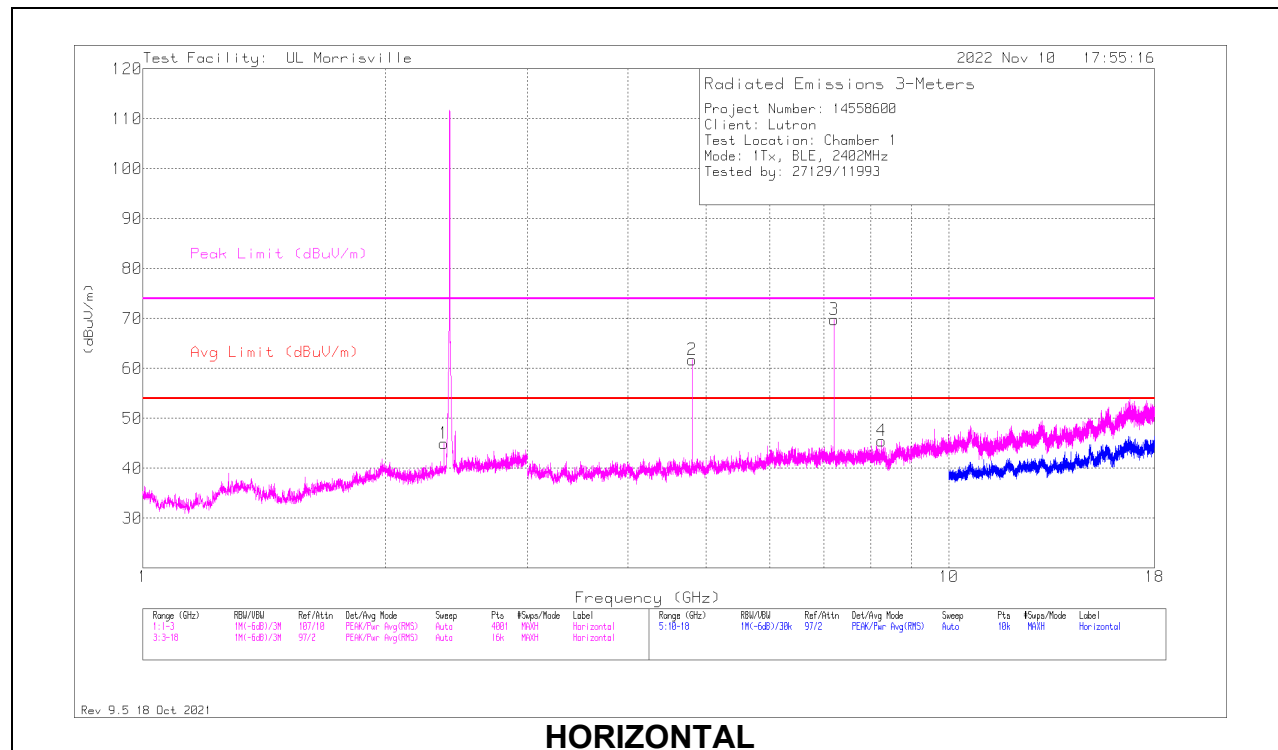
Pk - Peak detector

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | *** 2.364 | 37.83 | Pk | 32 | -24.9 | 0 | 44.93 | 54 | -9.07 | 74 | -29.07 | 0-360 | 101 | H |
| 5 | *** 2.8445 | 34.38 | Pk | 32.5 | -24 | 0 | 42.88 | 54 | -11.12 | 74 | -31.12 | 0-360 | 200 | V |
| 2 | *** 4.80298 | 61.49 | PK2 | 34.1 | -32 | 0 | 63.59 | - | - | 74 | -10.41 | 208 | 244 | H |
| | *** 4.80482 | 54.98 | ADV | 34.1 | -32.1 | -13.15 | 43.83 | 54 | -10.17 | - | - | 208 | 244 | H |
| 4 | *** 8.25 | 38.79 | Pk | 35.8 | -29.1 | 0 | 45.49 | 54 | -8.51 | 74 | -28.51 | 0-360 | 199 | H |
| 6 | *** 4.80294 | 63.64 | PK2 | 34.1 | -32 | 0 | 65.74 | - | - | 74 | -8.26 | 83 | 115 | V |
| | *** 4.80306 | 57.2 | ADV | 34.1 | -32 | -13.15 | 46.15 | 54 | -7.85 | - | - | 83 | 115 | V |
| 8 | *** 8.17031 | 39.18 | Pk | 35.8 | -29.2 | 0 | 45.78 | 54 | -8.22 | 74 | -28.22 | 0-360 | 101 | V |
| 3 | 7.2075 | 64.27 | Pk | 35.7 | -30.2 | 0 | 69.77 | - | - | - | - | 0-360 | 101 | H |
| 7 | 7.2075 | 64.17 | Pk | 35.7 | -30.2 | 0 | 69.67 | - | - | - | - | 0-360 | 101 | V |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

