# TEST REPORT

**Report Number. :** R13407793-E3

| | | |
|---|---|---|
| **Applicant** | : | ANELTO INC.<br>6270 MORNINGSTAR DRIVE, SUITE 100<br>THE COLONY, TEXAS, 75056, USA |
| **Model** | : | ANW0720 |
| **FCC ID** | : | 2AGPI-ANW0720 |
| **IC** | : | 20951-ANW0720 |
| **EUT Description** | : | BLE WEARABLE DEVICE |
| **Test Standard(s)** | : | FCC 47 CFR PART 15 SUBPART C<br>ISED RSS-247 ISSUE 2<br>ISED RSS-GEN ISSUE 5 + Amendment 1 |

**Date Of Issue:**
2020-12-14

**Prepared by:**
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400

NVLAP TESTING

NVLAP Lab code: 200246-0

# REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 2020-10-15 | Initial Issue | Mike Antola |
| V2 | 2020-11-19 | Added antenna port conducted data | Cristian Melara |
| V3 | 2020-12-07 | Updated Maximum Output Power statement in section 6.2 | Cristian Melara |
| V4 | 2020-12-14 | Replaced Maximum Output Power data in sections 6.2 & 9.4 | Mike Antola |



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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ANELTO INC.
6270 MORNINGSTAR DRIVE, SUITE 100
THE COLONY, TEXAS, 75056, USA

**EUT DESCRIPTION:** BLE WEARABLE DEVICE

**MODEL:** ANW0720

**SERIAL NUMBER:** 200901

**DATE TESTED:** 2020-09-27 TO 2020-11-19

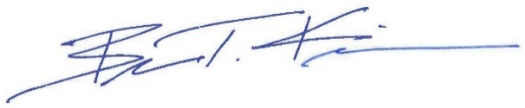
| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Complies |
| ISED RSS-247 Issue 2 | Complies |
| ISED RSS-GEN Issue 5 + Amendment 1 | Complies |

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:



Brian Kiewra
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Prepared By:

Mike Antola
Staff Engineer
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# 2. TEST RESULTS SUMMARY

| 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 | Compliant | None |
| 15.247 (b) (3) | RSS-247 5.4 (d) | Output Power | Compliant | None |
| See Comment | | Average power | Compliant | None |
| 15.247 (e) | RSS-247 5.2 (b) | PSD | Compliant | None |
| 15.247 (d) | RSS-247 5.5 | Conducted Spurious Emissions | Compliant | None |
| 15.209, 15.205 | RSS-GEN 8.9, 8.10 | Radiated Emissions | Compliant | None. |
| 15.207 | RSS-Gen 8.8 | AC Mains Conducted Emissions | Not applicable | EUT is battery powered only |

# 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15: 2020, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + Amendment 1: 2019, and RSS-247 Issue 2:2017

# 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, North Carolina, 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., Suite B |
|---|---|
| ☐ Chamber A RTP | ☒ North Chamber |
| ☐ Chamber C RTP | ☒ South Chamber |

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

# 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 | UNCERTAINTY |
|---|---|
| Radio Frequency (Spectrum Analyzer) | 141.2 Hz |
| Occupied Channel Bandwidth | 1.82% |
| RF output power, conducted | 1.3 dB (PK)<br>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 | 2.26°C |
| Humidity | 6.79% |
| DC Supply voltages | 1.70% |
| Time | 3.39% |

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



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## 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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV



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# 6. EQUIPMENT UNDER TEST

## 6.1. EUT DESCRIPTION

The EUT is a wearable BLE device.

## 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 | 0.92 | 1.24 |

## 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PIFA antenna, with a maximum gain of -2 dBi.

## 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was S140V7.0.1 Rev 191107.

The test utility software used during testing was NA.

## 6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz and above 18GHz were performed with the EUT set to transmit at the channel 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 X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.



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## 6.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

NA

**I/O CABLES**

NA

**TEST SETUP**

The EUT is a stand-alone device. Test software exercised the radio.

**SETUP DIAGRAMS**

Please refer to E13407793-EP1 for setup diagrams



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# 7. MEASUREMENT METHOD

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 -11.9.1.1 RBW ≥ DTS Bandwidth Method

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)

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11, 6.10.4

Emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1, 6.10.5

General Radiated Emissions: ANSI C63.10-2013 Section 6.3 - 6.6

On Time and Duty Cycle: ANSI C63.10: 2013 Section 11.6



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# 8. 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)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **0.009-30MHz** | **(Loop Ant.)** | | | |
| AT0079 | Active Loop Antenna | ETS-Lindgren | 6502 | 2020-08-20 | 2021-08-20 |
| | **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 | 2020-07-29 | 2021-07-29 |
| N-SAC02 | Gain-loss string: 25-1000MHz | Various | Various | 2020-07-29 | 2021-07-29 |
| N-SAC03 | Gain-loss string: 1-18GHz | Various | Various | 2020-07-28 | 2021-07-28 |
| | **Receiver & Software** | | | | |
| SA0026 | Spectrum Analyzer | Agilent | N9030A | 2020-07-16 | 2021-07-16 |
| SOFTEMI | EMI Software | UL | Version 9.5 (2020-07-07) | | |
| | **Additional Equipment used** | | | | |
| s/n 200037610 | Environmental Meter | Fisher Scientific | 06-662-4 | 2020-01-22 | 2022-01-22 |



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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **1-18 GHz** | | | | |
| AT0067 | Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz | ETS Lindgren | 3117 | 2020-04-28 | 2021-04-28 |
| | **18-40 GHz** | | | | |
| AT0076 | Horn Antenna, 18-26.5GHz | ARA | MWH-1826/B | 2019-11-07 | 2020-11-07 |
| | **Gain-Loss Chains** | | | | |
| S-SAC03 | Gain-loss string: 1-18GHz | Various | Various | 2020-07-06 | 2021-07-06 |
| S-SAC04 | Gain-loss string: 18-40GHz | Various | Various | 2020-07-07 | 2021-07-07 |
| | **Receiver & Software** | | | | |
| SA0027 | Spectrum Analyzer | Agilent | N9030A | 2020-06-10 | 2021-06-10 |
| SOFTEMI | EMI Software | UL | Version 9.5 (2020-07-07) | | |
| | **Additional Equipment used** | | | | |
| s/n 200037635 | Environmental Meter | Fisher Scientific | 06-662-4 | 2020-01-22 | 2022-01-22 |

Test Equipment Used - Wireless Conducted Measurement Equipment

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **Common Equipment** | | | | |
| | **Conducted Room 1** | | | | |
| PWS001 (PRE0137347) | Peak and Avg Power Sensor, 50MHz to 18GHz | Keysight Technologies | N1921A | 2020-05-27 | 2021-05-27 |
| PWM002 (PRE0137344) | RF Power Meter | Keysight Technologies | N1911A | 2020-07-31 | 2021-07-31 |
| HI0091 | Environmental Meter | Fisher Scientific | 15-077-963 | 2020-06-26 | 2021-06-26 |
| | **Conducted Room 2** | | | | |
| SA0027 (PRE0126407 | Spectrum Analyzer | Keysight Technologies | N9030A | 2020-06-10 | 2021-06-10 |
| HI0090 (PRE0191271) | Environmental Meter | Fisher Scientific | 15-077-963 | 2020-06-26 | 2021-06-26 |
| SOFTEMI | EMC Software | UL | Version 2020.10.22 | NA | NA |

# 9. ANTENNA PORT TEST RESULTS

## 9.1. DUTY CYCLE

**LIMITS**

None, for reporting purposes only

**TEST PROCEDURE**

ANSI C63.10 Zero Span Method.

| Mode | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Voltage Averaging Duty Cycle Correction Factor (dB) |
|---|---|---|---|---|---|
| **2.4GHz Band** | | | | | |
| BLE 1mbps | 10.380 | 10.500 | 0.989 | 98.86% | 0.00 |

Duty Cycle

## 9.2. 99% BANDWIDTH

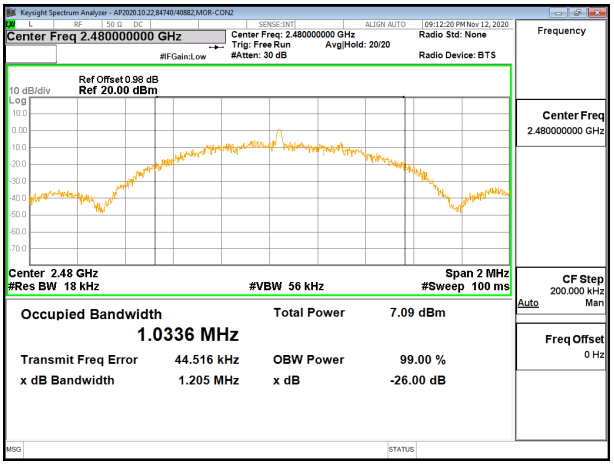
**LIMITS**

None; for reporting purposes only.

