# CERTIFICATION TEST REPORT

**Report Number. :** 11988903-E2V2

| | | |
|---|---|---|
| **Applicant** | : | Mayfield Robotics<br>400 Convention Way<br>Redwood City, CA 94063 |
| **Model** | : | AHR-M8T |
| **FCC ID** | : | 2AN44-AHR-M8T |
| **EUT Description** | : | General Consumer Home Robot |
| **Test Standard(s)** | : | FCC 47 CFR PART 15 SUBPART C |

**Date Of Issue:**
June 19, 2018

**Prepared by:**
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
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NVLAP LAB CODE 200065-0

# REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 6/11/18 | Initial Release | --- |
| V2 | 6/19/18 | Updated Section 5.6 setup diagram for radiated tests and setup diagram for line conducted | J.Qian |



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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Mayfield Robotics
400 Convention Way
Redwood City, CA 94063

**EUT DESCRIPTION:** General Consumer Home Robot

**MODEL:** AHR-M8T

**SERIAL NUMBER:** RADIATED: 17534007 (MF-001 Rev. A04)
CONDUCTED: 17450531 (MF-001 Rev. A04)

**DATE TESTED:** September 11th, 2017 – December 8th, 2017

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Complies |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc By:

Francisco De Anda
Operations Leader
UL Verification Services Inc.

Prepared By:

Eric Yu
Test Engineer
UL Verification Services Inc.

# 2. 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.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. 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.

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| ☒ Chamber A(ISED: 2324B-1) | ☐ Chamber D(ISED: 22541-1) |
| ☒ Chamber B(ISED: 2324B-2) | ☐ Chamber E(ISED: 22541-2) |
| ☒ Chamber C(ISED: 2324B-3) | ☐ Chamber F(ISED: 22541-3) |
| | ☐ Chamber G(ISED: 22541-4) |
| | ☐ Chamber H(ISED: 22541-5) |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at NVLAP Lab Search.


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# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

## 4.3. MEASUREMENT UNCERTAINTY

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

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

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 3.84 dB |
| Conducted Disturbance, 0.15 to 30 MHz | 3.65 dB |
| Radiated Disturbance, 9KHz to 30 MHz | 3.15 dB |
| Radiated Disturbance, 30 to 1000 MHz | 5.36 dB |
| Radiated Disturbance,1000 to 18000 MHz | 4.32 dB |
| Radiated Disturbance,18000 to 26000 MHz | 4.45 dB |
| Radiated Disturbance,26000 to 40000 MHz | 5.24 dB |

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



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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a general consumer home robot

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum output power as follows:

| | | Average | | Peak | |
|---|---|---|---|---|---|
| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) | Output Power (dBm) | Output Power (mW) |
| 2402 - 2480 | BLE | -17.99 | 0.02 | -10.45 | 0.09 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes antenna, with a maximum gain of 3.1 dBi

## 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Windows 10

The test utility software used during testing was BlueSuite v2.6.4.1046

## 5.5. 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 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 EUT cannot be used in different orientations. Therefore, all final radiated testing was performed with the EUT in typical standing orientation.

Worst-case data rates as provided by the client were:

BLE: 1 Mbps.

The height of the robot is at 0.51 meters and the highest point of the antennas is at 0.31 meters. Given the measurement antenna height range, 1 meter to 4 meters, and for above 1GHz testing, the boring sight mechanism and beamwidth of the antenna,testing on the floor would prevent capturing full emissions strength. Testing on the floor the antenna would not capture worst case emissions, therefore EUT was tested as table top equipment.



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## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| Laptop | Lenovo | X1 Carbon | R9-0JM36P |
| AC/DC Adapter | Lenovo | ADL170NDC2A | 11S36200317ZZ40077C20J |
| DC Power Supply | BK Precesion | 1550 | 238D15253 |
| USB ethernet adapter | Cable Matters Inc. | 202013 | TS3G9FQ7 |
| EUT AC Adapter | DYS | DYS902-190473W | NSN |
| Monitor | ODROID-VU | GH620A | YXD090TN02-40NMO1 |

**I/O CABLES**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | Ethernet | 1 | RJ45 | unshielded | 2.1 | |
| 2 | DC | 1 | Header | unshielded | 1.85 | To EUT from DC P/S |
| 3 | DC | 1 | barrel | unshielded | 1.32 | To EUT AC adapter |
| 4 | AC | 1 | 2-prong | unshielded | 1.22 | |
| 5 | HDMI | 1 | HDMI | shielded | 2.5 | |
| 6 | DC | 1 | Barrle | shielded | 1.5 | To laptop |
| 7 | AC | 2 | 3-prong | shielded | 1 | |

**TEST SETUP**

The EUT is connected to a test laptop. Test software exercises the radio.