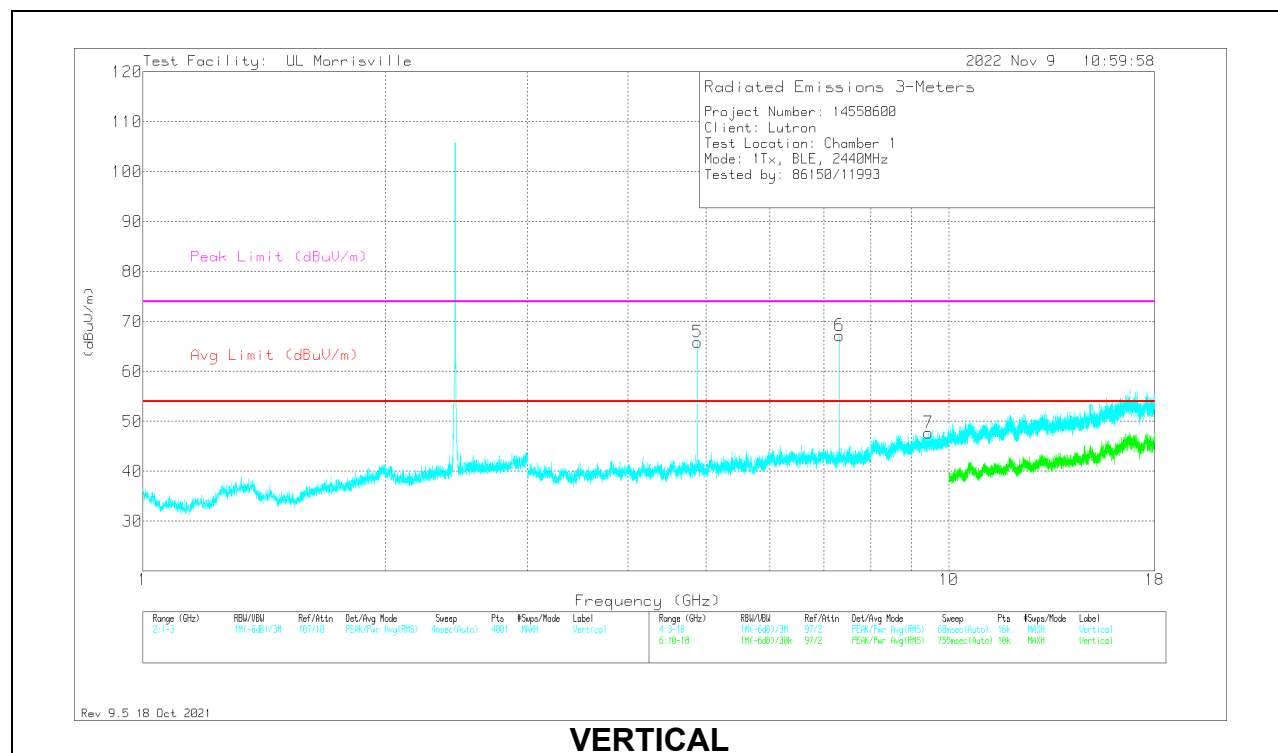
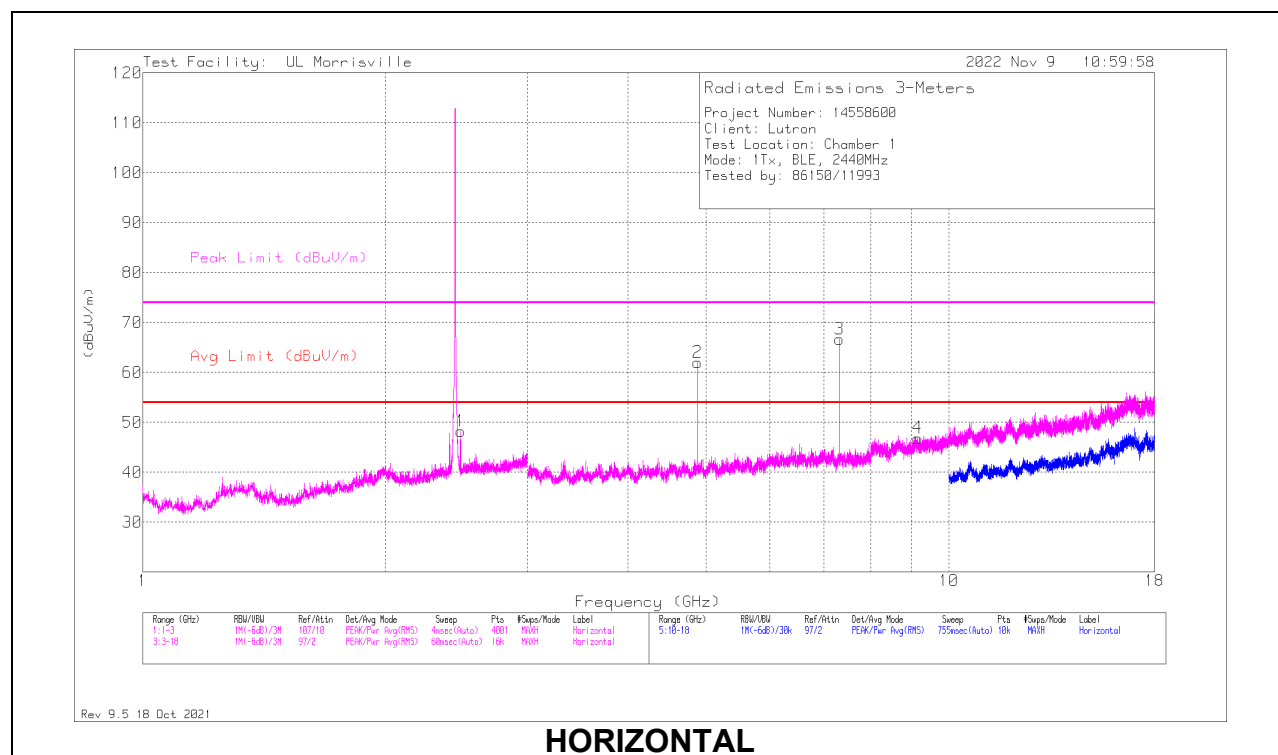
Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

MID CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2 | *** 4.87891 | 60.39 | PK2 | 34 | -31.3 | 0 | 63.09 | - | - | 74 | -10.91 | 184 | 105 | H |
| | *** 4.87908 | 54.32 | ADV | 34 | -31.3 | -13.15 | 43.87 | 54 | -10.13 | - | - | 184 | 105 | H |
| 3 | *** 7.31843 | 60.78 | PK2 | 35.6 | -29.6 | 0 | 66.78 | - | - | 74 | -7.22 | 316 | 102 | H |
| | *** 7.3187 | 54.58 | ADV | 35.6 | -29.6 | -13.15 | 47.43 | 54 | -6.57 | - | - | 316 | 102 | H |
| 4 | *** 9.14344 | 38.77 | Pk | 36.3 | -28.2 | 0 | 46.87 | 54 | -7.13 | 74 | -27.13 | 0-360 | 101 | H |
| 5 | *** 4.87893 | 60.58 | PK2 | 34 | -31.3 | 0 | 63.28 | - | - | 74 | -10.72 | 8 | 375 | V |
| | *** 4.87896 | 54.49 | ADV | 34 | -31.3 | -13.15 | 44.04 | 54 | -9.96 | - | - | 8 | 375 | V |
| 6 | *** 7.3184 | 58.33 | PK2 | 35.6 | -29.6 | 0 | 64.33 | - | - | 74 | -9.67 | 60 | 345 | V |
| | *** 7.31863 | 51.94 | ADV | 35.6 | -29.6 | -13.15 | 44.79 | 54 | -9.21 | - | - | 60 | 345 | V |
| 7 | *** 9.44063 | 39.43 | Pk | 36.6 | -28.3 | 0 | 47.73 | 54 | -6.27 | 74 | -26.27 | 0-360 | 200 | V |
| 1 | 2.479 | 40.34 | Pk | 32.5 | -24.6 | 0 | 48.24 | - | - | - | - | 0-360 | 101 | H |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