**RESULTS**

### 9.2.1. BLE (1Mbps)

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 2402 | 1.0384 |
| Middle | 2440 | 1.0374 |
| High | 2480 | 1.0336 |




**WORST CASE 99% OBW**

## 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 | 0.6360 | 0.5 |
| Middle | 2440 | 0.6420 | 0.5 |
| High | 2480 | 0.6480 | 0.5 |


**WORST CASE 6dB BANDWIDTH**



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## 9.4. OUTPUT POWER

**LIMITS**

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

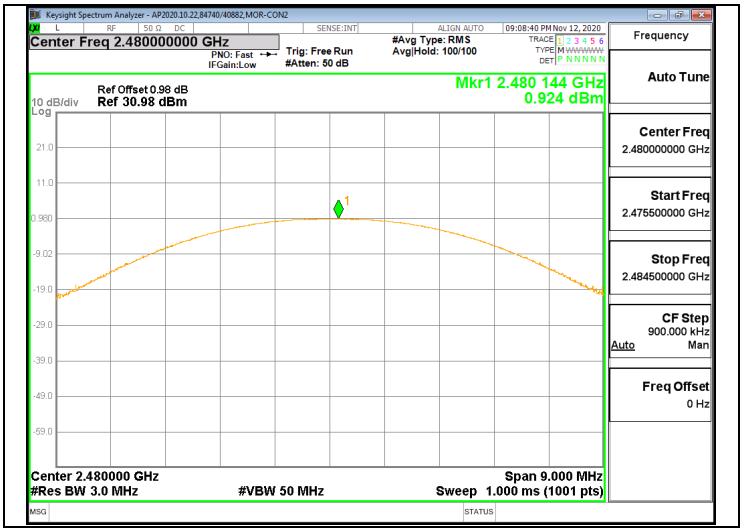
The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

**TEST PROCEDURE**
The transmitter output is connected to a spectrum analyzer.

**RESULTS**

### 9.4.1. BLE (1Mbps)

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2402 | 0.356 | 30 | -29.644 |
| Middle | 2440 | 0.747 | 30 | -29.253 |
| High | 2480 | 0.924 | 30 | -29.076 |




**WORST CASE OUTPUT POWER**

## 9.5. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 0.98 (0.98 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

**RESULTS**

### 9.5.1. BLE (1Mbps)

| | |
|---|---|
| **Tested By:** | 84740/40882 |
| **Date:** | 2020-11-12 |

| Channel | Frequency (MHz) | AV power (dBm) |
|---|---|---|
| Low | 2402 | 0.07 |
| Middle | 2440 | 0.19 |
| High | 2480 | 0.45 |

## 9.6. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

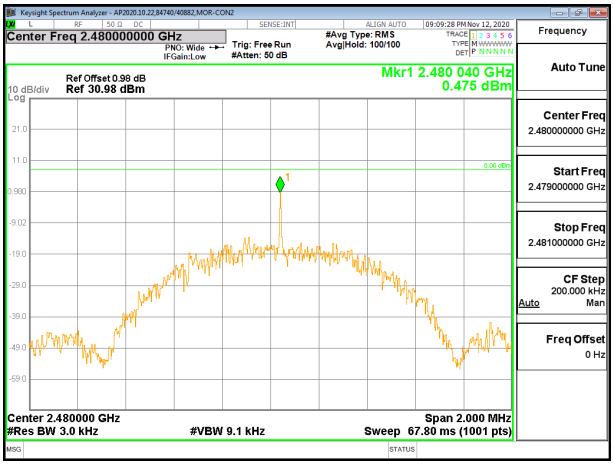
RSS-247 (5.2) (b)

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 | -0.10 | 8 | -8.10 |
| Middle | 2440 | 0.36 | 8 | -7.64 |
| High | 2480 | 0.48 | 8 | -7.53 |




**WORST CASE PSD**



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## 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 dB.

**RESULTS**



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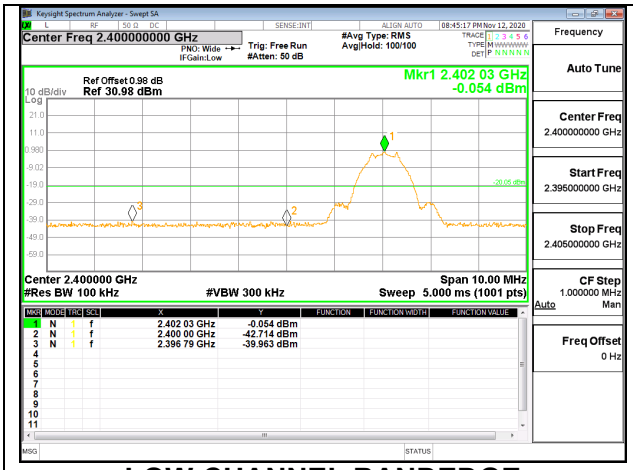
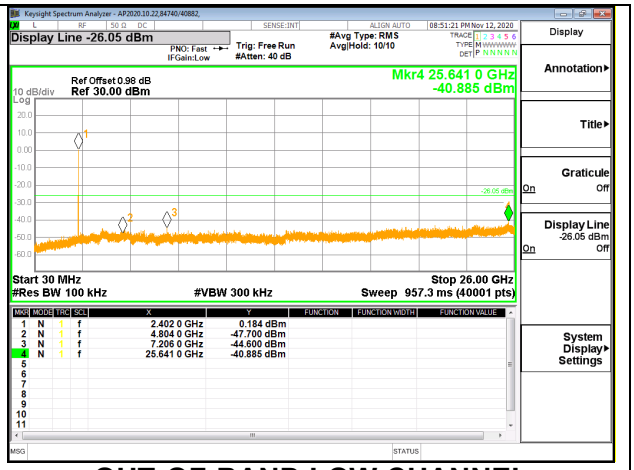
### 9.7.1. BLE (1Mbps)

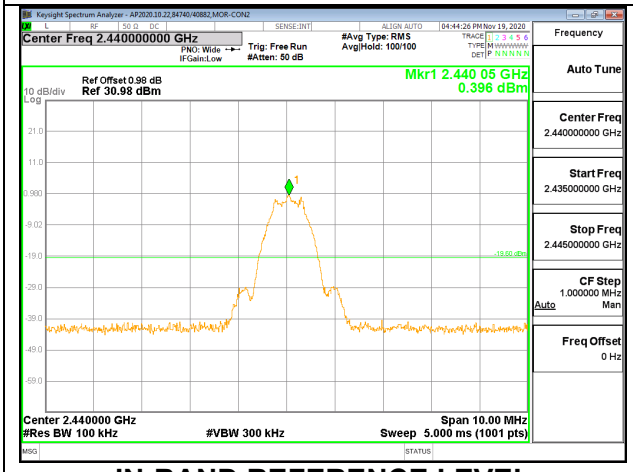
*Note – For low channel conducted spurious emissions, the limit line does not match the reference limit as determined by the low channel bandedge plot. However, the current conducted spurious emission limit line is lower and therefore can be used as a worst case.



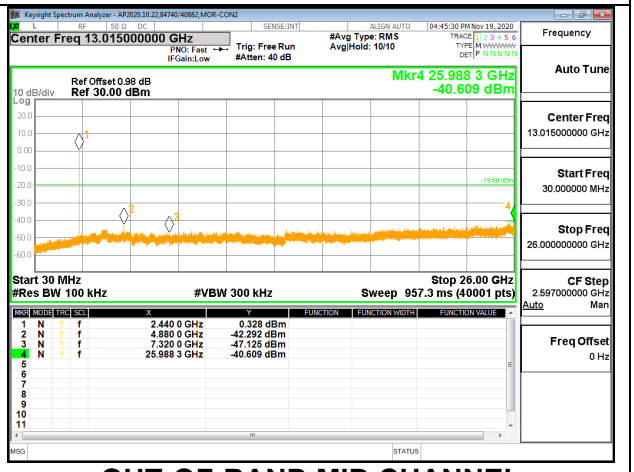

LOW CHANNEL BANDEDGE



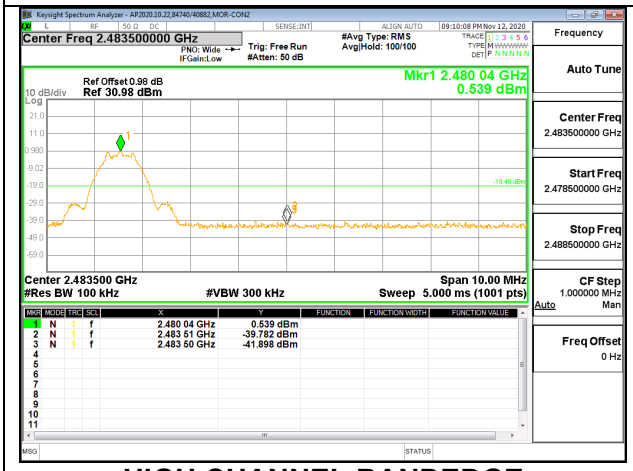

OUT-OF-BAND LOW CHANNEL



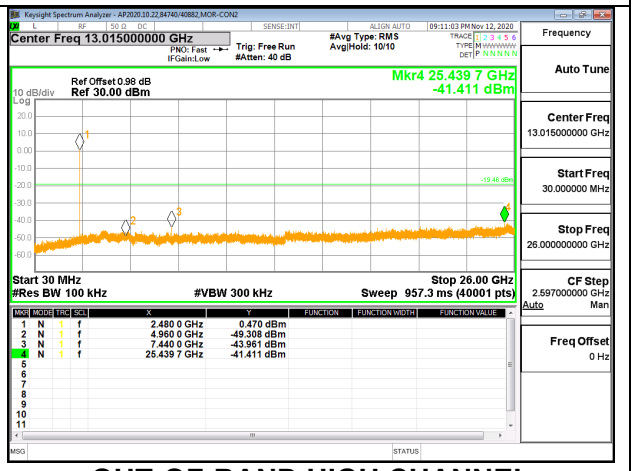

IN-BAND REFERENCE LEVEL




OUT-OF-BAND MID CHANNEL




HIGH CHANNEL BANDEDGE




OUT-OF-BAND HIGH CHANNEL

# 10. RADIATED TEST RESULTS

## 10.1. LIMITS AND PROCEDURE

**LIMITS**

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

| 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 |

**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.

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 9-150kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz 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 (voltage averaging).