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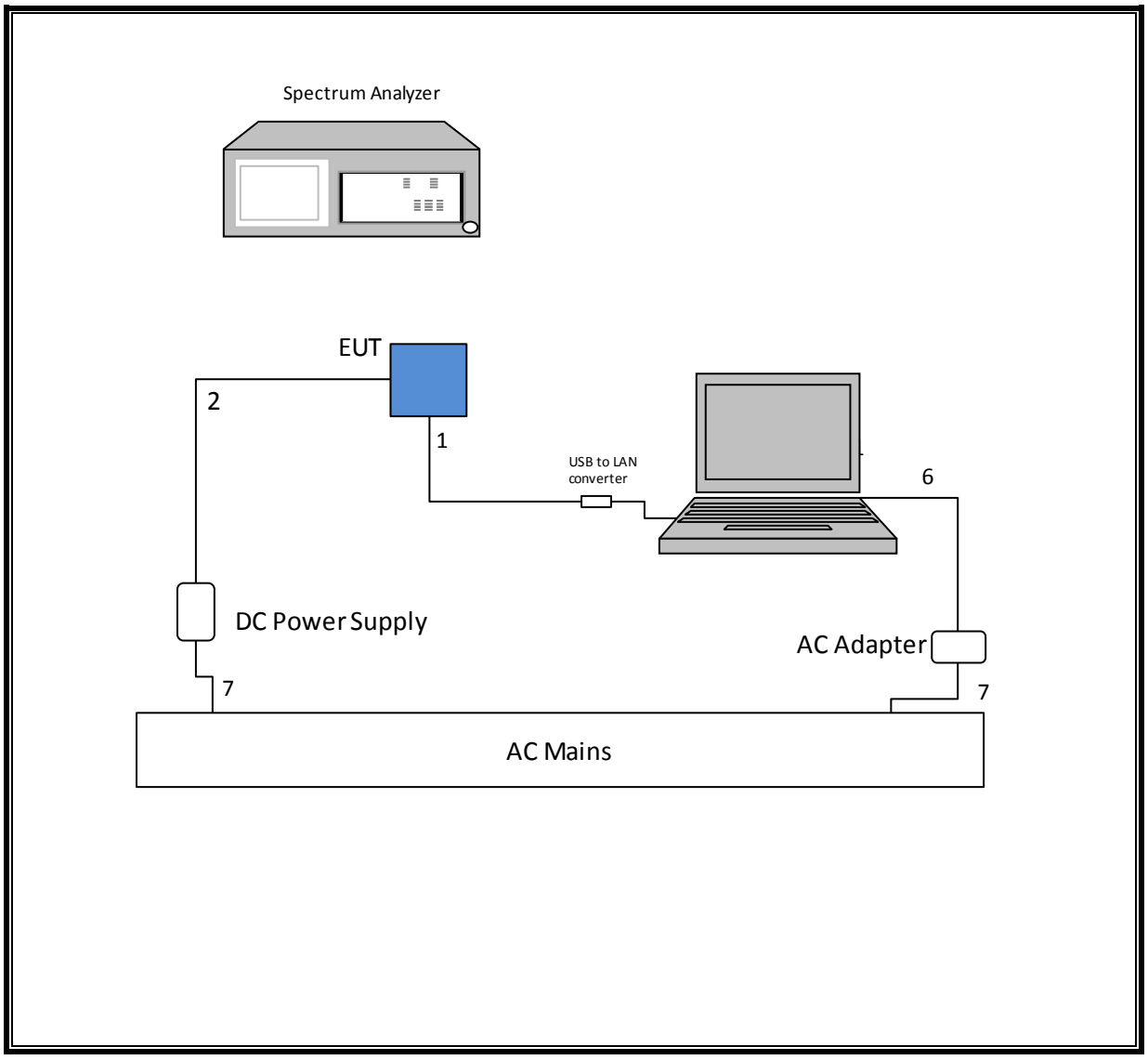
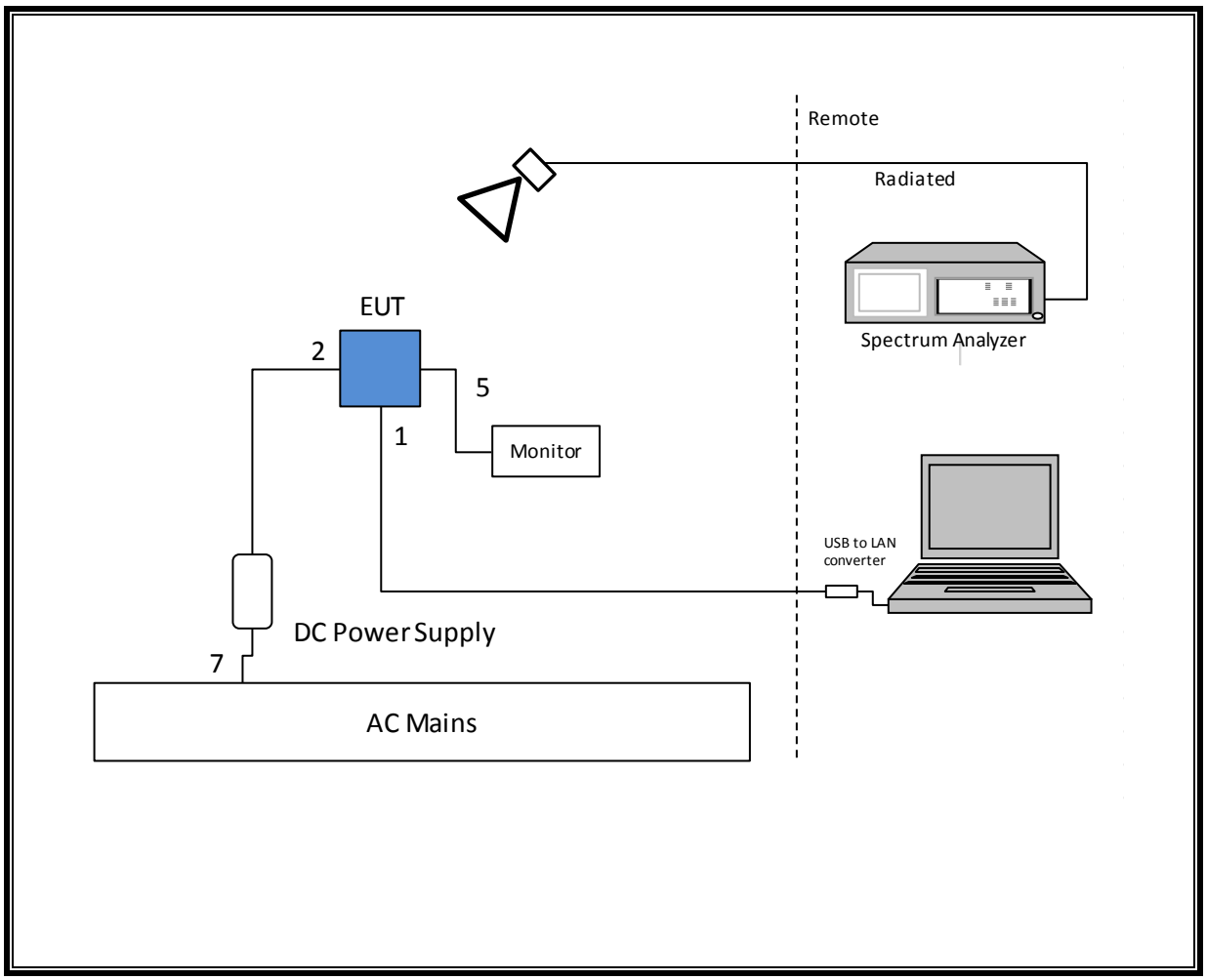
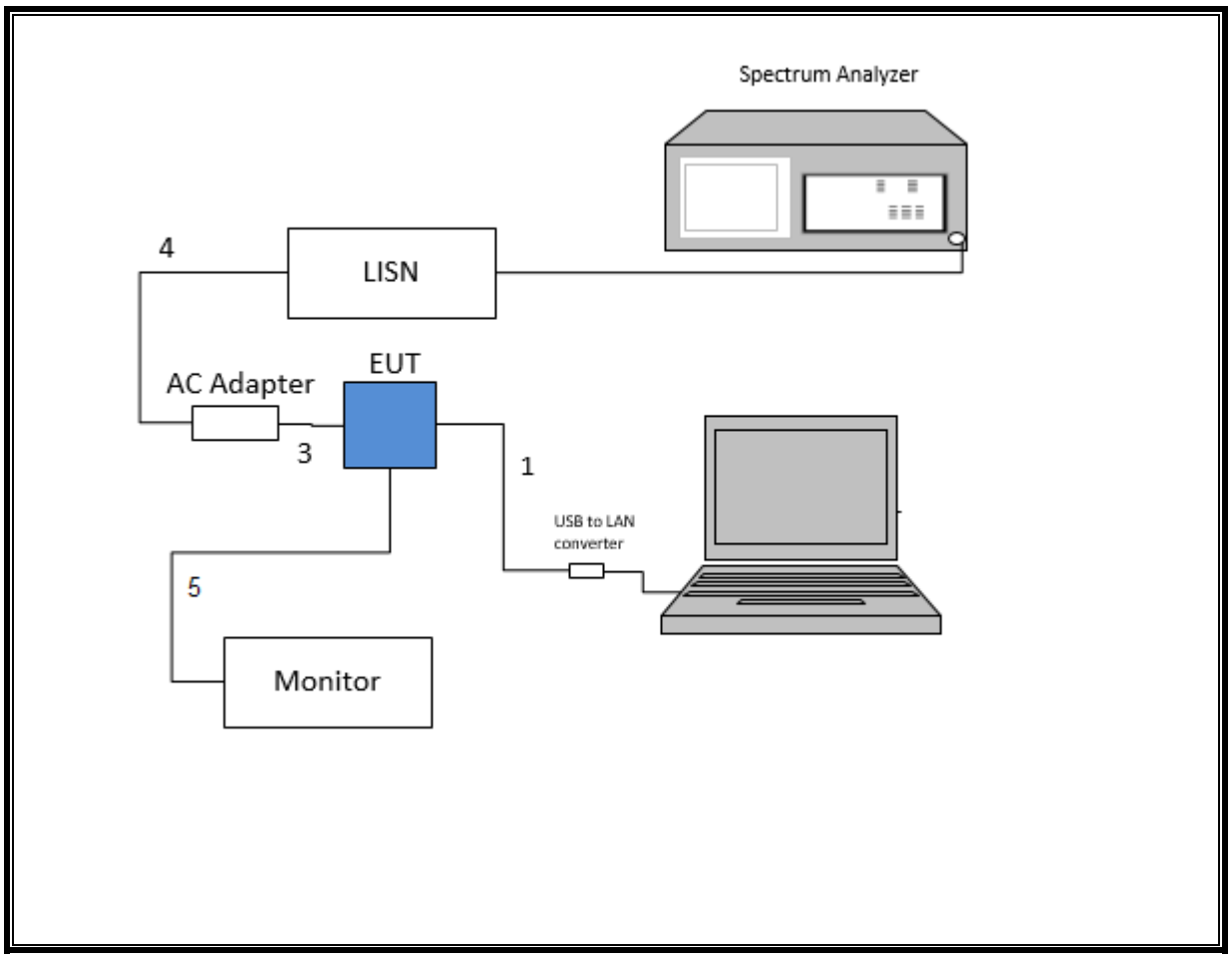
**SETUP DIAGRAM FOR ANTENNA PORT CONDUCTED TESTS**



**SETUP DIAGRAM FOR RADIATED TESTS**



**SETUP DIAGRAM FOR LINE CONDUCTED TEST**



# 6. TEST AND MEASUREMENT EQUIPMENT

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

| Description | Manufacturer | Model | ID Num | Cal Due | Last Cal |
|---|---|---|---|---|---|
| Spectrum Analyzer | Keysight | E4446A | T146 | 07/17/18 | 07/17/17 |
| Spectrum Analyzer | Keysight | N9030A | T1466 | 04/11/18 | 04/11/17 |
| Antenna, Biconolog, 30MHz – 1GHz | Sunol Sciences | JB1 | T130 | 10/16/18 | 10/16/17 |
| Antenna, Horn, 1-18GHz | ETS Lindgren | 3117 | T862 | 06/09/18 | 06/09/17 |
| RF Preamplifier, 10kHz - 1GHz | Sonoma | 310N | T300 | 11/10/17 | 11/10/16 |
| RF Preamplifier, 1 - 18GHz | Miteq | AFS42-00101800-25-S-42 | T1165 | 06/24/18 | 06/24/17 |
| RF Preamplifier, 1 - 8GHz | Miteq | AMF-4D-01000800-30-29P | T1573 | 06/24/18 | 06/24/17 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | T486 | 06/24/18 | 06/24/17 |
| Antenna, Horn, 1-18GHz | ETS Lindgren | 3117 | T863 | 06/09/18 | 06/09/17 |
| RF Preamplifier, 1 - 18GHz | Miteq | AFS42-00101800-25-S-42 | T493 | 02/15/18 | 02/15/17 |
| RF Preamplifier, 1 - 8GHz | Miteq | AMF-4D-01000800-30-29P | T1156 | 02/15/18 | 02/15/17 |
| Spectrum Analyzer | Keysight | N9030A | T907 | 01/23/18 | 01/23/17 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | T485 | 02/15/18 | 02/15/17 |
| Antenna, Horn, 1-18GHz | ETS Lindgren | 3117 | T712 | 01/30/18 | 01/30/17 |
| RF Preamplifier, 1 - 18GHz | Miteq | AFS42-00101800-25-S-42 | T931 | 06/21/18 | 06/21/17 |
| Spectrum Analyzer | Keysight | N9030A | T905 | 01/11/18 | 01/11/17 |
| Antenna, Horn, 18-26-GHz | ARA | MWH-1826 | T89 | 01/04/18 | 01/04/17 |
| Antenna, Active Loop 9KHz to 30MHz | COM-POWER | AL-130R | T1866 | 10/10/2018 | 10/10/2017 |
| RF Preamplifier, 1-26GHz | Agilent | 8449B | T404 | 07/23/18 | 07/23/17 |
| Spectrum Analyzer, 40GHz | Keysight | N9030A | T1454 | 12/15/17 | 12/15/16 |
| Power Meter | Keysight | N1911A | T1271 | 07/17/18 | 07/17/17 |
| Power Sensor | Keysight | N1921A | T413 | 06/22/18 | 06/22/17 |
| EMI Receiver | Rohde & Schwarz | ESR | T1436 | 01/06/18 | 01/06/17 |
| LISN | Fischer Custom Communications | FCC-LISN-50/250-25-2-01 | T1310 | 06/15/18 | 06/15/17 |

| Test Software List | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Version** |
| Radiated Software | UL | UL EMC | Ver 9.5, Dec 01, 2016 |
| Conducted Emissions Software | UL | UL EMC | Ver 9.5, May 26, 2015 |

**NOTES:**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.



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# 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

Output Power: KDB 558074 D01 v04, Section 9.1.3.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.