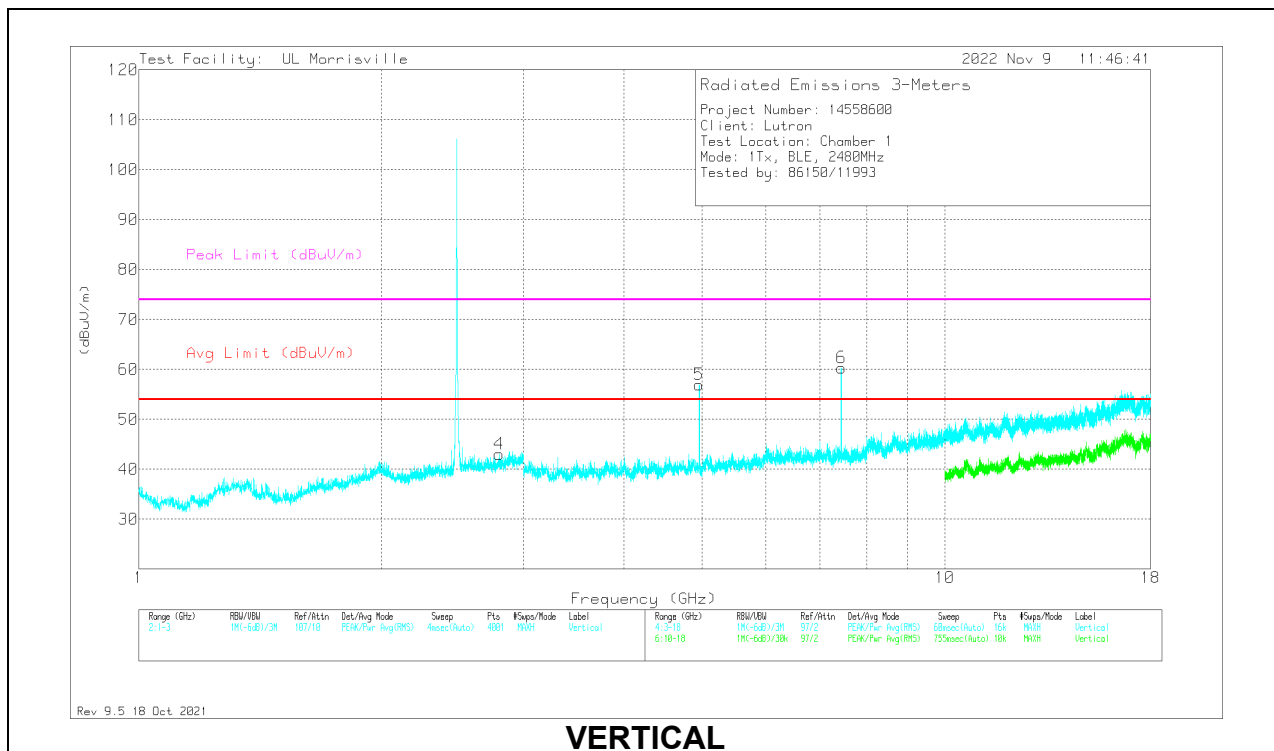
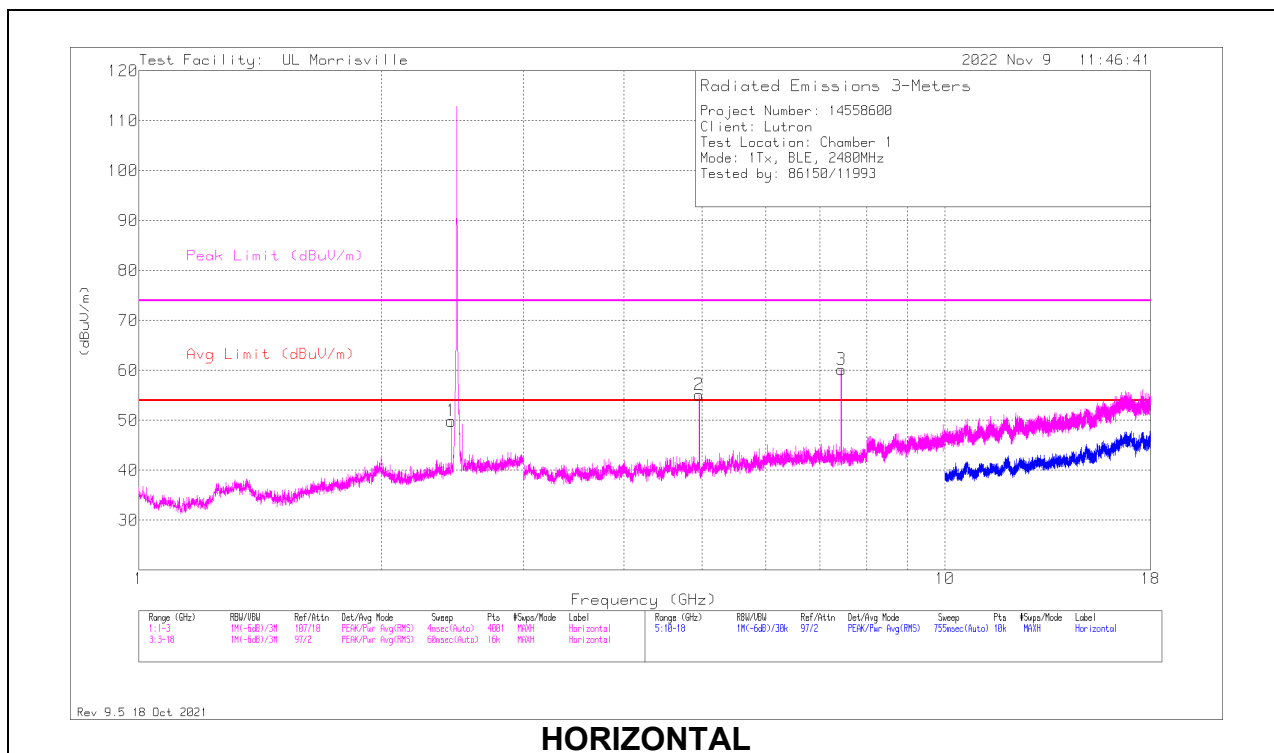
Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 (dB/m) | Gain/Loss (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 4 | *** 2.7995 | 34.33 | Pk | 32.6 | -23.9 | 0 | 43.03 | 54 | -10.97 | 74 | -30.97 | 0-360 | 101 | V |
| 2 | *** 4.95896 | 55.57 | PK2 | 34 | -32.7 | 0 | 56.87 | - | - | 74 | -17.13 | 216 | 207 | H |
| | *** 4.95903 | 48.8 | ADV | 34 | -32.8 | -13.15 | 36.85 | 54 | -17.15 | - | - | 216 | 207 | H |
| 3 | *** 7.44134 | 55.16 | PK2 | 35.6 | -29.5 | 0 | 61.26 | - | - | 74 | -12.74 | 313 | 113 | H |
| | *** 7.44113 | 48.74 | ADV | 35.6 | -29.5 | -13.15 | 41.69 | 54 | -12.31 | - | - | 313 | 113 | H |
| 5 | *** 4.95892 | 57.56 | PK2 | 34 | -32.7 | 0 | 58.86 | - | - | 74 | -15.14 | 95 | 129 | V |
| | *** 4.95893 | 51.28 | ADV | 34 | -32.7 | -13.15 | 39.43 | 54 | -14.57 | - | - | 95 | 129 | V |
| 6 | *** 7.44148 | 53.45 | PK2 | 35.6 | -29.5 | 0 | 59.55 | - | - | 74 | -14.45 | 73 | 350 | V |
| | *** 7.44104 | 46.46 | ADV | 35.6 | -29.5 | -13.15 | 39.41 | 54 | -14.59 | - | - | 73 | 350 | V |
| 1 | 2.442 | 42.26 | Pk | 32.2 | -24.6 | 0 | 49.86 | - | - | - | - | 0-360 | 101 | H |