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.



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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.



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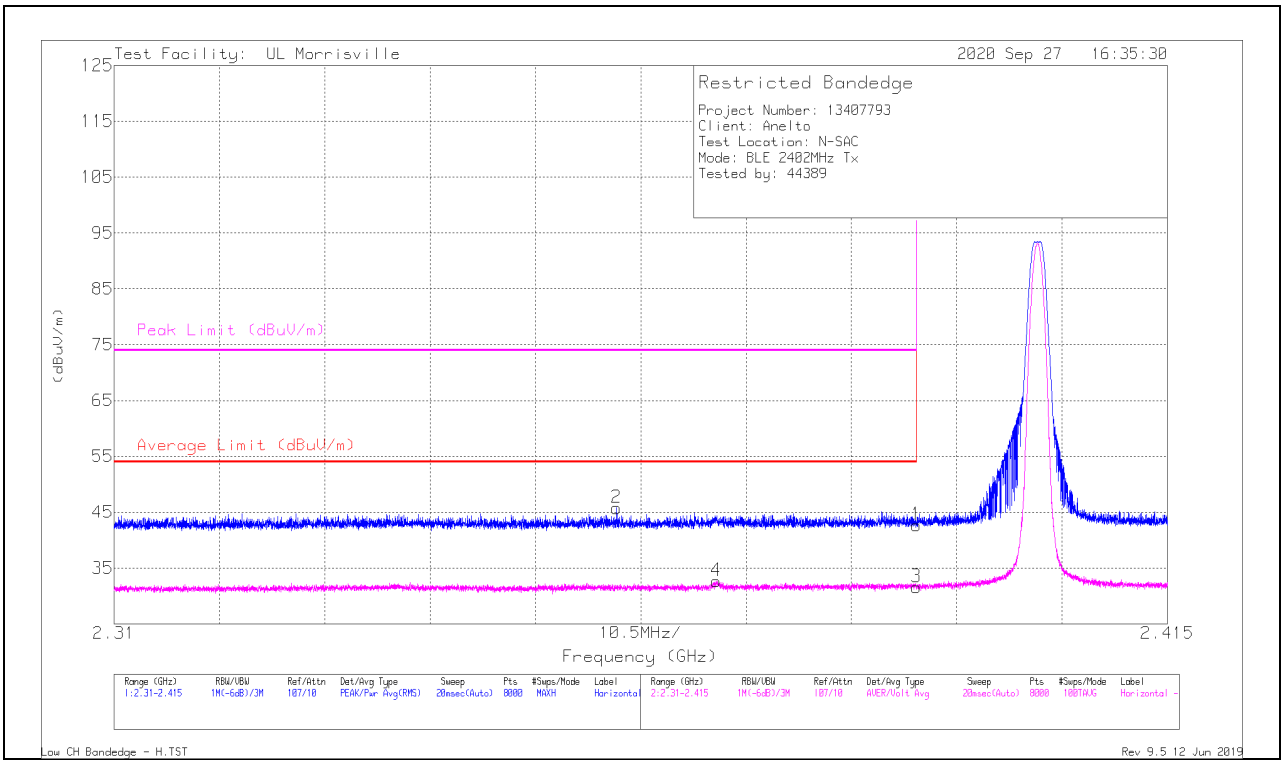
## 10.2. TRANSMITTER ABOVE 1 GHz

### 10.2.1. BLE (1Mbps)

**Antenna 1**

**BANDEDGE (LOW CHANNEL)**

**HORIZONTAL RESULT**




| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 2.39 | 35.29 | Pk | 31.8 | -24.4 | 42.69 | - | - | 74 | -31.31 | 158 | 172 | H |
| 2 | * ** 2.36011 | 38.46 | Pk | 31.7 | -24.4 | 45.76 | - | - | 74 | -28.24 | 158 | 172 | H |
| 3 | * ** 2.39 | 24.2 | ADV | 31.8 | -24.4 | 31.6 | 54 | -22.4 | - | - | 158 | 172 | H |
| 4 | * ** 2.37004 | 25.38 | ADV | 31.7 | -24.4 | 32.68 | 54 | -21.32 | - | - | 158 | 172 | 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



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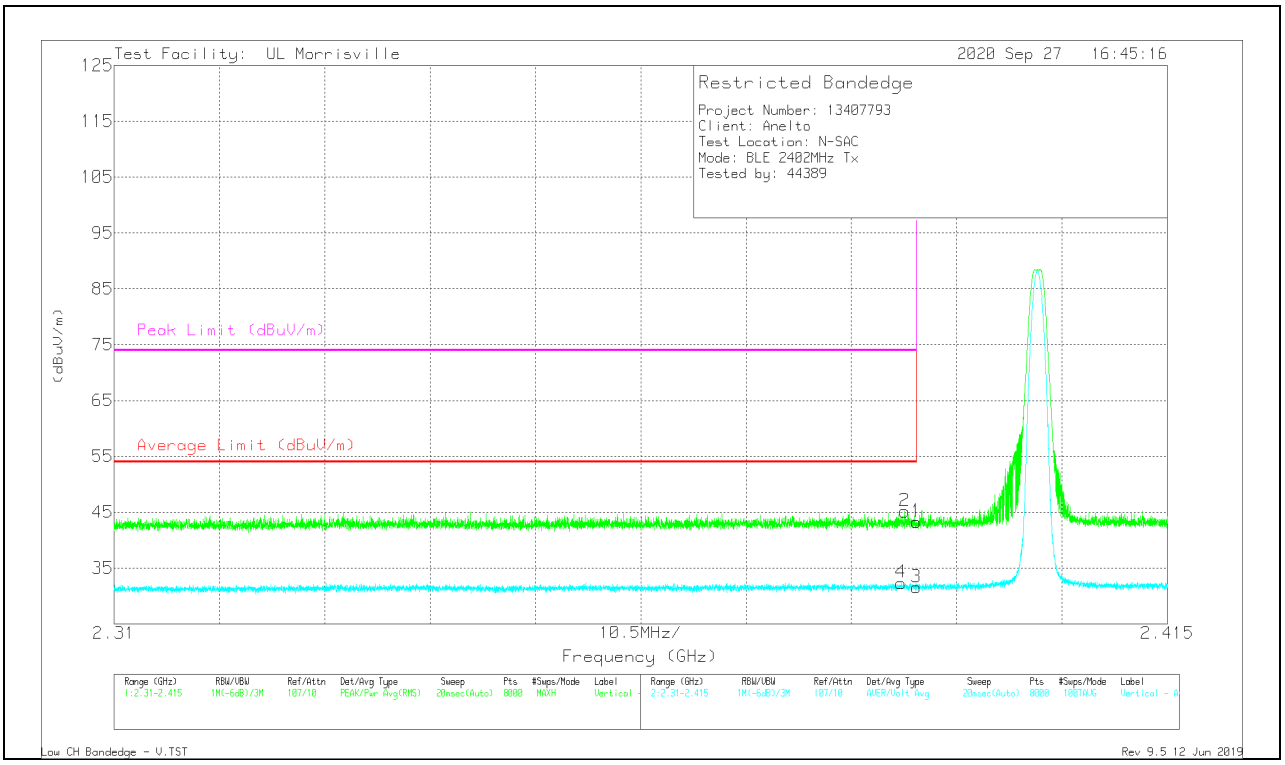
## VERTICAL RESULT




| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 2.39 | 35.86 | Pk | 31.8 | -24.4 | 43.26 | - | - | 74 | -30.74 | 101 | 399 | V |
| 2 | * ** 2.38882 | 37.77 | Pk | 31.8 | -24.4 | 45.17 | - | - | 74 | -28.83 | 101 | 399 | V |
| 3 | * ** 2.39 | 24.15 | ADV | 31.8 | -24.4 | 31.55 | 54 | -22.45 | - | - | 101 | 399 | V |
| 4 | * ** 2.38845 | 24.95 | ADV | 31.8 | -24.4 | 32.35 | 54 | -21.65 | - | - | 101 | 399 | 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