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# 8. ANTENNA PORT TEST RESULTS

## 8.1. ON TIME, DUTY CYCLE

**LIMITS**

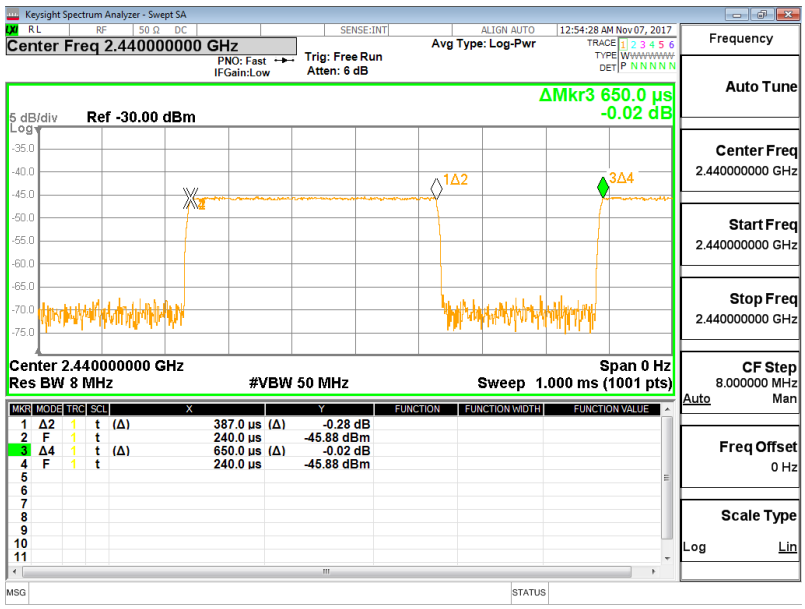
None; for reporting purposes only.

**PROCEDURE**

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/T Minimum VBW (kHz) |
|---|---|---|---|---|---|---|
| BLE | 0.387 | 0.650 | 0.595 | 59.54% | 2.25 | 2.584 |




**LOW CHANNEL**

## 8.2. 6 dB BANDWIDTH

**LIMITS**

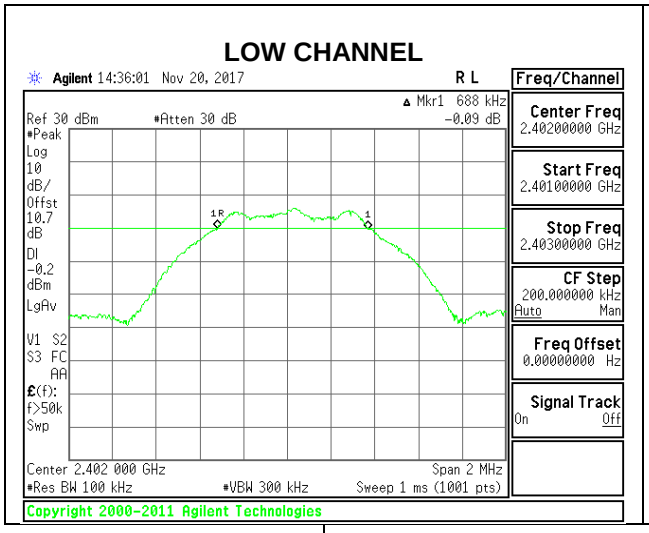
FCC §15.247 (a) (2)

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

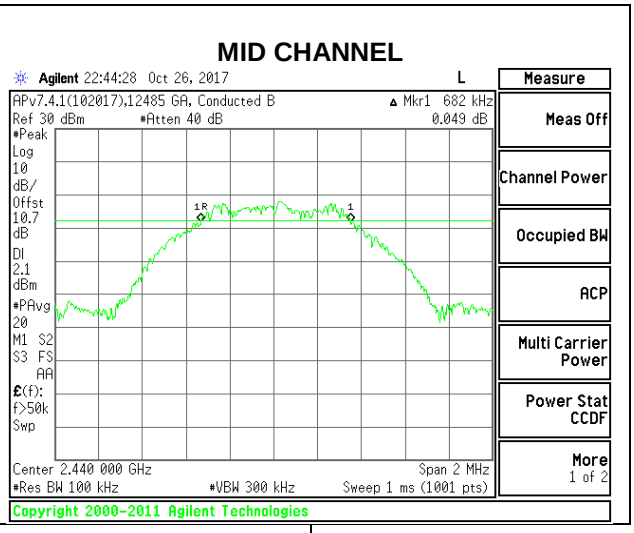
**RESULTS**

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 2402 | 0.688 | 0.5 |
| Middle | 2440 | 0.682 | 0.5 |
| High | 2480 | 0.708 | 0.5 |

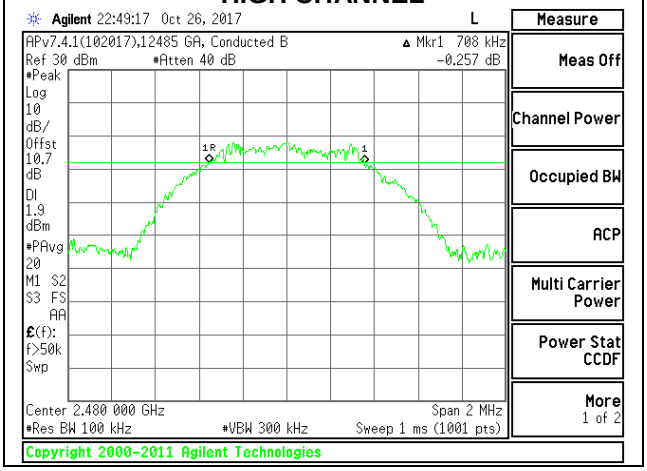
LOW CHANNEL




MID CHANNEL




HIGH CHANNEL



## 8.3. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**Test Procedure**

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

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 2402 | 1.0256 |
| Middle | 2440 | 1.0290 |
| High | 2480 | 1.0257 |



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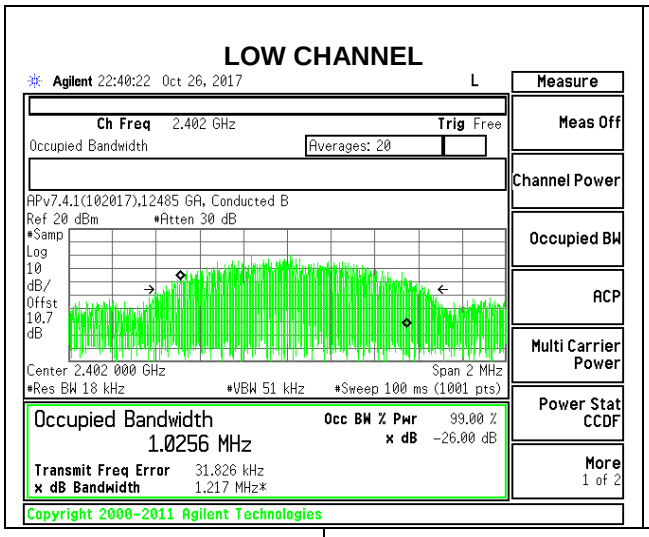
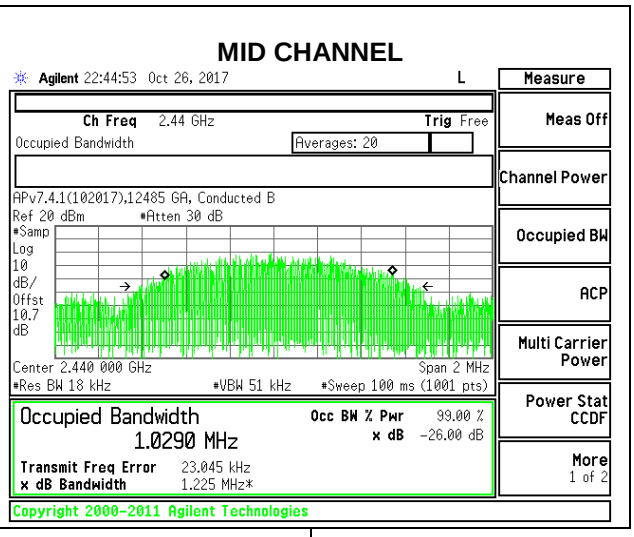
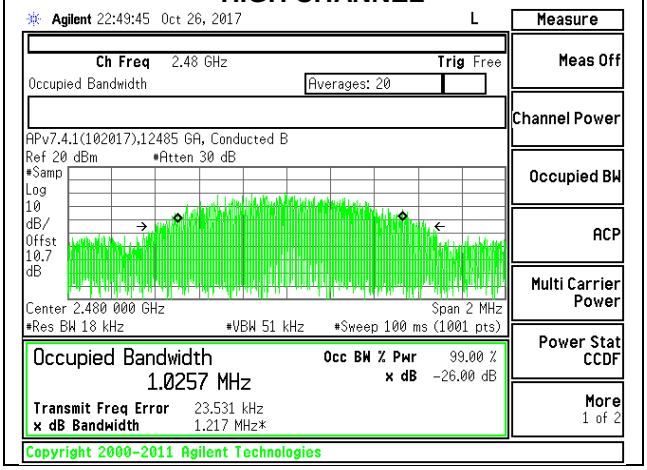
**LOW CHANNEL**




**MID CHANNEL**




**HIGH CHANNEL**



## 8.4. 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 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

**RESULTS**

| | | | |
|---|---|---|---|
| **TEST ENGINEER:** | 12485 | **Date:** | 12/04/17 |

| Channel | Frequency (MHz) | AV Power (dBm) |
|---|---|---|
| Low | 2402 | -22.36 |
| Middle | 2440 | -19.48 |
| High | 2480 | -17.99 |



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## 8.5. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

**RESULTS**

| | | | |
|---|---|---|---|
| **TEST ENGINEER:** | 12485 | **Date:** | 12/04/17 |

| Channel | Frequency (MHz) | Peak Power Reading (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2402 | -11.15 | 30 | -41.150 |
| Middle | 2440 | -10.88 | 30 | -40.880 |
| High | 2480 | -10.45 | 30 | -40.450 |



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## 8.6. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

**RESULTS**

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---|---|---|---|---|
| Low | 2402 | -8.40 | 8 | -16.40 |
| Middle | 2440 | -7.04 | 8 | -15.04 |
| High | 2480 | -6.52 | 8 | -14.52 |