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

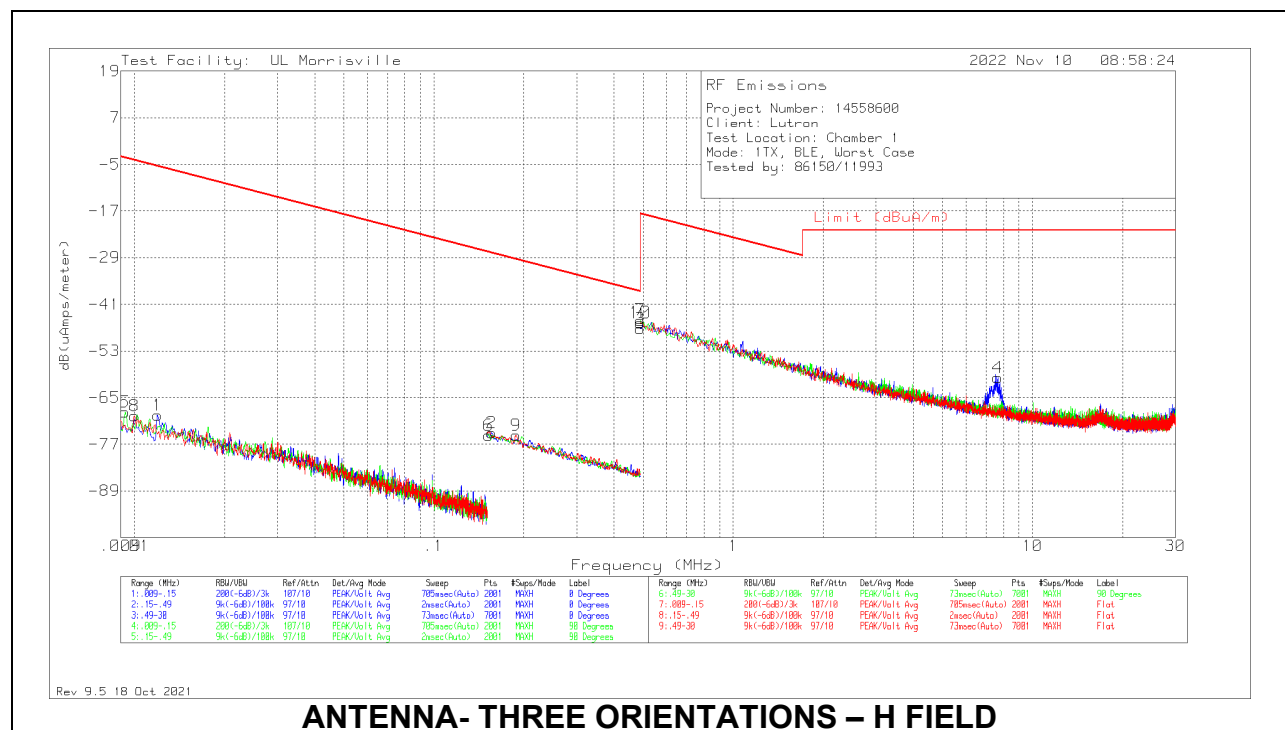
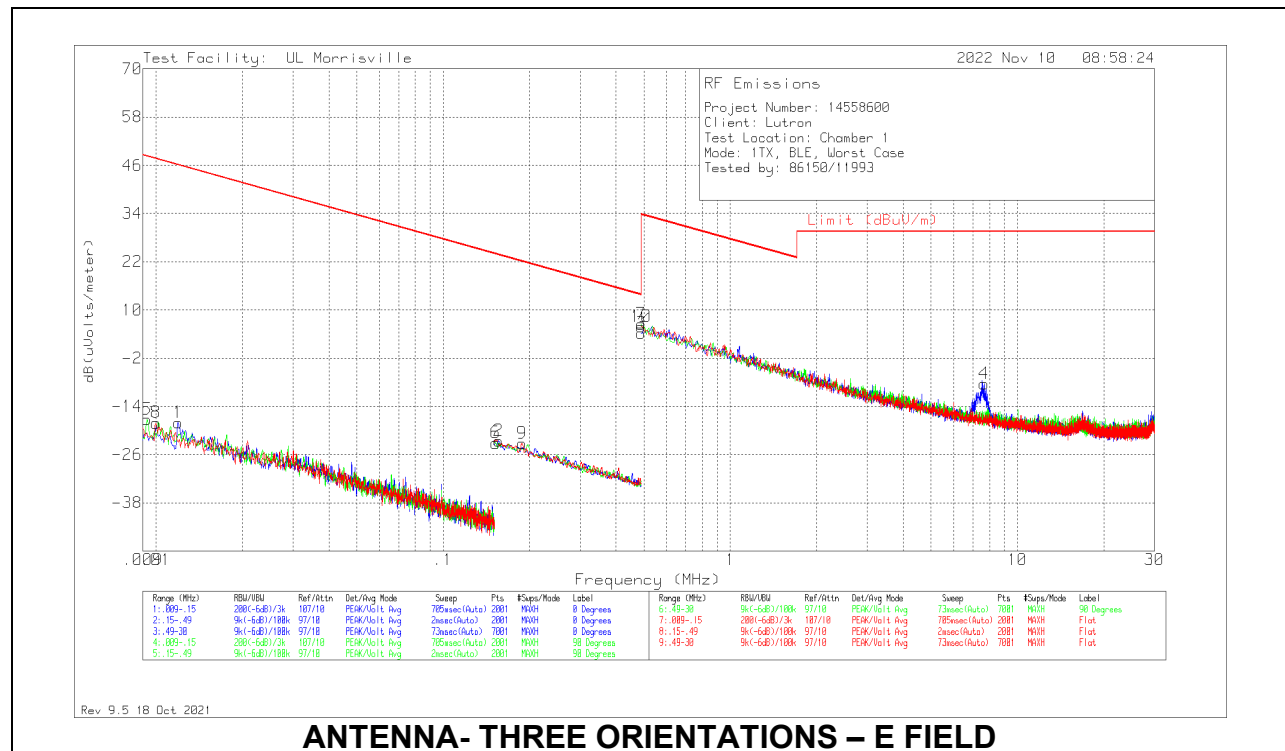
PK2 - Maximum Peak

ADV - Linear Voltage Average

Note: For all average measurements, the Real-Life Duty Cycle Correction factor was applied after the tests were run. Therefore, the tabular data are the actual measurements, and the plots may not line up with the tabular. All testing was performed according to ANSI C63.10.

10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



Below 30MHz Data – E FIELD

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0079 (dB/m) | Gain/Loss (dB) | Dist. Corr. Factor (dB) | Corrected Reading dB(uVolts/meter) | QP/AV Limit (dBuV/m) | Pk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Loop Angle |
|--------|-----------------|----------------------|-----|---------------|----------------|-------------------------|------------------------------------|----------------------|-------------------|-------------|----------------|-------------|------------|
| 5 | .00928 | 43.93 | Pk | 18.7 | .1 | -80 | -17.27 | 48.25 | 68.25 | -65.52 | 0-360 | 400 | 90 degs |
| 8 | .00999 | 43.37 | Pk | 18.4 | .1 | -80 | -18.13 | 47.61 | 67.61 | -65.74 | 0-360 | 400 | Flat |
| 1 | .01195 | 44.39 | Pk | 17.5 | .1 | -80 | -18.01 | 46.06 | 66.06 | -64.07 | 0-360 | 400 | 0 degs |
| 6 | .15255 | 45.67 | Pk | 11.1 | .1 | -80 | -23.13 | 23.94 | 43.94 | -47.07 | 0-360 | 400 | 90 degs |
| 2 | .15587 | 46.18 | Pk | 11.1 | .1 | -80 | -22.62 | 23.75 | 43.75 | -46.37 | 0-360 | 400 | 0 degs |
| 9 | .18817 | 45.64 | Pk | 11.1 | .1 | -80 | -23.16 | 22.11 | 42.11 | -45.27 | 0-360 | 400 | Flat |
| 3 | .49 | 32.98 | Pk | 11 | .2 | -40 | 4.18 | 13.8 | 33.8 | -9.62 | 0-360 | 400 | 0 degs |
| 7 | .49 | 35.21 | Pk | 11 | .2 | -40 | 6.41 | 13.8 | 33.8 | -7.39 | 0-360 | 400 | 90 degs |
| 10 | .49 | 34.56 | Pk | 11 | .2 | -40 | 5.76 | 13.8 | 33.8 | -8.04 | 0-360 | 400 | Flat |
| 4 | 7.64877 | 20.03 | Pk | 11 | .6 | -40 | -8.37 | 29.54 | - | -37.91 | 0-360 | 400 | 0 degs |