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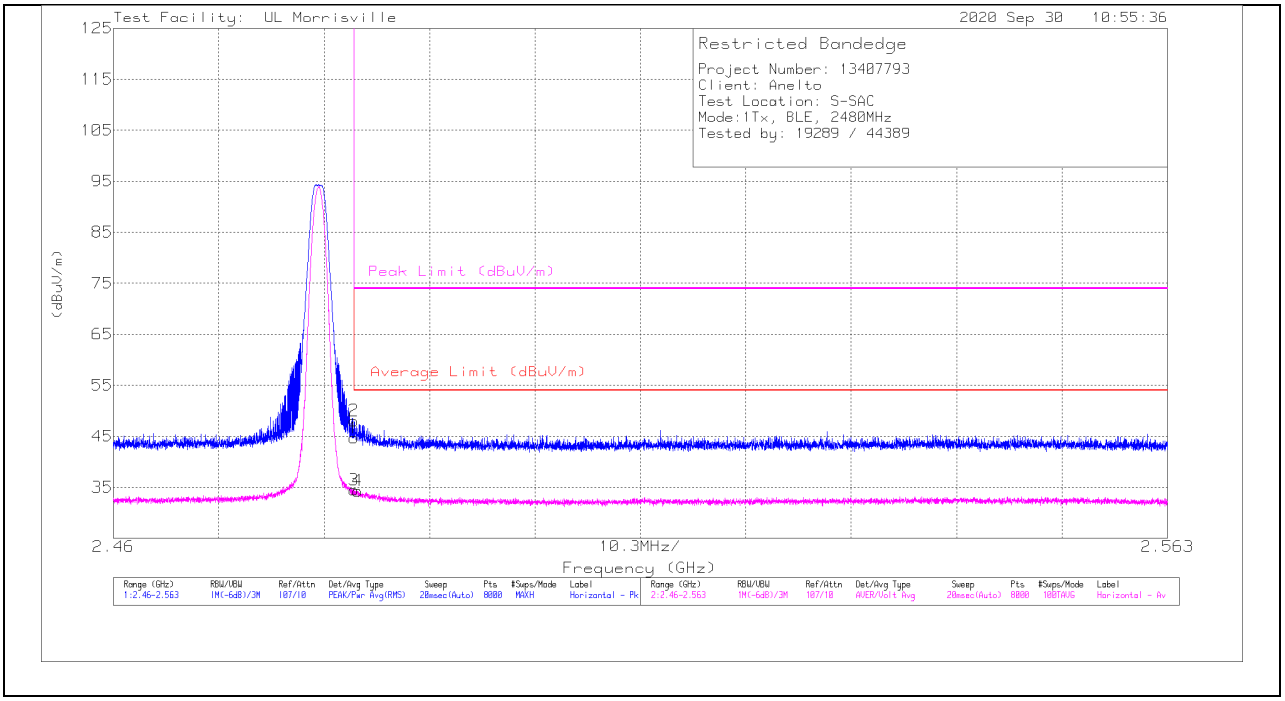
## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT




| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 2.4835 | 36.68 | Pk | 32.4 | -24.4 | 44.68 | - | - | 74 | -29.32 | 61 | 258 | H |
| 2 | * ** 2.48353 | 40.06 | Pk | 32.4 | -24.4 | 48.06 | - | - | 74 | -25.94 | 61 | 258 | H |
| 3 | * ** 2.4835 | 26.5 | ADV | 32.4 | -24.4 | 34.5 | 54 | -19.5 | - | - | 61 | 258 | H |
| 4 | * ** 2.48387 | 26.31 | ADV | 32.4 | -24.4 | 34.31 | 54 | -19.69 | - | - | 61 | 258 | 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



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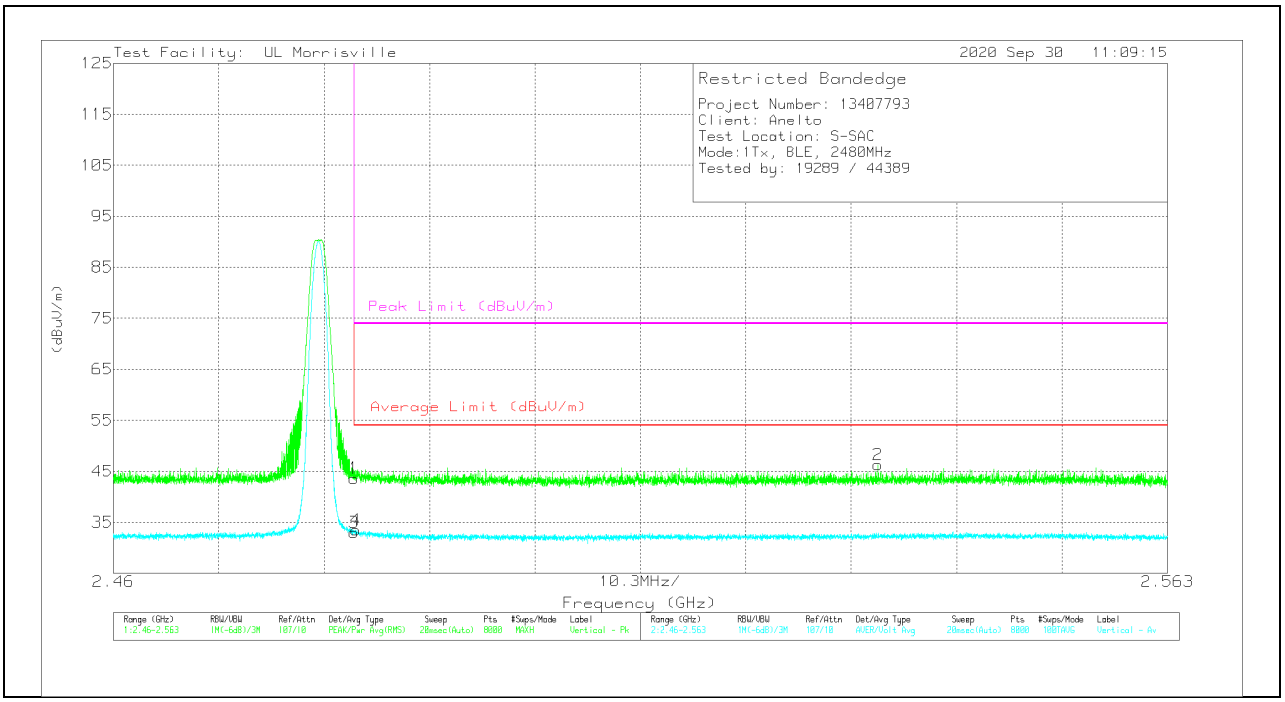
## VERTICAL RESULT




| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 2.4835 | 35.64 | Pk | 32.4 | -24.4 | 43.64 | - | - | 74 | -30.36 | 325 | 359 | V |
| 2 | ** 2.53471 | 38.46 | Pk | 32.6 | -24.8 | 46.26 | - | - | 74 | -27.74 | 325 | 359 | V |
| 3 | * ** 2.4835 | 25.04 | ADV | 32.4 | -24.4 | 33.04 | 54 | -20.96 | - | - | 325 | 359 | V |
| 4 | * ** 2.48369 | 25.53 | ADV | 32.4 | -24.4 | 33.53 | 54 | -20.47 | - | - | 325 | 359 | 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