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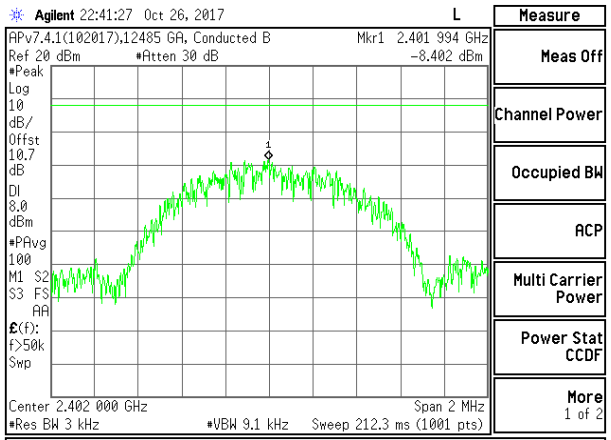
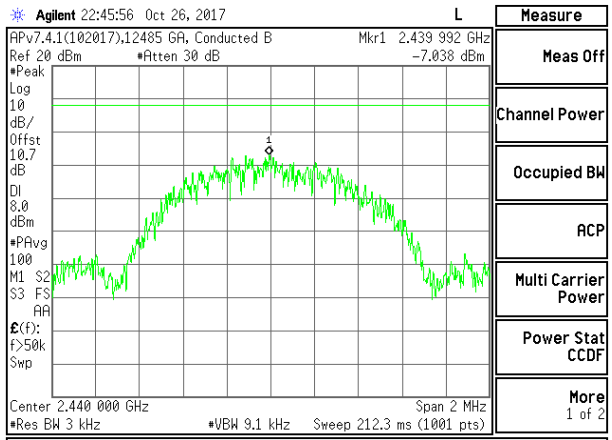
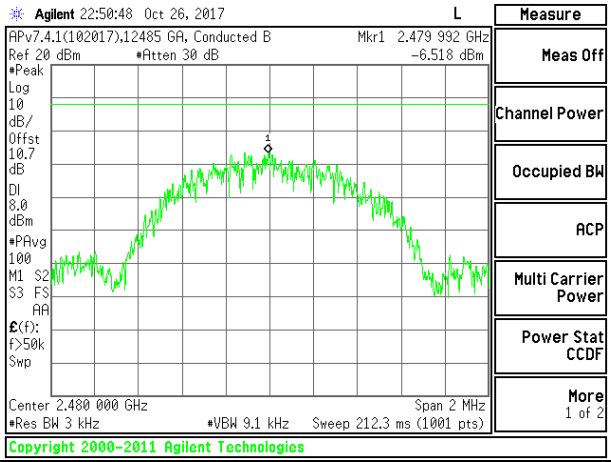
**LOW CHANNEL**




**MID CHANNEL**




**HIGH CHANNEL**



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## 8.7. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**RESULTS**



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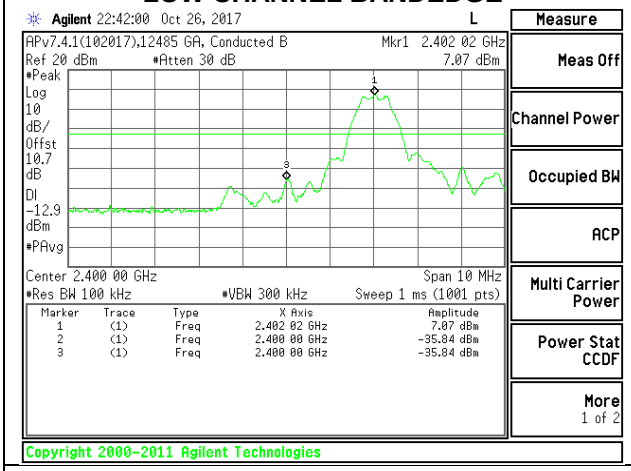
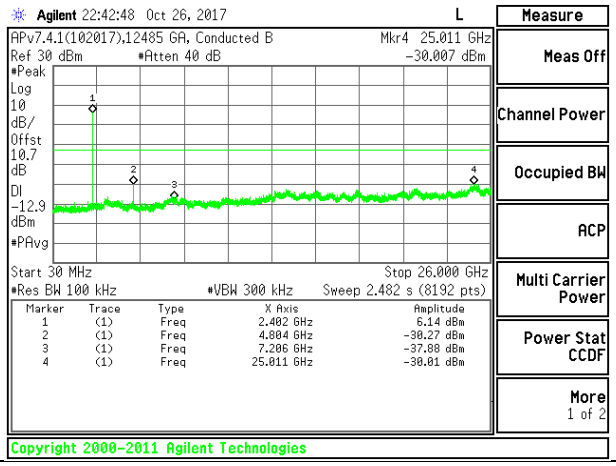
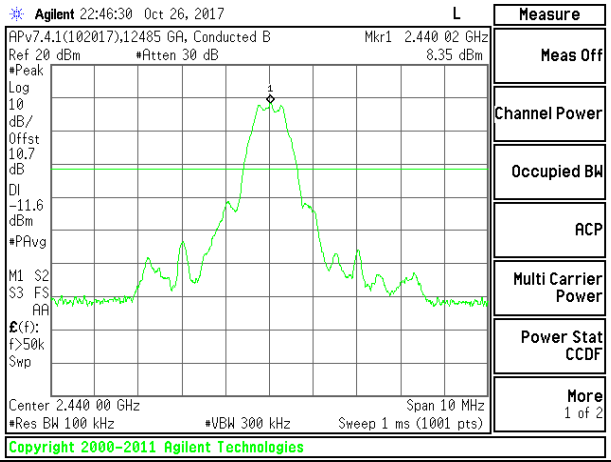
## LOW CHANNEL BANDEDGE



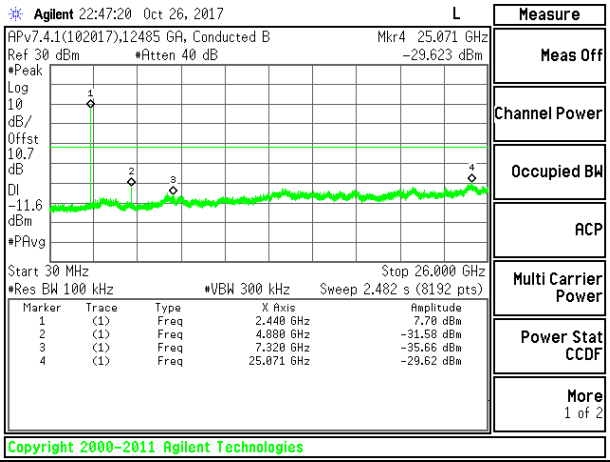

## OUT-OF-BAND LOW CHANNEL



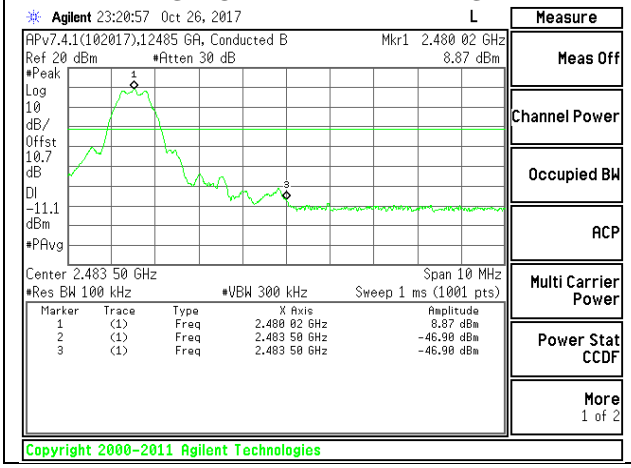

## MID CHANNEL BANDEDGE



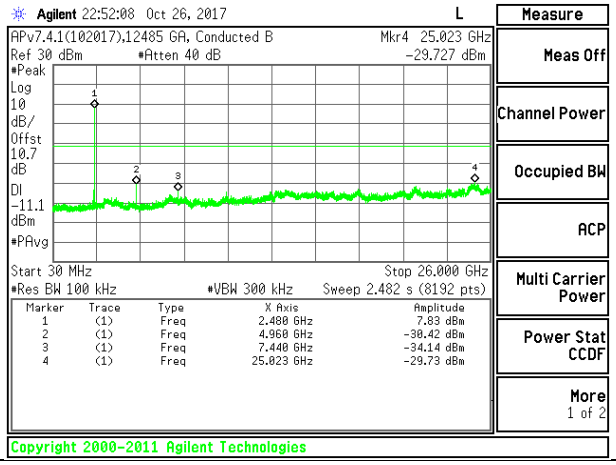

## OUT-OF-BAND MID CHANNEL




## HIGH CHANNEL BANDEDGE




## OUT-OF-BAND HIGH CHANNEL



# 9. RADIATED TEST RESULTS

**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 |

**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. 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.

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.