Pk - Peak detector

Below 30MHz Data – H FIELD

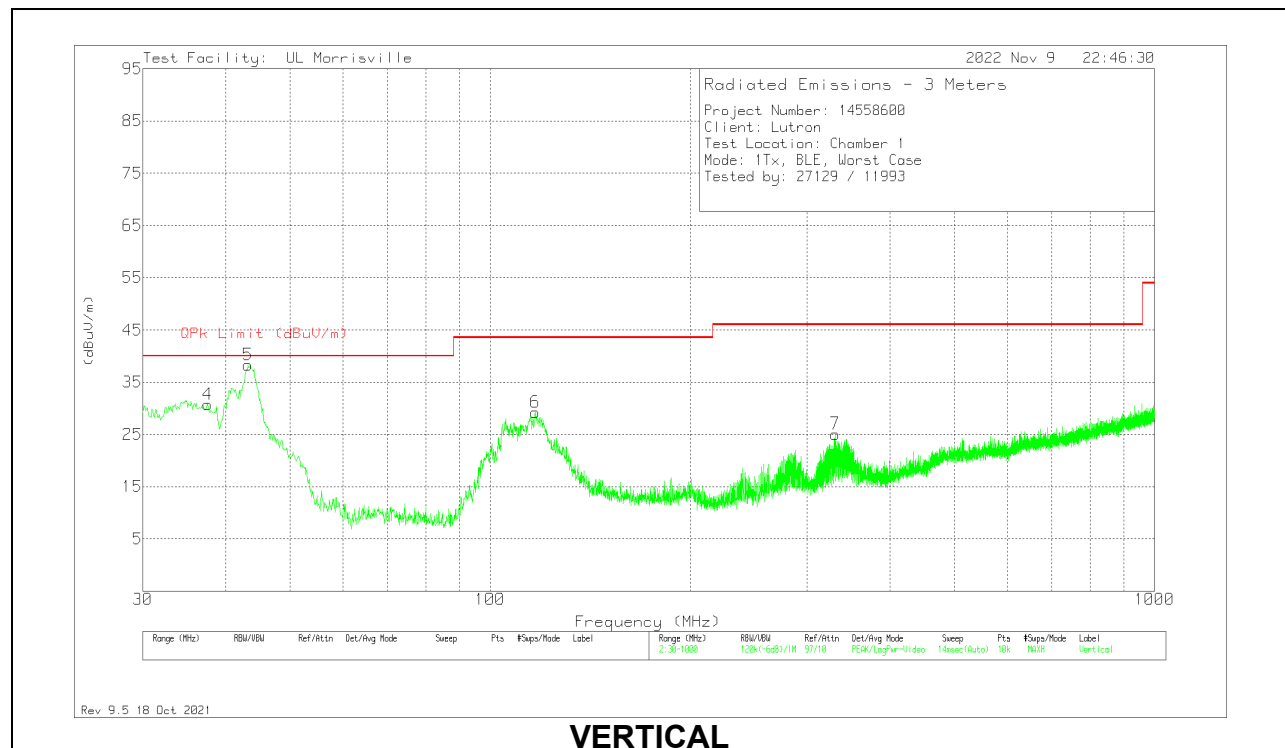
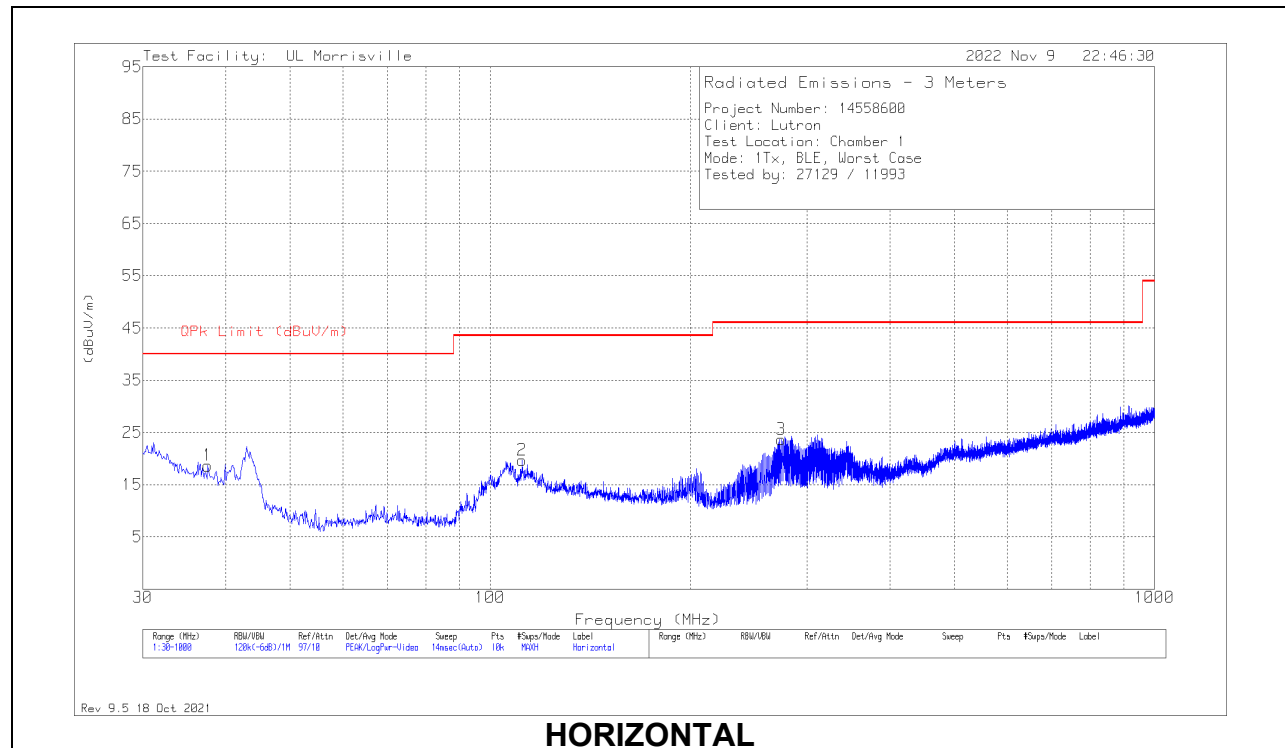
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0079 (dB/m) | Gain/Loss (dB) | Dist. Corr. Factor (dB) | Corrected Reading dB(uAmps/meter) | QP/AV Limit (dBuA/m) | PK Limit (dBuA/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Loop Angle |
|--------|-----------------|----------------------|-----|---------------|----------------|-------------------------|-----------------------------------|----------------------|-------------------|-------------|----------------|-------------|------------|
| 5 | .00928 | 43.93 | Pk | -32.8 | .1 | -80 | -68.77 | -3.25 | 16.75 | -65.52 | 0-360 | 400 | 90 degs |
| 8 | .00999 | 43.37 | Pk | -33.1 | .1 | -80 | -69.63 | -3.89 | 16.11 | -65.74 | 0-360 | 400 | Flat |
| 1 | .01195 | 44.39 | Pk | -34 | .1 | -80 | -69.51 | -5.44 | 14.56 | -64.07 | 0-360 | 400 | 0 degs |
| 6 | .15255 | 45.67 | Pk | -40.4 | .1 | -80 | -74.63 | -27.56 | -7.56 | -47.07 | 0-360 | 400 | 90 degs |
| 2 | .15587 | 46.18 | Pk | -40.4 | .1 | -80 | -74.12 | -27.75 | -7.75 | -46.37 | 0-360 | 400 | 0 degs |
| 9 | .18817 | 45.64 | Pk | -40.4 | .1 | -80 | -74.66 | -29.39 | -9.39 | -45.27 | 0-360 | 400 | Flat |
| 3 | .49 | 32.98 | Pk | -40.5 | .2 | -40 | -47.32 | -37.7 | -17.7 | -9.62 | 0-360 | 400 | 0 degs |
| 7 | .49 | 35.21 | Pk | -40.5 | .2 | -40 | -45.09 | -37.7 | -17.7 | -7.39 | 0-360 | 400 | 90 degs |
| 10 | .49 | 34.56 | Pk | -40.5 | .2 | -40 | -45.74 | -37.7 | -17.7 | -8.04 | 0-360 | 400 | Flat |
| 4 | 7.64877 | 20.03 | Pk | -40.5 | .6 | -40 | -59.87 | -21.96 | - | -37.91 | 0-360 | 400 | 0 degs |