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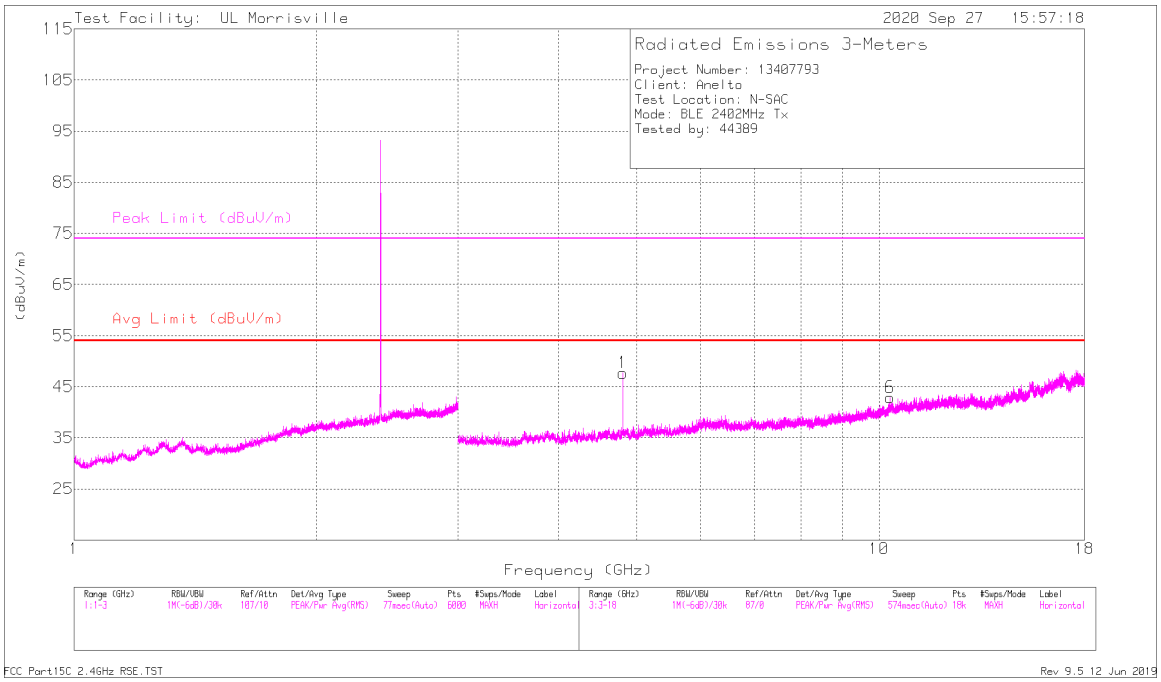
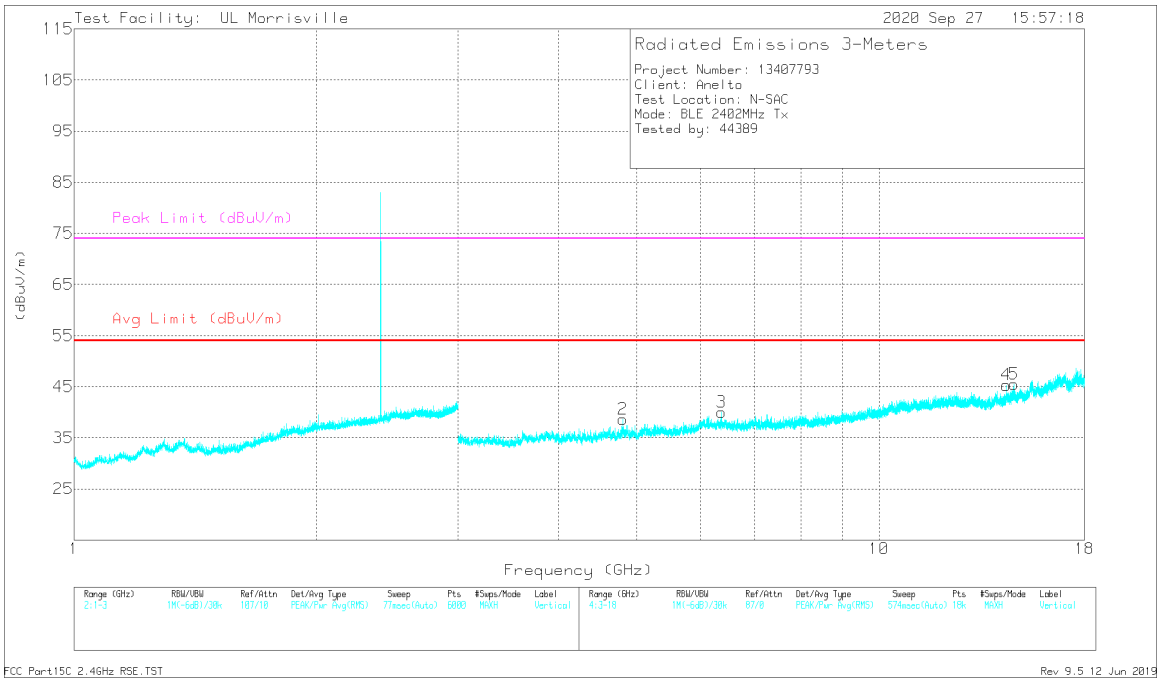
## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL RESULTS




**HORIZONTAL**




**VERTICAL**



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## RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 4.8041 | 48.26 | PK2 | 34.3 | -31.5 | 51.06 | - | - | 74 | -22.94 | 245 | 117 | H |
| | * ** 4.80409 | 43.75 | ADV | 34.3 | -31.5 | 46.55 | 54 | -7.45 | - | - | 245 | 117 | H |
| 2 | * ** 4.80413 | 43.14 | PK2 | 34.3 | -31.5 | 45.94 | - | - | 74 | -28.06 | 288 | 376 | V |
| | * ** 4.80402 | 35.35 | ADV | 34.3 | -31.5 | 38.15 | 54 | -15.85 | - | - | 288 | 376 | V |
| 3 | 6.37602 | 34.22 | Pk | 35.6 | -29.8 | 40.02 | - | - | - | - | 0-360 | 102 | V |
| 6 | 10.32208 | 30.89 | Pk | 37.5 | -25.5 | 42.89 | - | - | - | - | 0-360 | 102 | H |
| 4 | 14.3848 | 33.22 | Pk | 39.2 | -27.1 | 45.32 | - | - | - | - | 0-360 | 102 | V |
| 5 | 14.71066 | 31.8 | Pk | 39.7 | -26 | 45.5 | - | - | - | - | 0-360 | 198 | 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



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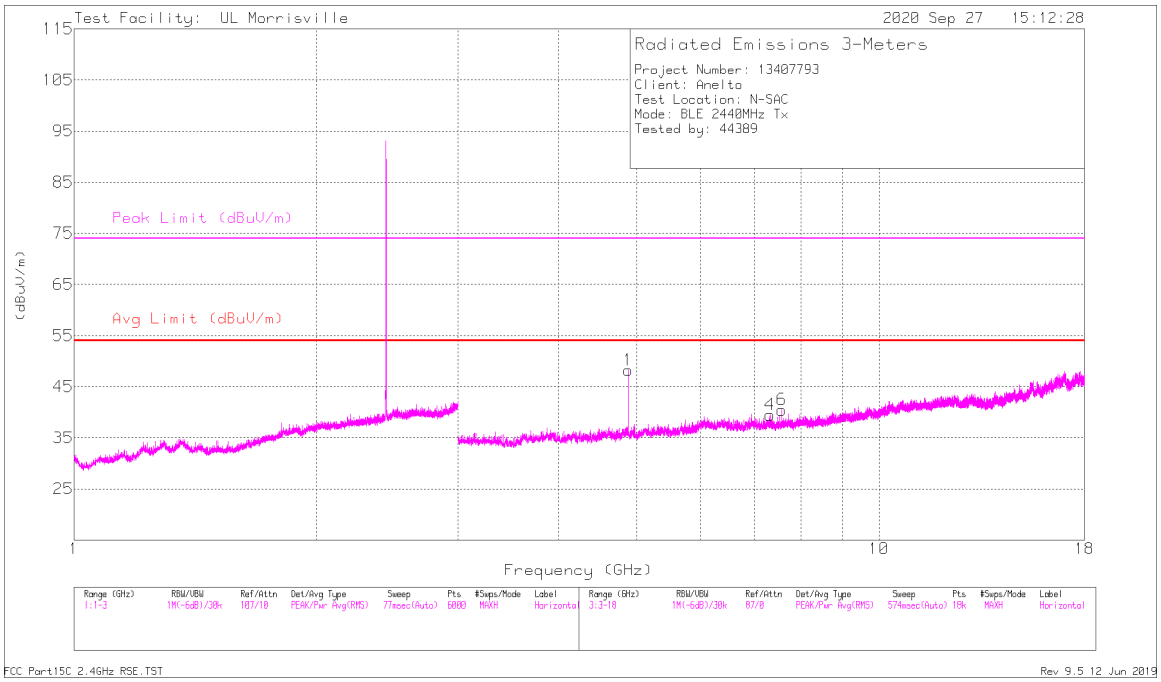
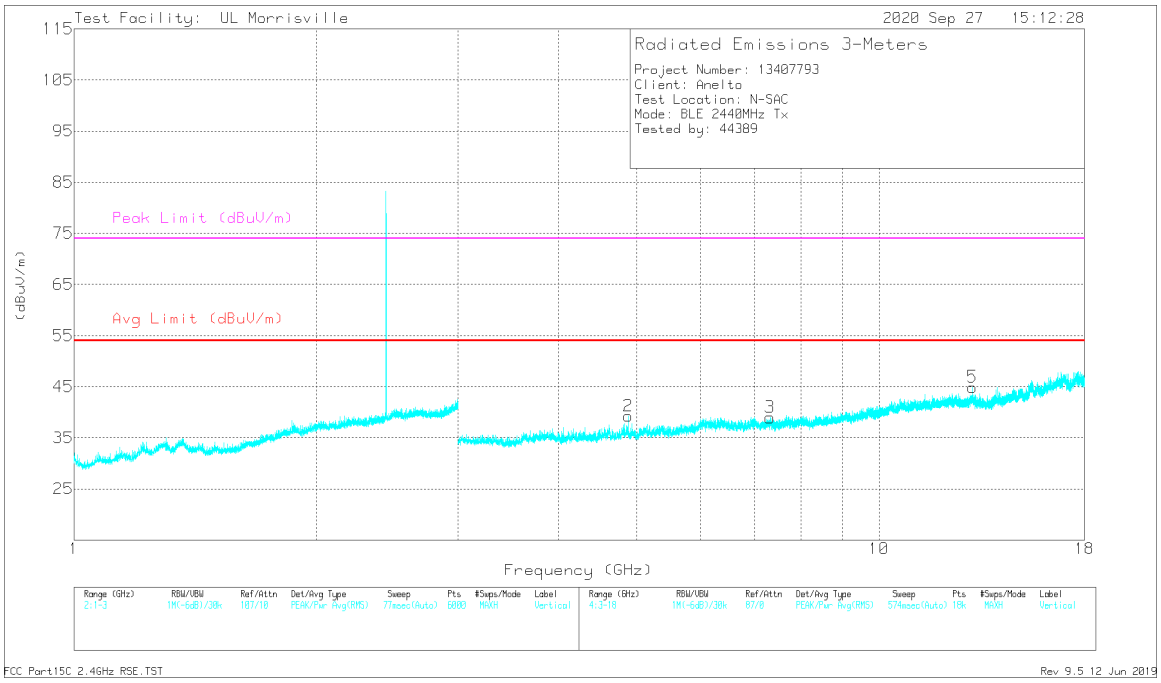
## MID CHANNEL RESULTS