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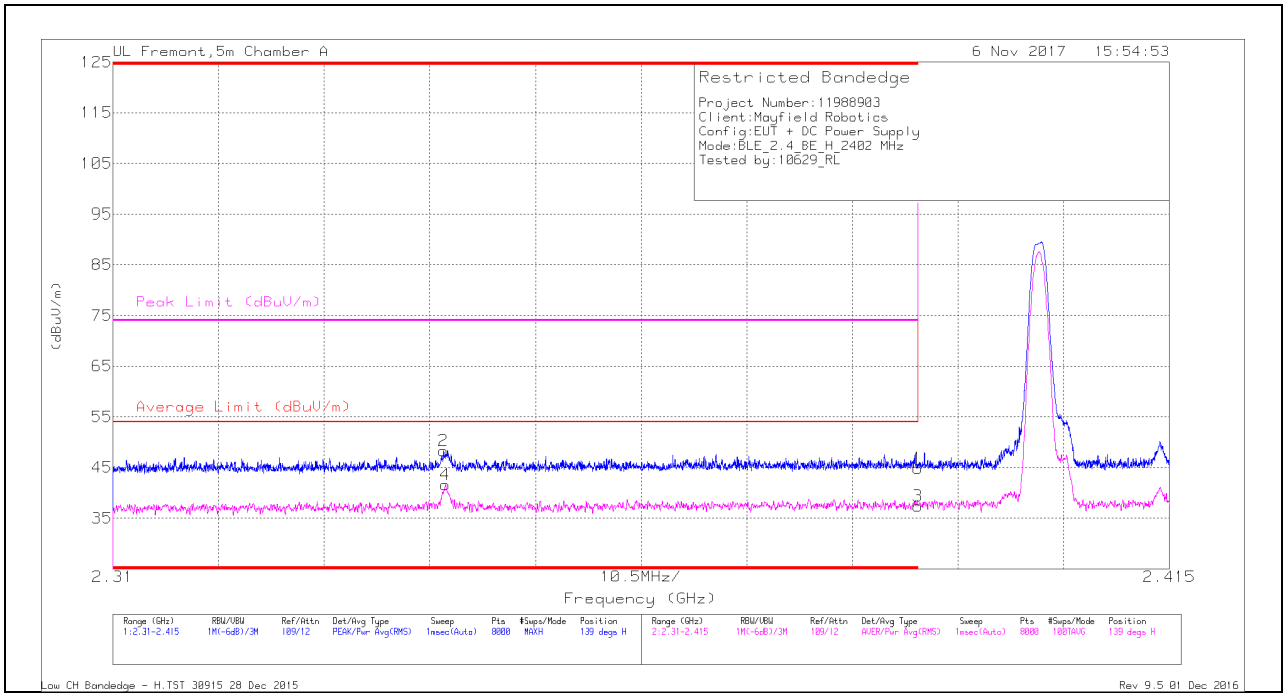
# 9.1. TRANSMITTER ABOVE 1 GHz

## 9.1.1. BANDEDGE (LOW CHANNEL)

**HORIZONTAL RESULT**

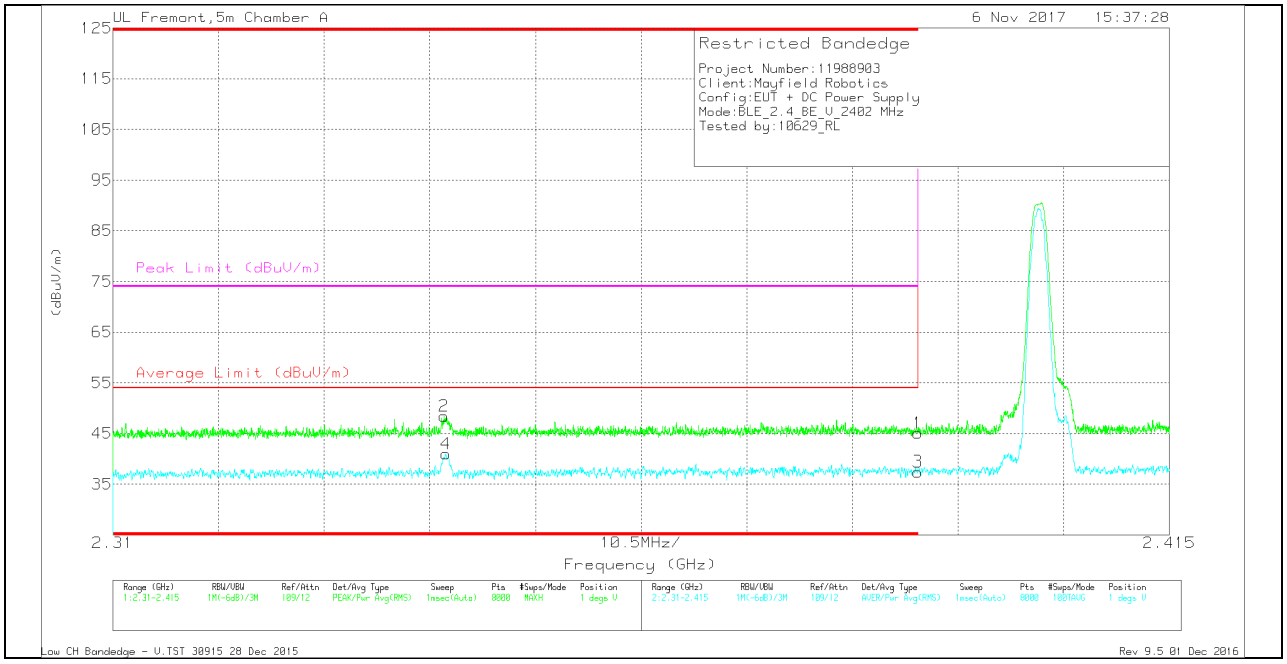



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (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 | * 2.39 | 36.27 | Pk | 31.8 | -23.2 | 0 | 44.87 | - | - | 74 | -29.13 | 139 | 245 | H |
| 2 | * 2.343 | 39.92 | Pk | 31.6 | -23.2 | 0 | 48.32 | - | - | 74 | -25.68 | 139 | 245 | H |
| 3 | * 2.39 | 26.55 | RMS | 31.8 | -23.2 | 2.25 | 37.4 | 54 | -16.6 | - | - | 139 | 245 | H |
| 4 | * 2.343 | 30.96 | RMS | 31.6 | -23.2 | 2.25 | 41.61 | 54 | -12.39 | - | - | 139 | 245 | H |

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

**VERTICAL RESULT**



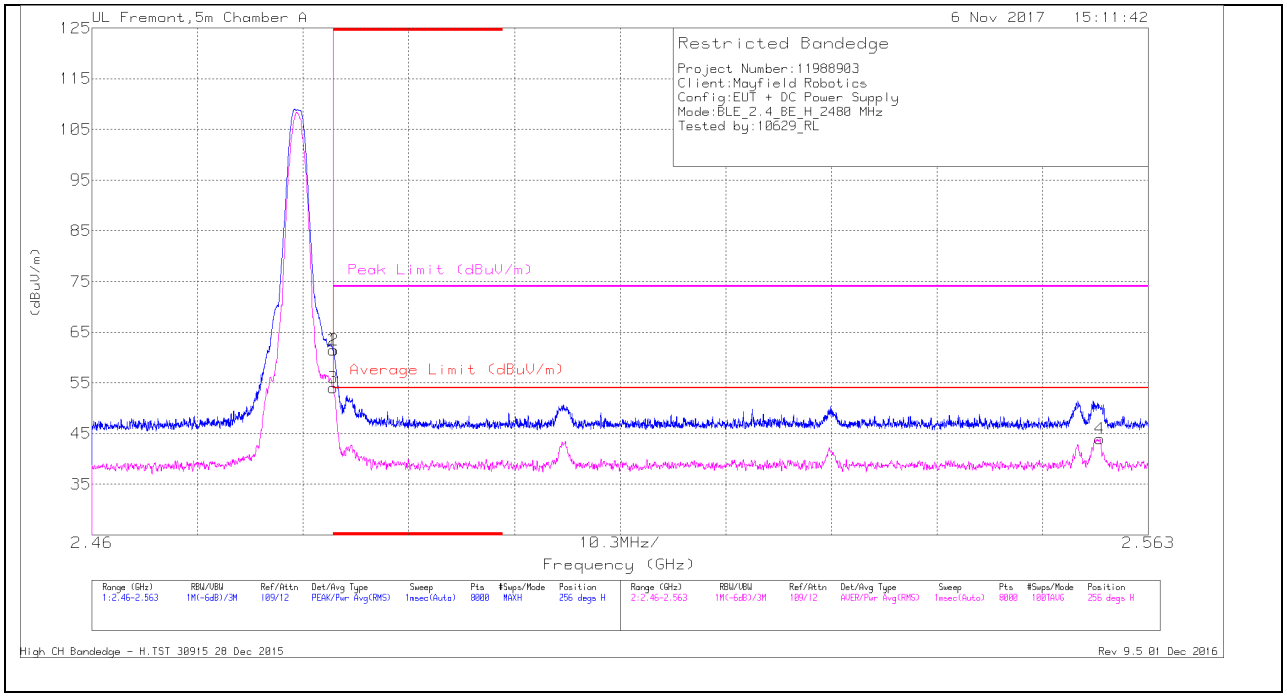

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (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 | * 2.39 | 36.52 | Pk | 31.8 | -23.2 | 0 | 45.12 | - | - | 74 | -28.88 | 1 | 236 | V |
| 2 | * 2.343 | 40.06 | Pk | 31.6 | -23.2 | 0 | 48.46 | - | - | 74 | -25.54 | 1 | 236 | V |
| 3 | * 2.39 | 26.59 | RMS | 31.8 | -23.2 | 2.25 | 37.44 | 54 | -16.56 | - | - | 1 | 236 | V |
| 4 | * 2.343 | 30.34 | RMS | 31.6 | -23.2 | 2.25 | 40.99 | 54 | -13.01 | - | - | 1 | 236 | V |