Pk - Peak detector

Note: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) 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 limits were $40 \cdot \log(\text{test distance} / \text{specification distance})$.

10.4. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



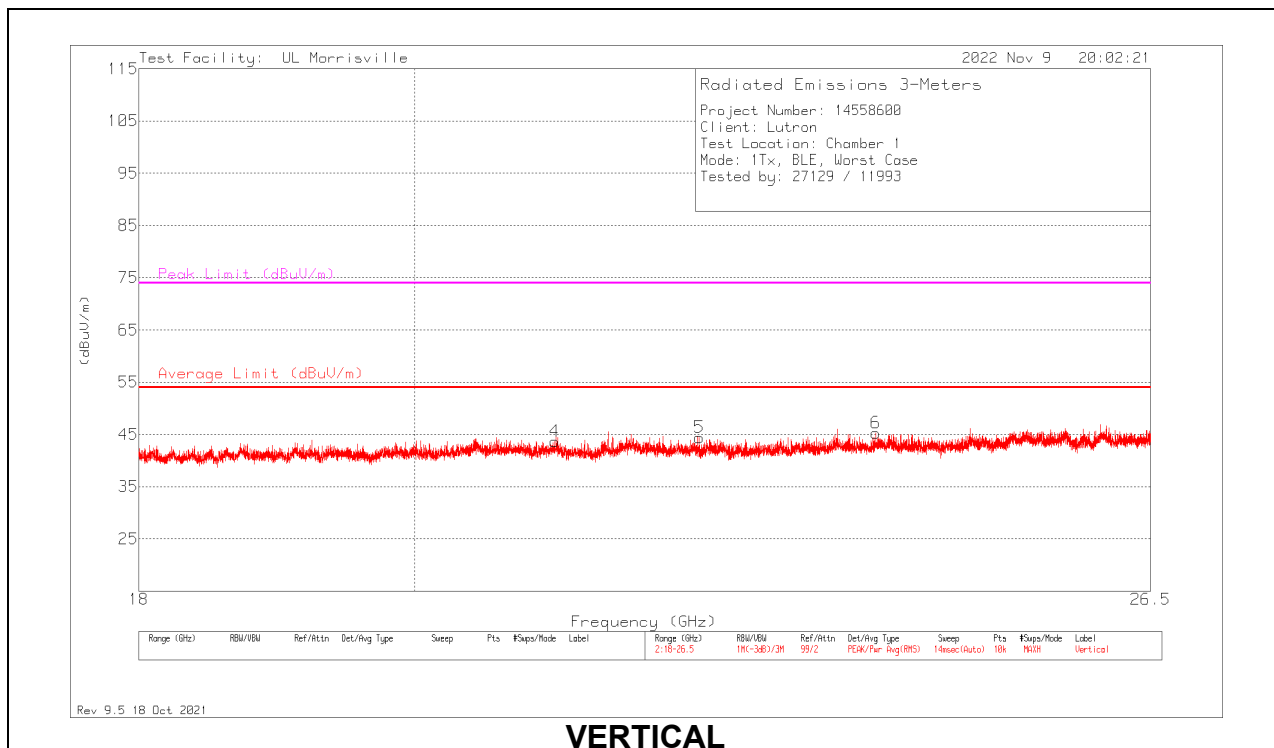
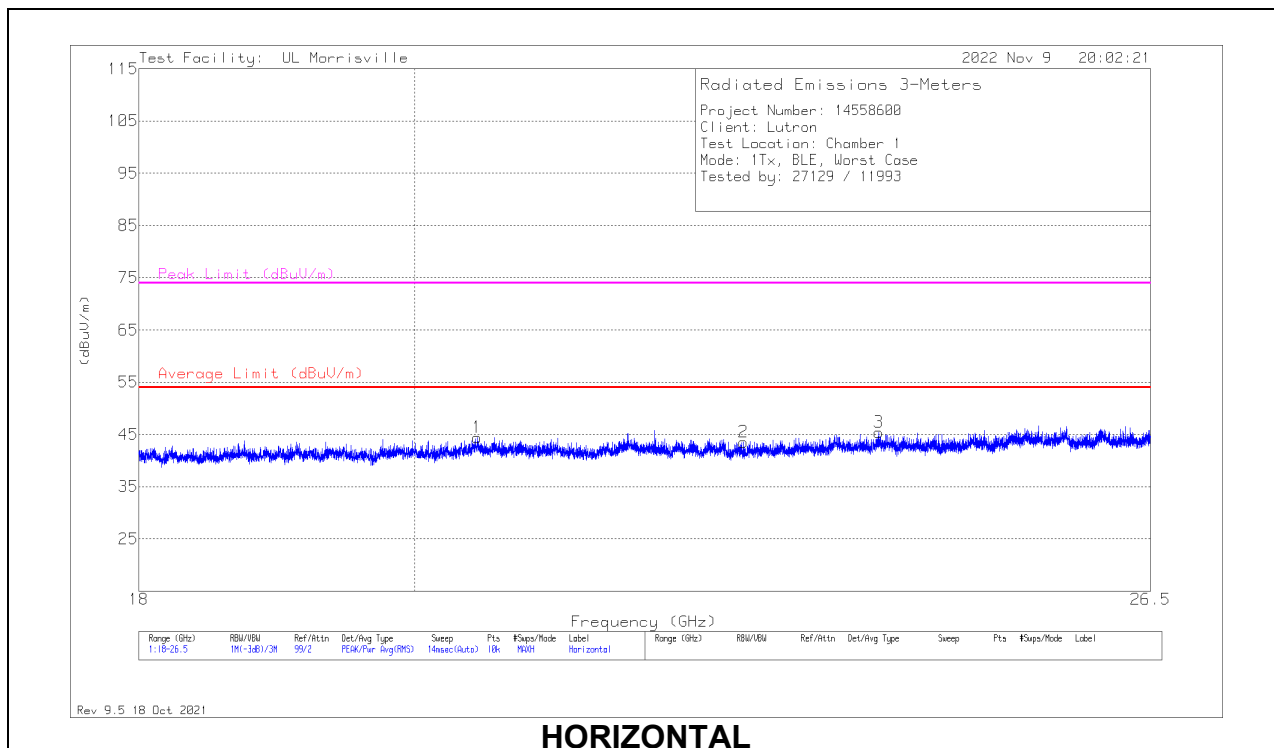
Below 1GHz Data