**HORIZONTAL**




**VERTICAL**



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## RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0072 dB(/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 4.88007 | 48.67 | PK2 | 34.1 | -31.4 | 51.37 | - | - | 74 | -22.63 | 244 | 105 | H |
| | * ** 4.8801 | 44.37 | ADV | 34.1 | -31.4 | 47.07 | 54 | -6.93 | - | - | 244 | 105 | H |
| 4 | * ** 7.32036 | 38.25 | PK2 | 35.6 | -29.2 | 44.65 | - | - | 74 | -29.35 | 107 | 357 | H |
| | * ** 7.32028 | 26.94 | ADV | 35.6 | -29.2 | 33.34 | 54 | -20.66 | - | - | 107 | 357 | H |
| 6 | * ** 7.5692 | 38.3 | PK2 | 35.7 | -29.6 | 44.4 | - | - | 74 | -29.6 | 191 | 110 | H |
| | * ** 7.56873 | 25.65 | ADV | 35.7 | -29.6 | 31.75 | 54 | -22.25 | - | - | 191 | 110 | H |
| 2 | * ** 4.88011 | 44.05 | PK2 | 34.1 | -31.4 | 46.75 | - | - | 74 | -27.25 | 288 | 389 | V |
| | * ** 4.88003 | 36.76 | ADV | 34.1 | -31.4 | 39.46 | 54 | -14.54 | - | - | 288 | 389 | V |
| 3 | * ** 7.31937 | 38.53 | PK2 | 35.6 | -29.3 | 44.83 | - | - | 74 | -29.17 | 318 | 370 | V |
| | * ** 7.32027 | 26.46 | ADV | 35.6 | -29.2 | 32.86 | 54 | -21.14 | - | - | 318 | 370 | V |
| 5 | 13.06973 | 32.1 | Pk | 39.1 | -26.3 | 44.9 | - | - | - | - | 0-360 | 102 | 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



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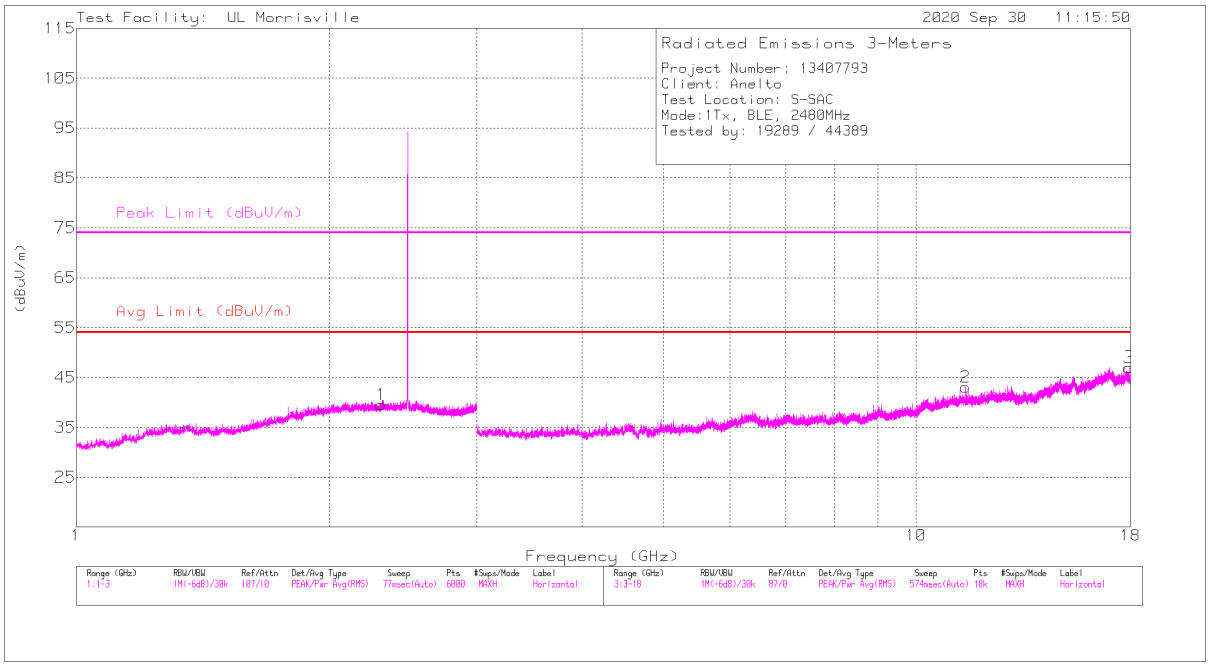
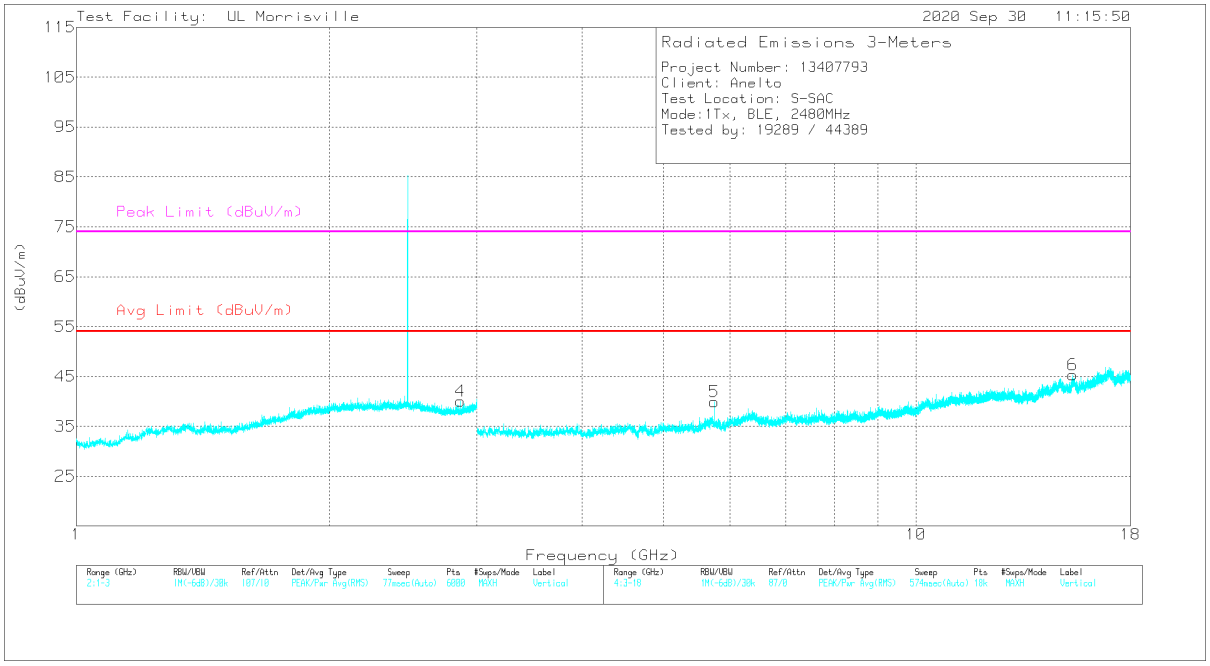
## HIGH CHANNEL RESULTS




**HORIZONTAL**




**VERTICAL**



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## RADIATED EMISSIONS

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0067 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | * ** 2.86735 | 38.02 | PK2 | 32.6 | -25.9 | 44.72 | - | - | 74 | -29.28 | 49 | 220 | V |
| | * ** 2.86742 | 24.74 | ADV | 32.6 | -25.9 | 31.44 | 54 | -22.56 | - | - | 49 | 220 | V |
| 2 | * ** 11.45609 | 33.24 | PK2 | 38.2 | -24.2 | 47.24 | - | - | 74 | -26.76 | 6 | 258 | H |
| | * ** 11.45648 | 20.91 | ADV | 38.2 | -24.2 | 34.91 | 54 | -19.09 | - | - | 6 | 258 | H |
| 3 | * ** 17.92417 | 33.18 | PK2 | 41.2 | -22.2 | 52.18 | - | - | 74 | -21.82 | 4 | 213 | H |
| | * ** 17.92369 | 20.67 | ADV | 41.2 | -22.2 | 39.67 | 54 | -14.33 | - | - | 4 | 213 | H |
| 6 | * ** 15.37659 | 33 | PK2 | 40.3 | -22.7 | 50.6 | - | - | 74 | -23.4 | 206 | 209 | V |
| | * ** 15.37654 | 20.71 | ADV | 40.3 | -22.7 | 38.31 | 54 | -15.69 | - | - | 206 | 209 | V |
| 1 | 2.30688 | 31.15 | Pk | 32 | -23.6 | 39.55 | - | - | - | - | 0-360 | 101 | H |
| 5 | 5.74599 | 35.43 | Pk | 34.6 | -30.1 | 39.93 | - | - | - | - | 0-360 | 200 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector