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

## 9.1.2. BANDEDGE (HIGH CHANNEL)

**HORIZONTAL RESULT**

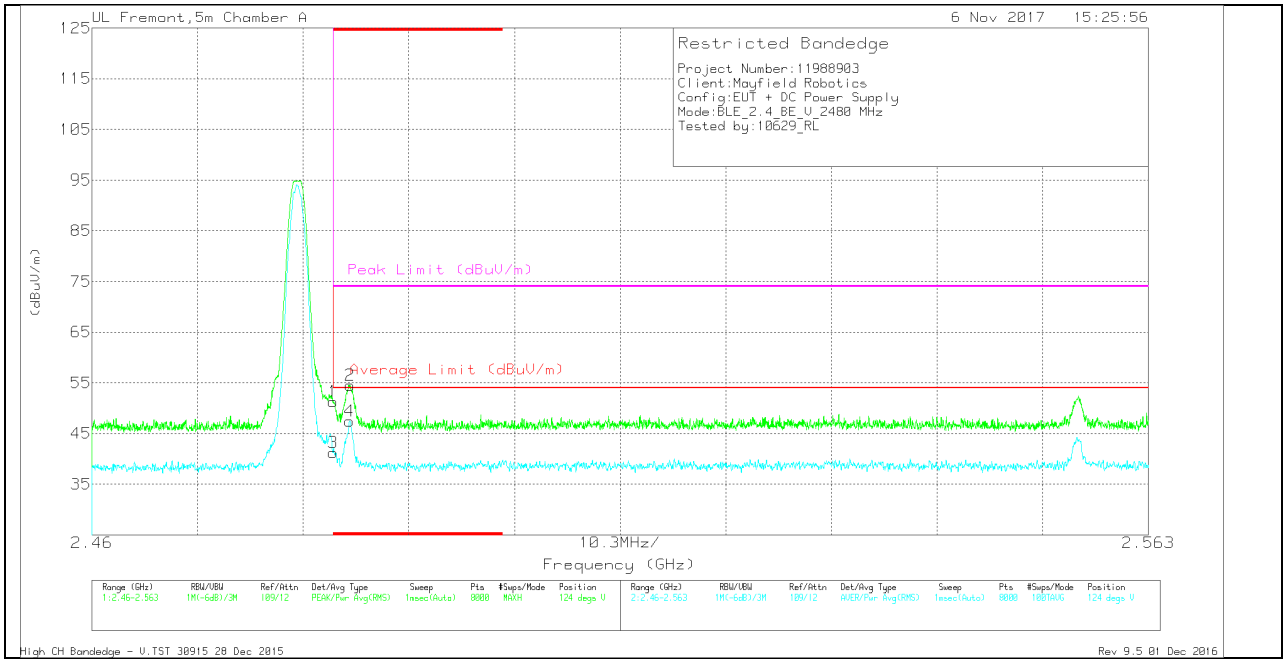



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (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 | * 2.484 | 52.22 | Pk | 32.3 | -23.1 | 0 | 61.42 | - | - | 74 | -12.58 | 256 | 122 | H |
| 2 | * 2.484 | 52.28 | Pk | 32.3 | -23.1 | 0 | 61.48 | - | - | 74 | -12.52 | 256 | 122 | H |
| 3 | * 2.484 | 42.53 | RMS | 32.3 | -23.1 | 2.25 | 53.98 | 54 | -.02 | - | - | 256 | 122 | H |
| 4 | 2.558 | 32.35 | RMS | 32.4 | -23 | 2.25 | 44 | 54 | -10 | - | - | 256 | 122 | H |

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

**VERTICAL RESULT**



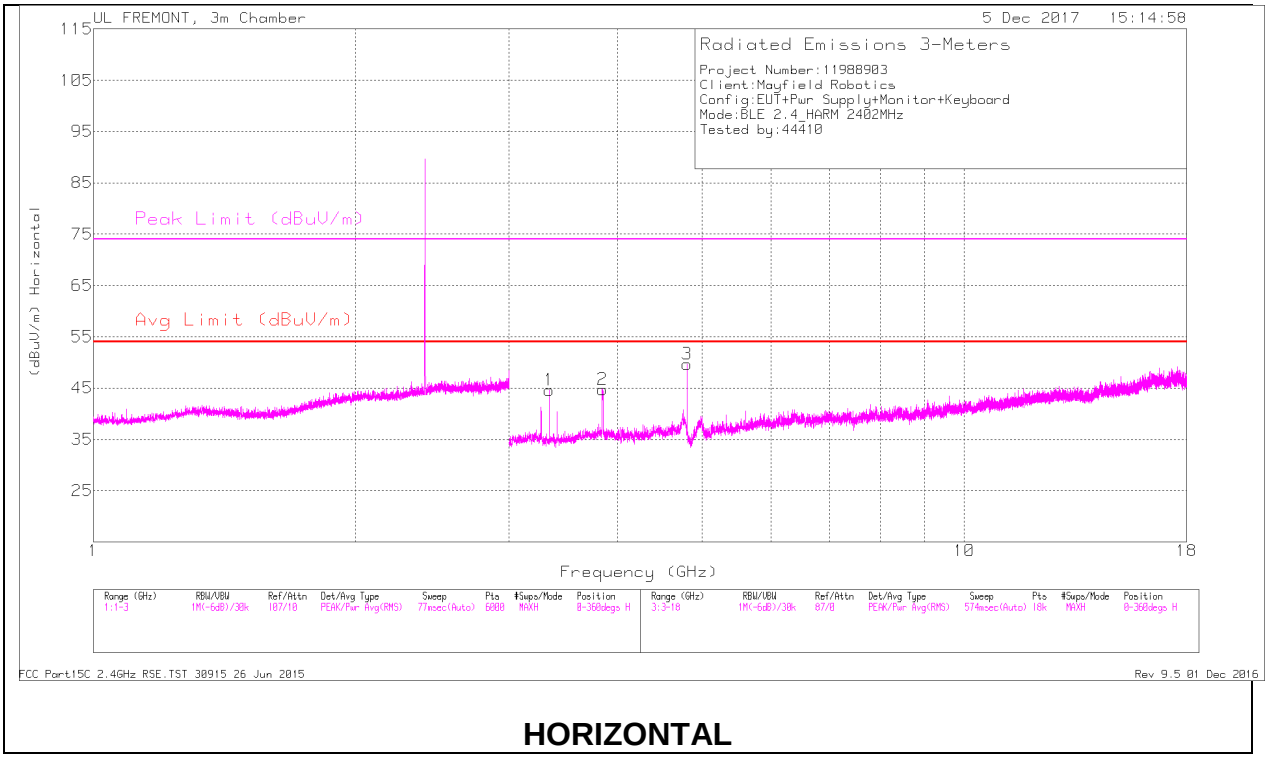

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (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 | * 2.484 | 42.11 | Pk | 32.3 | -23.1 | 0 | 51.31 | - | - | 74 | -22.69 | 124 | 288 | V |
| 2 | * 2.485 | 45.33 | Pk | 32.3 | -23.1 | 0 | 54.53 | - | - | 74 | -19.47 | 124 | 288 | V |
| 3 | * 2.484 | 29.82 | RMS | 32.3 | -23.1 | 2.25 | 41.27 | 54 | -12.73 | - | - | 124 | 288 | V |
| 4 | * 2.485 | 35.99 | RMS | 32.3 | -23.1 | 2.25 | 47.44 | 54 | -6.56 | - | - | 124 | 288 | V |

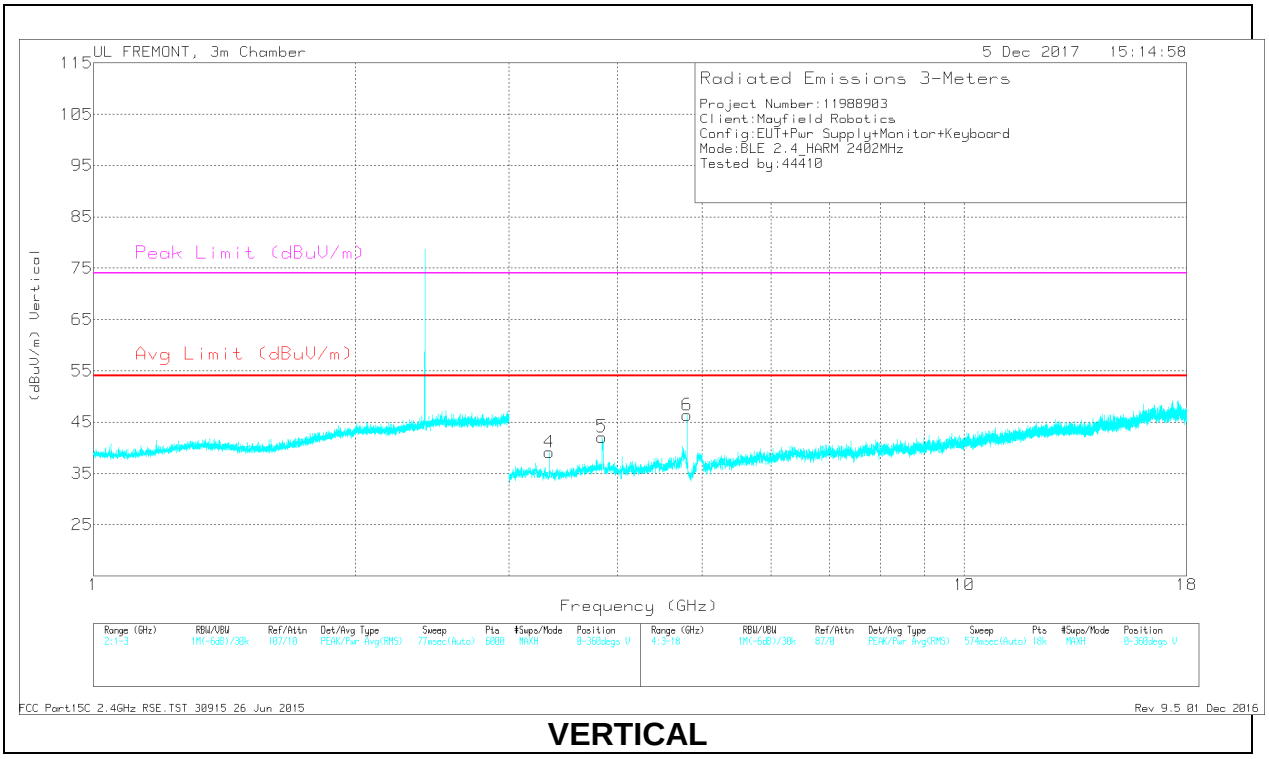
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