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0066 (dB/m) | Gain/Loss (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 1 | *** 37.566 | 28.22 | Pk | 21.8 | -31.4 | 18.62 | 40 | -21.38 | 0-360 | 399 | H |
| 2 | *** 111.771 | 31.42 | Pk | 18.5 | -30.3 | 19.62 | 43.52 | -23.9 | 0-360 | 199 | H |
| 3 | *** 274.149 | 33.35 | Pk | 19.1 | -28.8 | 23.65 | 46.02 | -22.37 | 0-360 | 100 | H |
| 4 | *** 37.566 | 40.28 | Pk | 21.8 | -31.4 | 30.68 | 40 | -9.32 | 0-360 | 100 | V |
| 6 | *** 116.815 | 40.32 | Pk | 19.2 | -30.3 | 29.22 | 43.52 | -14.3 | 0-360 | 100 | V |
| 7 | *** 330.409 | 33.57 | Pk | 19.7 | -28.2 | 25.07 | 46.02 | -20.95 | 0-360 | 100 | V |
| 5 | 43.192 | 52.24 | Pk | 17.5 | -31.4 | 38.34 | - | - | 0-360 | 100 | V |

Pk - Peak detector

10.5. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



18 – 26GHz Data

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 204704 (dB/m) | Gain/Loss (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------------|----------------------------|------------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 1 | * ** 20.48565 | 49.25 | Pk | 34.2 | -39.1 | 44.35 | 54 | -9.65 | 74 | -29.65 | 0-360 | 249 | H |
| 4 | * ** 21.10366 | 48.68 | Pk | 34.1 | -39.1 | 43.68 | 54 | -10.32 | 74 | -30.32 | 0-360 | 151 | V |
| 5 | * ** 22.30143 | 49.39 | Pk | 34.5 | -39.5 | 44.39 | 54 | -9.61 | 74 | -29.61 | 0-360 | 200 | V |
| 2 | * ** 22.68227 | 48.47 | Pk | 34.3 | -39.2 | 43.57 | 54 | -10.43 | 74 | -30.43 | 0-360 | 200 | H |
| 6 | * ** 23.85794 | 49.16 | Pk | 35.1 | -39 | 45.26 | 54 | -8.74 | 74 | -28.74 | 0-360 | 101 | V |
| 3 | * ** 23.88429 | 49.13 | Pk | 35 | -38.8 | 45.33 | 54 | -8.67 | 74 | -28.67 | 0-360 | 299 | H |

Pk - Peak detector

11. 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.

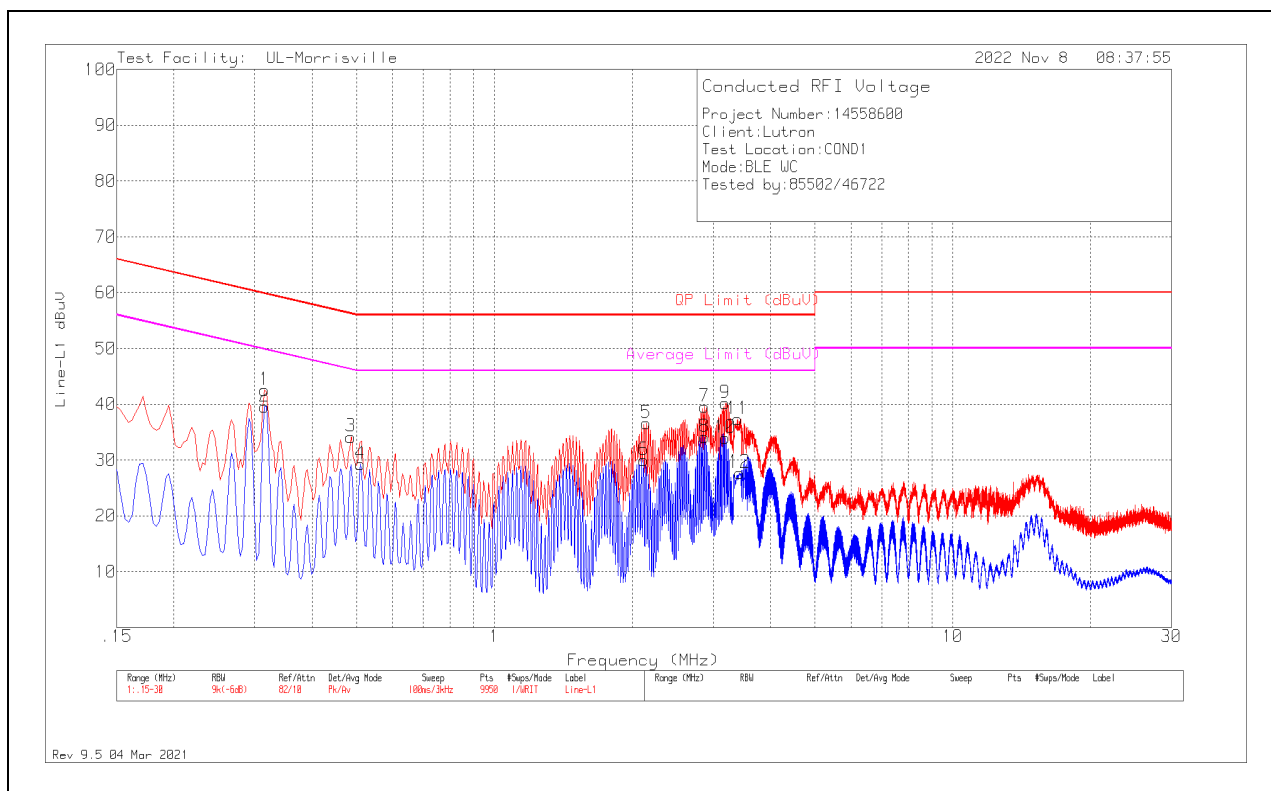
The receiver is set to a resolution bandwidth of 9 kHz. Peak Detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both lines.