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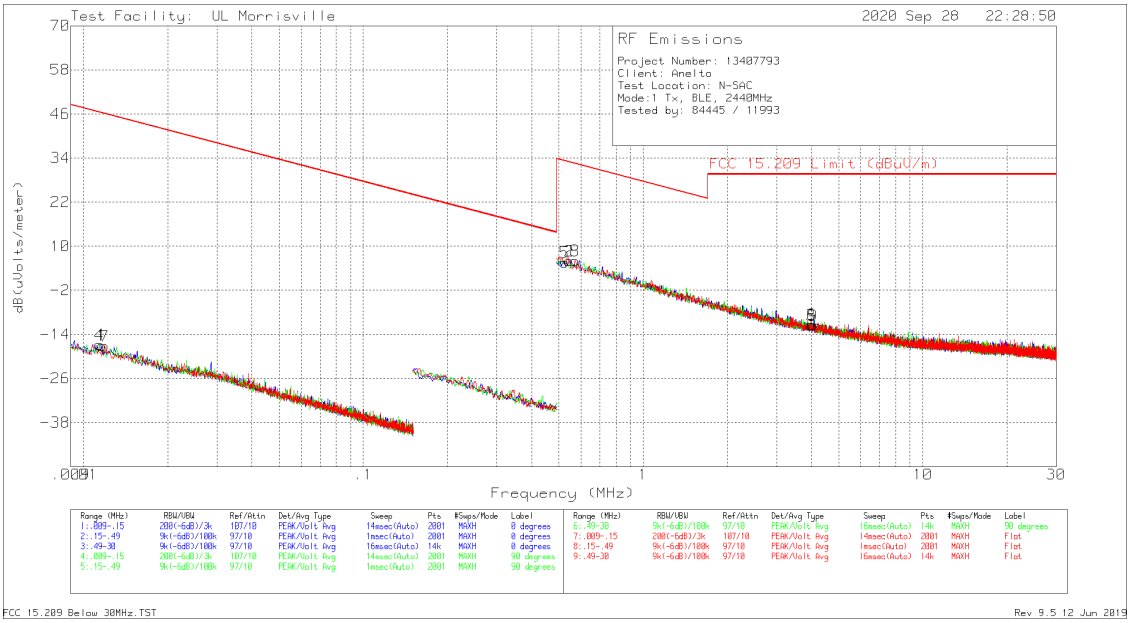
## 10.3. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: 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*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 11.41 KHz resulted in a level of -16.75 dBuV/m, which is equivalent to -16.75 - 51.5 = -68.25 dBuA/m, which has the same margin, -63.21 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

**SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)**




**ANTENNA- THREE ORIENTATIONS**



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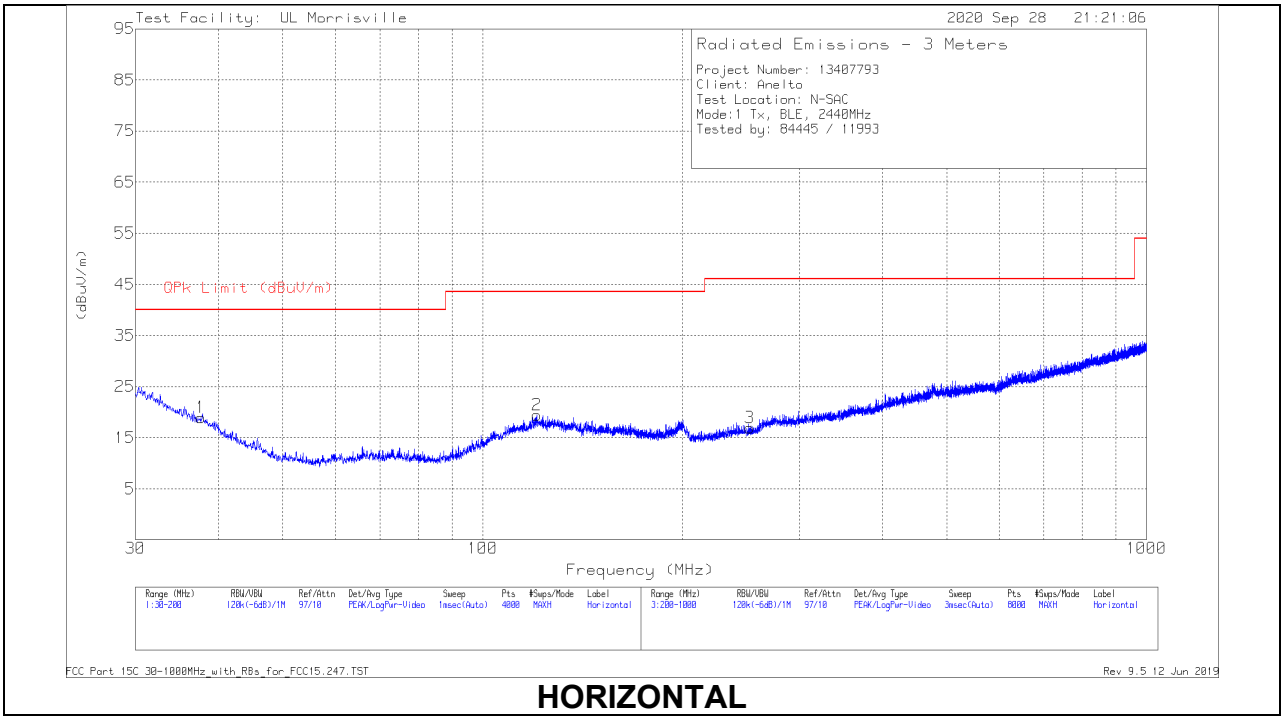
## Below 30MHz Data

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0079 (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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | .01141 | 45.85 | Pk | 17.3 | .1 | -80 | -16.75 | 46.46 | 66.46 | -63.21 | 0-360 |
| 1 | .01163 | 45.67 | Pk | 17.2 | .1 | -80 | -17.03 | 46.3 | 66.3 | -63.33 | 0-360 |
| 7 | .01191 | 45.63 | Pk | 17.1 | .1 | -80 | -17.17 | 46.09 | 66.09 | -63.26 | 0-360 |
| 5 | .52373 | 34.61 | Pk | 10.8 | .2 | -40 | 5.61 | 33.22 | - | -27.61 | 0-360 |
| 2 | .54586 | 35.04 | Pk | 10.8 | .2 | -40 | 6.04 | 32.86 | - | -26.82 | 0-360 |
| 8 | .57221 | 35.09 | Pk | 10.8 | .2 | -40 | 6.09 | 32.45 | - | -26.36 | 0-360 |
| 3 | 3.9682 | 17.07 | Pk | 11.2 | .4 | -40 | -11.33 | 29.54 | - | -40.87 | 0-360 |
| 6 | 4.01036 | 17.12 | Pk | 11.2 | .4 | -40 | -11.28 | 29.54 | - | -40.82 | 0-360 |
| 9 | 4.05463 | 16.91 | Pk | 11.2 | .4 | -40 | -11.49 | 29.54 | - | -41.03 | 0-360 |

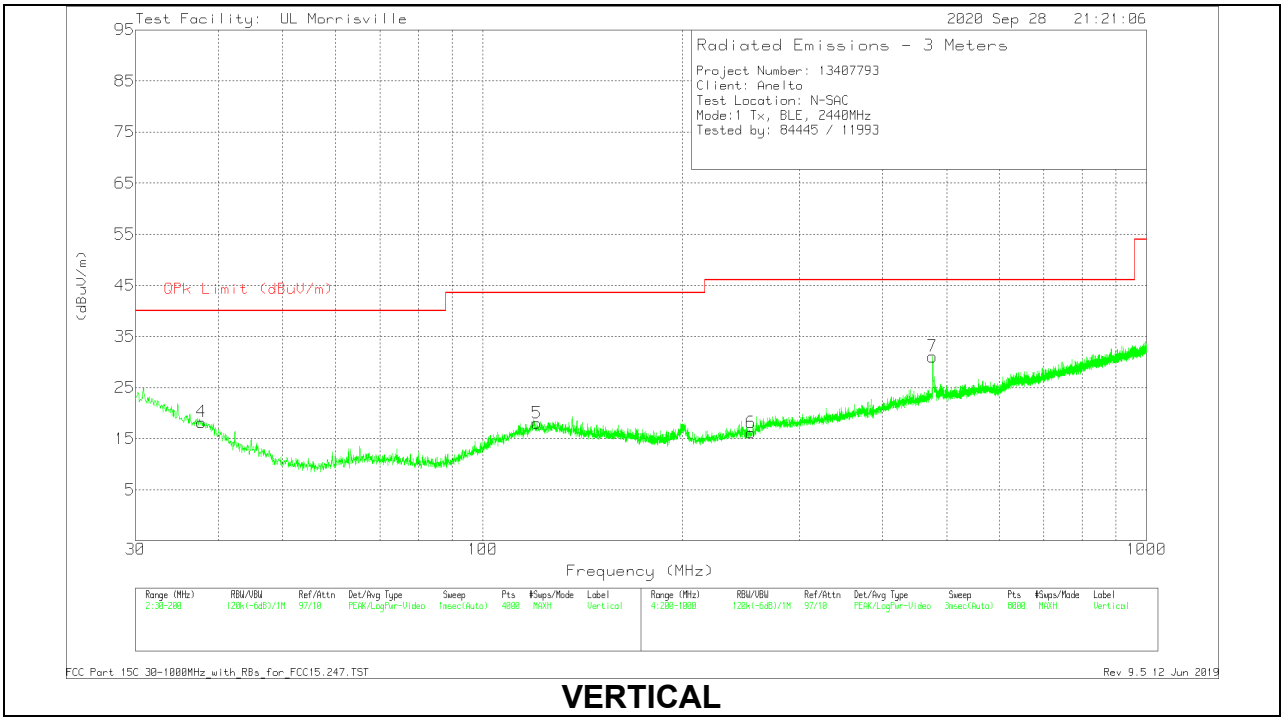
Pk - Peak detector

## 10.4. WORST CASE BELOW 1 GHZ

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




**HORIZONTAL**




**VERTICAL**



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## Below 1GHz Data

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0074 (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 37.6095 | 28.83 | Pk | 21.4 | -31.3 | 18.93 | 40 | -21.07 | 0-360 | 199 | H |
| 2 | * ** 120.8035 | 29.61 | Pk | 20 | -30.2 | 19.41 | 43.52 | -24.11 | 0-360 | 399 | H |
| 4 | * ** 37.737 | 28.13 | Pk | 21.4 | -31.3 | 18.23 | 40 | -21.77 | 0-360 | 102 | V |
| 5 | * ** 120.8035 | 28.26 | Pk | 20 | -30.2 | 18.06 | 43.52 | -25.46 | 0-360 | 102 | V |
| 3 | * ** 252.7069 | 28.18 | Pk | 17.6 | -28.9 | 16.88 | 46.02 | -29.14 | 0-360 | 102 | H |
| 6 | * ** 253.607 | 27.45 | Pk | 17.6 | -28.9 | 16.15 | 46.02 | -29.87 | 0-360 | 299 | V |
| 7 | 476.3359 | 34.86 | Pk | 23.7 | -27.5 | 31.06 | 46.02 | -14.96 | 0-360 | 102 | V |



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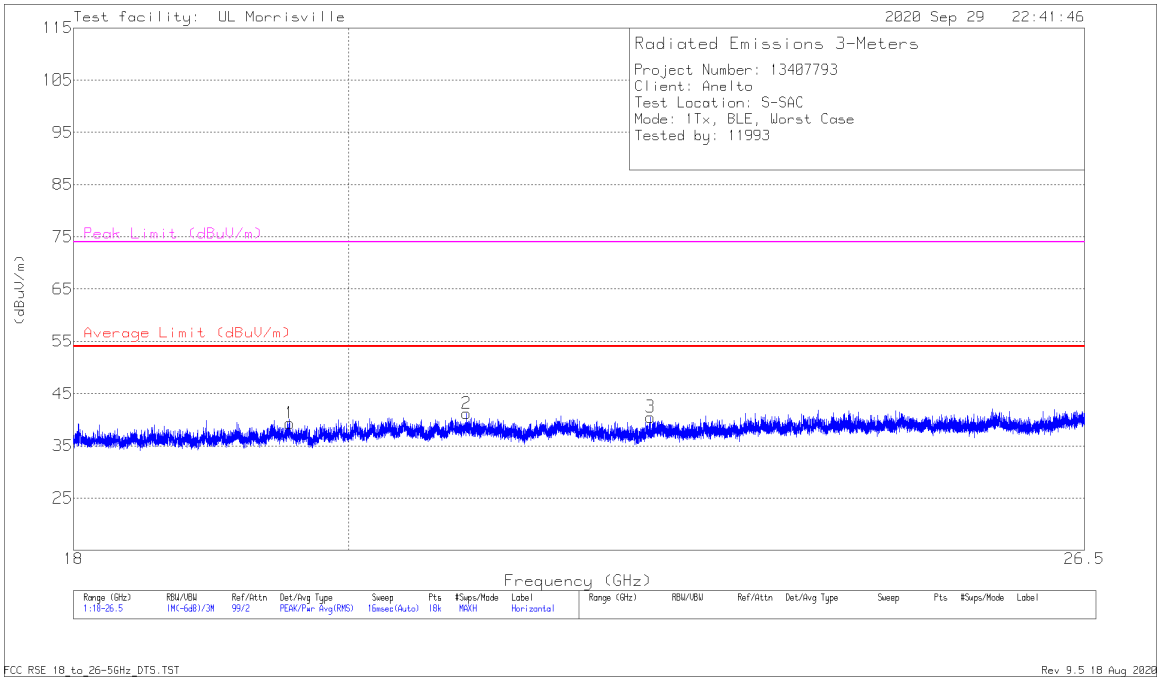
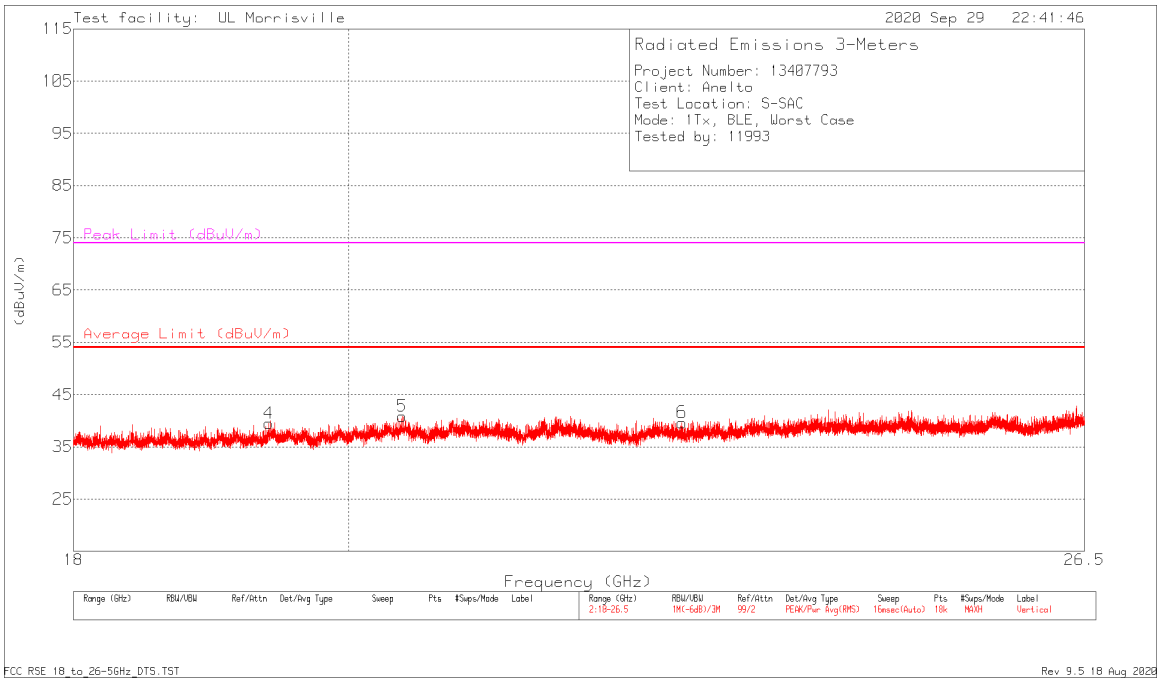
## 10.5. WORST CASE 18-26 GHZ

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




**HORIZONTAL**




**VERTICAL**



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## 18 – 26GHz DATA

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AT0076 AF (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * ** 19.5537 | 45.51 | Pk | 32.8 | -39 | 39.31 | 54 | -14.69 | 74 | -34.69 | 0-360 | 149 | H |
| 2 | * ** 20.91944 | 46.97 | Pk | 33.2 | -39 | 41.17 | 54 | -12.83 | 74 | -32.83 | 0-360 | 300 | H |
| 3 | * ** 22.44574 | 46.32 | Pk | 33.6 | -39.4 | 40.52 | 54 | -13.48 | 74 | -33.48 | 0-360 | 250 | H |
| 4 | * ** 19.39597 | 45.79 | Pk | 32.8 | -39.1 | 39.49 | 54 | -14.51 | 74 | -34.51 | 0-360 | 150 | V |
| 5 | * ** 20.41319 | 46.43 | Pk | 33.1 | -38.7 | 40.83 | 54 | -13.17 | 74 | -33.17 | 0-360 | 101 | V |
| 6 | * ** 22.71823 | 45.05 | Pk | 33.6 | -39 | 39.65 | 54 | -14.35 | 74 | -34.35 | 0-360 | 101 | V |



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# 11. SETUP PHOTOS

Please refer to R13407793-EP1 for setup photos

# END OF TEST REPORT