RESULTS

11.1.1. AC Power Line Norm

LINE 1 RESULTS

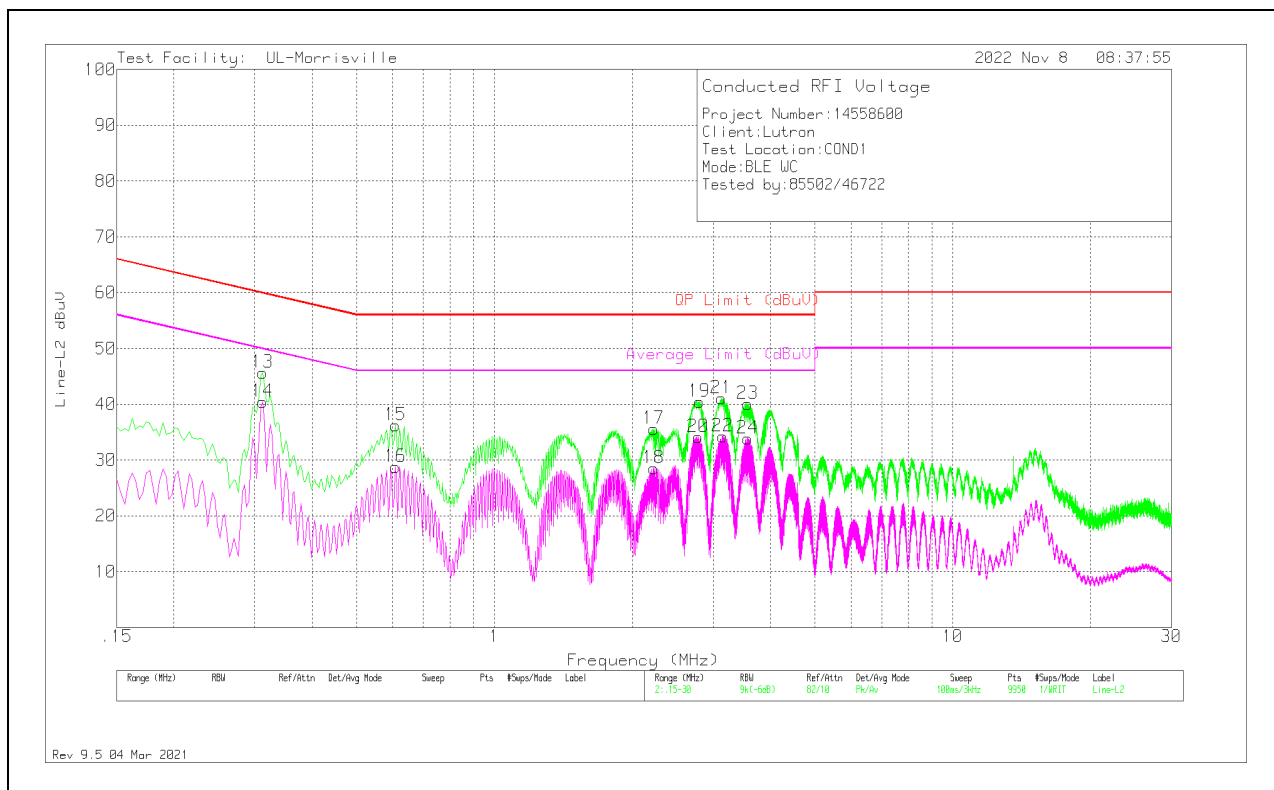


| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | |
|------------------------------|-----------------|----------------------|-----|---------------|------------------|------------------------|-----------------|-------------|----------------------|-------------|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN VCF (dB) | Cbl/Limiter (dB) | Corrected Reading dBuV | QP Limit (dBuV) | Margin (dB) | Average Limit (dBuV) | Margin (dB) |
| 1 | .315 | 32.69 | Pk | .1 | 9.8 | 42.59 | 59.84 | -17.25 | - | - |
| 2 | .315 | 29.65 | Av | .1 | 9.8 | 39.55 | - | - | 49.84 | -10.29 |
| 3 | .486 | 24.37 | Pk | 0 | 9.8 | 34.17 | 56.24 | -22.07 | - | - |
| 4 | .51 | 19.42 | Av | 0 | 9.8 | 29.22 | - | - | 46 | -16.78 |
| 5 | 2.142 | 26.83 | Pk | 0 | 9.8 | 36.63 | 56 | -19.37 | - | - |
| 6 | 2.115 | 20.24 | Av | 0 | 9.8 | 30.04 | - | - | 46 | -15.96 |
| 7 | 2.874 | 29.73 | Pk | 0 | 9.8 | 39.53 | 56 | -16.47 | - | - |
| 8 | 2.871 | 24.36 | Av | 0 | 9.8 | 34.16 | - | - | 46 | -11.84 |
| 9 | 3.189 | 30.34 | Pk | 0 | 9.9 | 40.24 | 56 | -15.76 | - | - |
| 10 | 3.186 | 24.11 | Av | 0 | 9.9 | 34.01 | - | - | 46 | -11.99 |
| 11 | 3.393 | 27.49 | Pk | 0 | 9.9 | 37.39 | 56 | -18.61 | - | - |
| 12 | 3.429 | 17.81 | Av | 0 | 9.9 | 27.71 | - | - | 46 | -18.29 |

Pk – Peak Detector

Av – Average Detector

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN VCF (dB) | Cbl/Limiter (dB) | Corrected Reading dBuV | QP Limit (dBuV) | Margin (dB) | Average Limit (dBuV) | Margin (dB) |
|--------|-----------------|----------------------|-----|---------------|------------------|------------------------|-----------------|-------------|----------------------|-------------|
| 13 | .312 | 35.78 | Pk | .1 | 9.8 | 45.68 | 59.92 | -14.24 | - | - |
| 14 | .312 | 30.53 | Av | .1 | 9.8 | 40.43 | - | - | 49.92 | -9.49 |
| 15 | .609 | 26.44 | Pk | 0 | 9.8 | 36.24 | 56 | -19.76 | - | - |
| 16 | .609 | 18.97 | Av | 0 | 9.8 | 28.77 | - | - | 46 | -17.23 |
| 17 | 2.229 | 25.85 | Pk | 0 | 9.8 | 35.65 | 56 | -20.35 | - | - |
| 18 | 2.229 | 18.68 | Av | 0 | 9.8 | 28.48 | - | - | 46 | -17.52 |
| 19 | 2.799 | 30.66 | Pk | 0 | 9.8 | 40.46 | 56 | -15.54 | - | - |
| 20 | 2.784 | 24.28 | Av | 0 | 9.8 | 34.08 | - | - | 46 | -11.92 |
| 21 | 3.132 | 31.3 | Pk | 0 | 9.8 | 41.1 | 56 | -14.9 | - | - |
| 22 | 3.15 | 24.47 | Av | 0 | 9.8 | 34.27 | - | - | 46 | -11.73 |
| 23 | 3.567 | 30.18 | Pk | 0 | 9.9 | 40.08 | 56 | -15.92 | - | - |
| 24 | 3.567 | 23.93 | Av | 0 | 9.9 | 33.83 | - | - | 46 | -12.17 |

Pk – Peak Detector

Av – Average Detector

12. SETUP PHOTOS

Please refer to R14558600-EP1 for setup photos

END OF TEST REPORT