## 9.1.3. HARMONICS AND SPURIOUS EMISSIONS

**LOW CHANNEL RESULTS**




**HORIZONTAL**




**VERTICAL**

## Radiated Emissions

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/Pad (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 | 3.337 | 46.11 | PK2 | 32.8 | -29.5 | 0 | 49.41 | - | - | 74 | -24.59 | 280 | 220 | H |
| | 3.337 | 39.69 | MAv1 | 32.8 | -29.5 | 2.25 | 45.24 | 54 | -8.76 | - | - | 280 | 220 | H |
| 4 | 3.337 | 43.21 | PK2 | 32.8 | -29.5 | 0 | 46.51 | - | - | 74 | -27.49 | 289 | 102 | V |
| | 3.337 | 34.25 | MAv1 | 32.8 | -29.5 | 2.25 | 39.8 | 54 | -14.2 | - | - | 289 | 102 | V |
| 5 | 3.837 | 45.68 | PK2 | 33.4 | -29.1 | 0 | 49.98 | - | - | 74 | -24.02 | 330 | 394 | V |
| | 3.838 | 34.21 | MAv1 | 33.4 | -29.1 | 2.25 | 40.76 | 54 | -13.24 | - | - | 330 | 394 | V |
| 2 | 3.844 | 35.1 | MAv1 | 33.4 | -29 | 2.25 | 41.75 | 54 | -12.25 | - | - | 26 | 271 | H |
| | 3.845 | 48.31 | PK2 | 33.4 | -29 | 0 | 52.71 | - | - | 74 | -21.29 | 26 | 271 | H |
| 3 | 4.804 | 49.35 | PK2 | 34 | -28.3 | 0 | 55.05 | - | - | 74 | -18.95 | 321 | 399 | H |
| | 4.804 | 42.23 | MAv1 | 34 | -28.3 | 2.25 | 50.18 | 54 | -3.82 | - | - | 321 | 399 | H |
| 6 | 4.804 | 45.72 | PK2 | 34 | -28.3 | 0 | 51.42 | - | - | 74 | -22.58 | 24 | 389 | V |
| | 4.804 | 37.61 | MAv1 | 34 | -28.2 | 2.25 | 45.66 | 54 | -8.34 | - | - | 24 | 389 | V |

PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average



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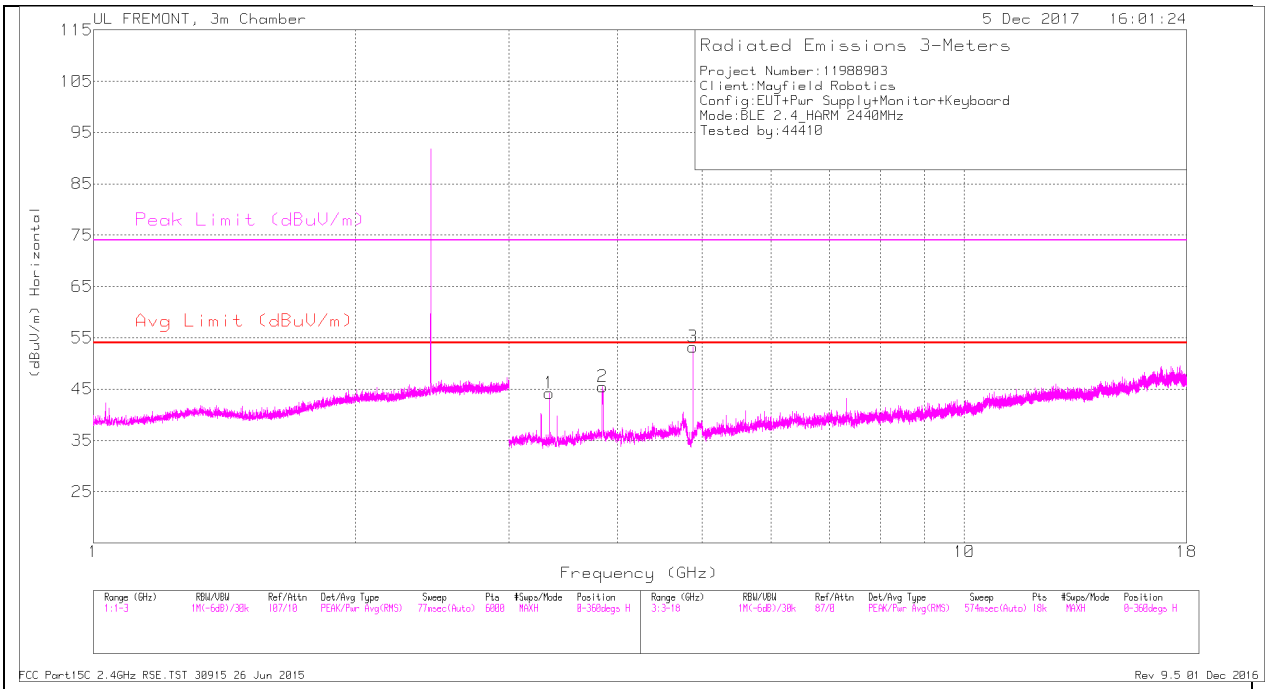
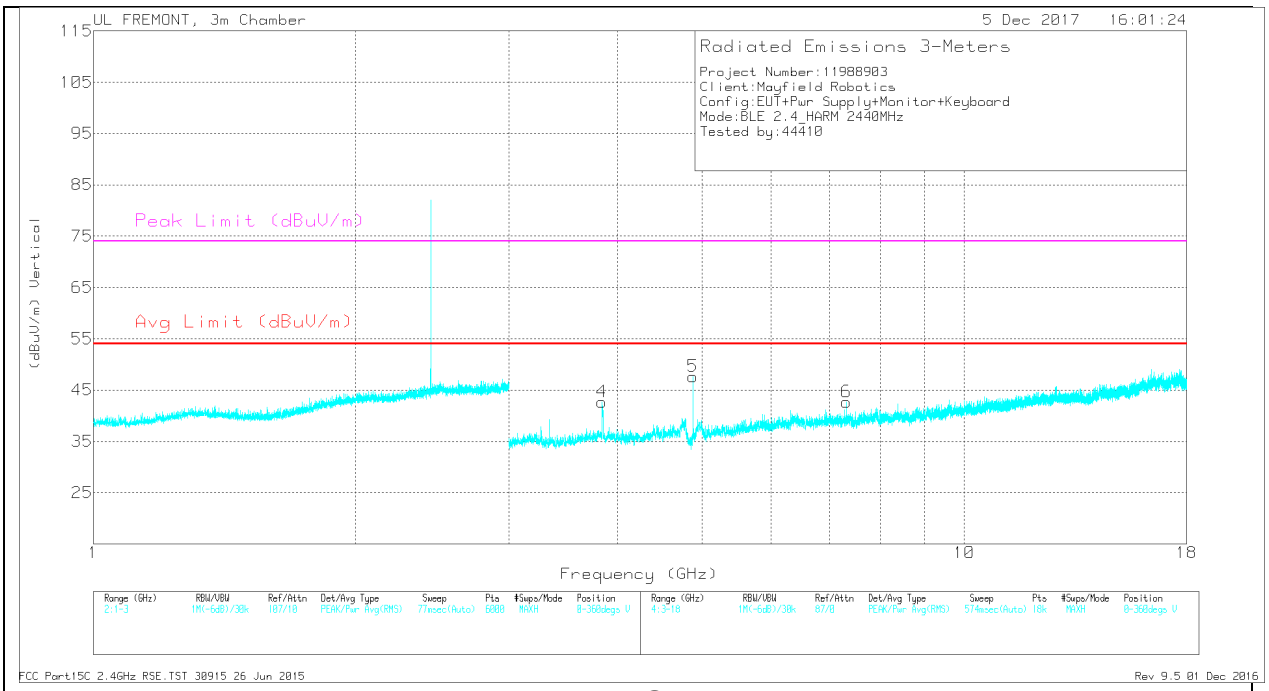
**MID CHANNEL, RESULTS**




**HORIZONTAL**




**VERTICAL**

## Radiated Emissions

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/Pad (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) | Polari |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.337 | 46.47 | PK2 | 32.8 | -29.5 | 0 | 49.77 | - | - | 74 | -24.23 | 280 | 118 | H |
| | 3.337 | 40.35 | MAv1 | 32.8 | -29.5 | 2.25 | 45.9 | 54 | -8.1 | - | - | 280 | 118 | H |
| 4 | 3.838 | 46.66 | PK2 | 33.4 | -29.1 | 0 | 50.96 | - | - | 74 | -23.04 | 322 | 396 | V |
| | 3.838 | 35.84 | MAv1 | 33.4 | -29.1 | 2.25 | 42.39 | 54 | -11.61 | - | - | 322 | 396 | V |
| 2 | 3.845 | 48.85 | PK2 | 33.4 | -29 | 0 | 53.25 | - | - | 74 | -20.75 | 25 | 285 | H |
| | 3.845 | 35.46 | MAv1 | 33.4 | -29 | 2.25 | 42.11 | 54 | -11.89 | - | - | 25 | 285 | H |
| 5 | 4.88 | 49.3 | PK2 | 34 | -28 | 0 | 55.3 | - | - | 74 | -18.7 | 314 | 209 | H |
| | 4.88 | 42.71 | MAv1 | 34 | -28 | 2.25 | 50.96 | 54 | -3.04 | - | - | 314 | 209 | H |
| 3 | 4.88 | 47.25 | PK2 | 34 | -28 | 0 | 53.25 | - | - | 74 | -20.75 | 261 | 374 | V |
| | 4.88 | 40.03 | MAv1 | 34 | -28 | 2.25 | 48.28 | 54 | -5.72 | - | - | 261 | 374 | V |
| 6 | 7.319 | 40.19 | PK2 | 35.5 | -27 | 0 | 48.69 | - | - | 74 | -25.31 | 293 | 226 | V |
| | 7.319 | 29.13 | MAv1 | 35.5 | -27 | 2.25 | 39.88 | 54 | -14.12 | - | - | 293 | 226 | V |

PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average



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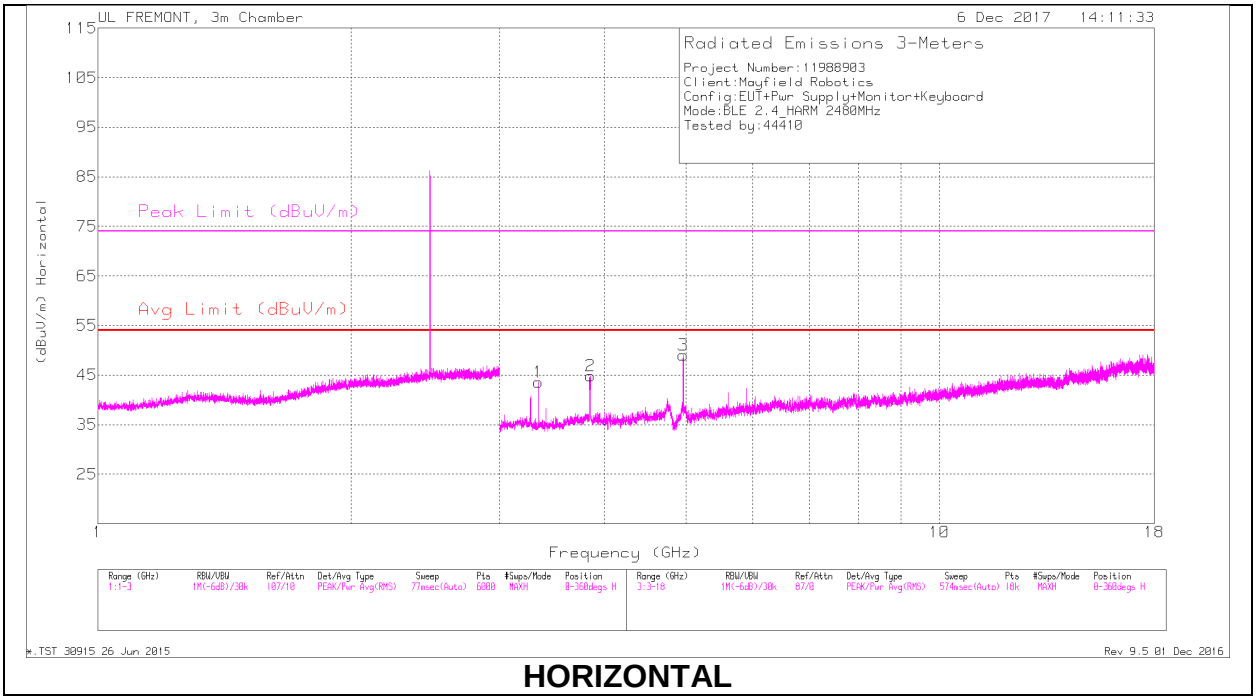
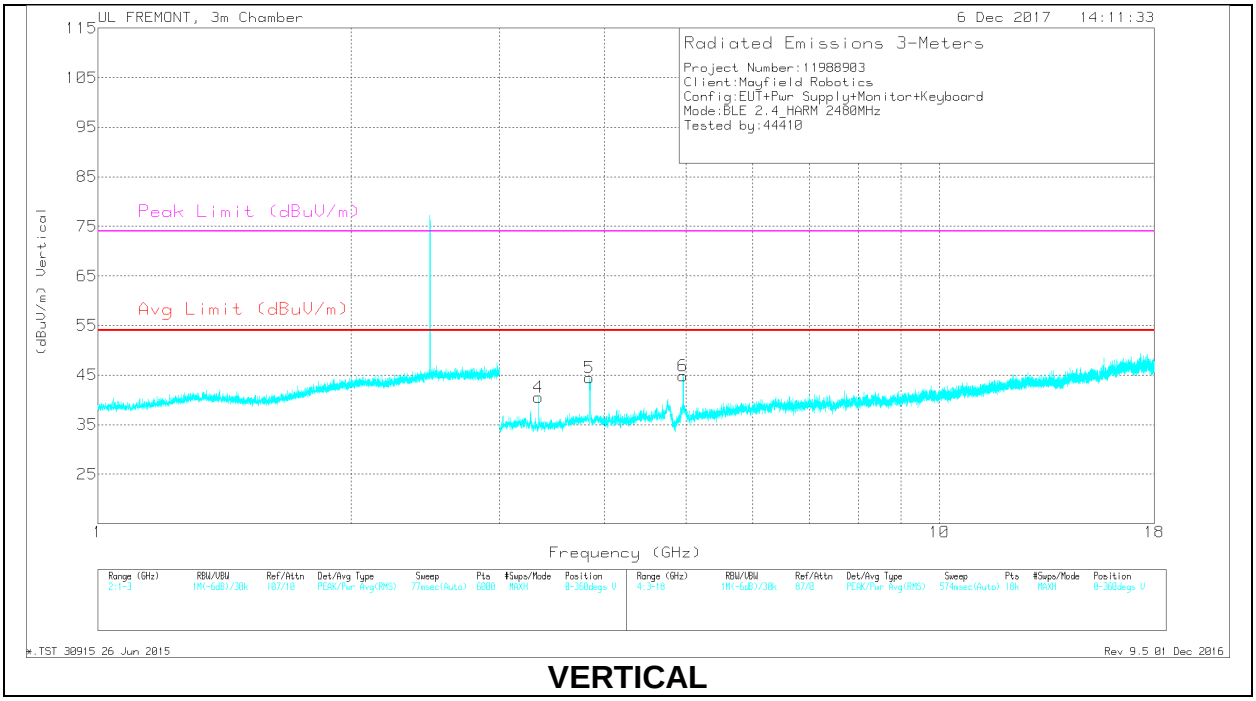
**HIGH CHANNEL, RESULTS**




**HORIZONTAL**




**VERTICAL**

## Radiated Emissions

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/ Pad (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 | 3.337 | 45.63 | PK2 | 32.8 | -29.5 | 0 | 48.93 | - | - | 74 | -25.07 | 285 | 297 | H |
| | 3.337 | 38.22 | MAv1 | 32.8 | -29.5 | 2.25 | 43.77 | 54 | -10.23 | - | - | 285 | 297 | H |
| 4 | 3.337 | 43.81 | PK2 | 32.8 | -29.5 | 0 | 47.11 | - | - | 74 | -26.89 | 234 | 100 | V |
| | 3.337 | 34.78 | MAv1 | 32.8 | -29.5 | 2.25 | 40.33 | 54 | -13.67 | - | - | 234 | 100 | V |
| 5 | 3.836 | 47.84 | PK2 | 33.4 | -29.2 | 0 | 52.04 | - | - | 74 | -21.96 | 323 | 388 | V |
| | 3.838 | 37.12 | MAv1 | 33.4 | -29.1 | 2.25 | 43.67 | 54 | -10.33 | - | - | 323 | 388 | V |
| 2 | 3.844 | 36.05 | MAv1 | 33.4 | -29 | 2.25 | 42.7 | 54 | -11.3 | - | - | 14 | 395 | H |
| | 3.846 | 49.39 | PK2 | 33.4 | -28.9 | 0 | 53.89 | - | - | 74 | -20.11 | 14 | 395 | H |
| 6 | 4.959 | 49.91 | PK2 | 34.1 | -29.2 | 0 | 54.81 | - | - | 74 | -19.19 | 304 | 355 | H |
| | 4.96 | 43.39 | MAv1 | 34.1 | -29.2 | 2.25 | 50.54 | 54 | -3.46 | - | - | 304 | 355 | H |
| 3 | 4.96 | 46.74 | PK2 | 34.1 | -29.2 | 0 | 51.64 | - | - | 74 | -22.36 | 235 | 367 | V |
| | 4.96 | 38.78 | MAv1 | 34.1 | -29.2 | 2.25 | 45.93 | 54 | -8.07 | - | - | 235 | 367 | V |

PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average



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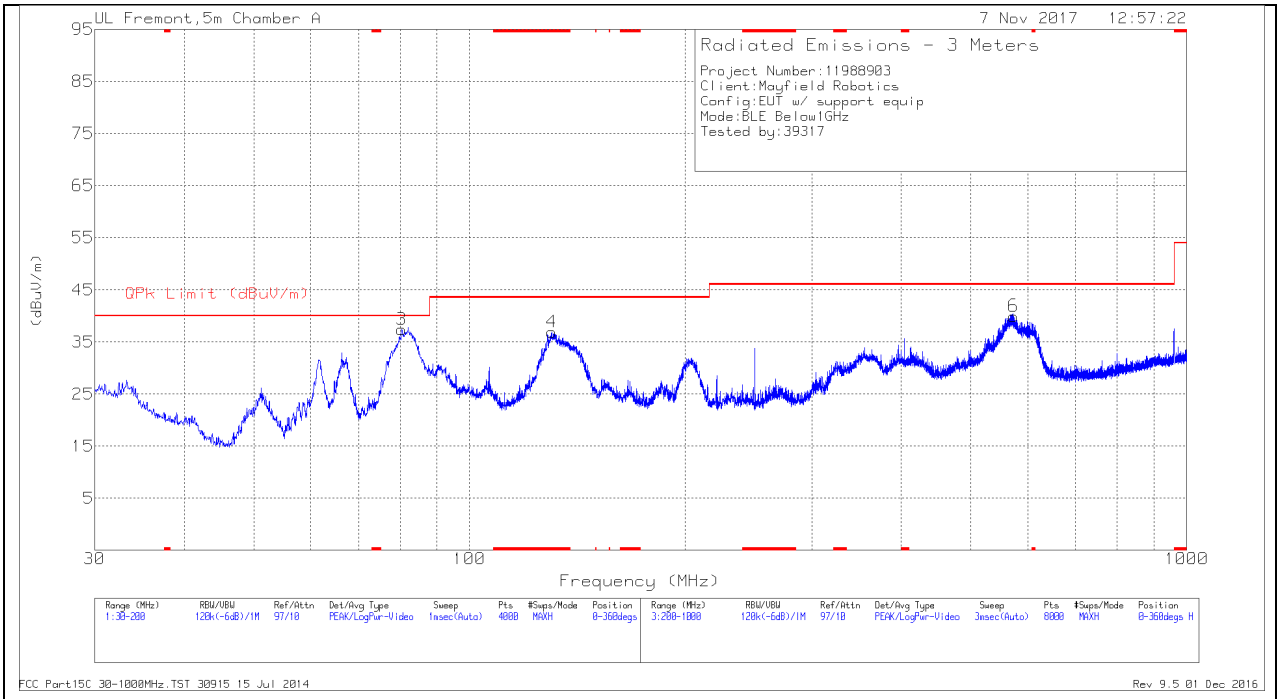
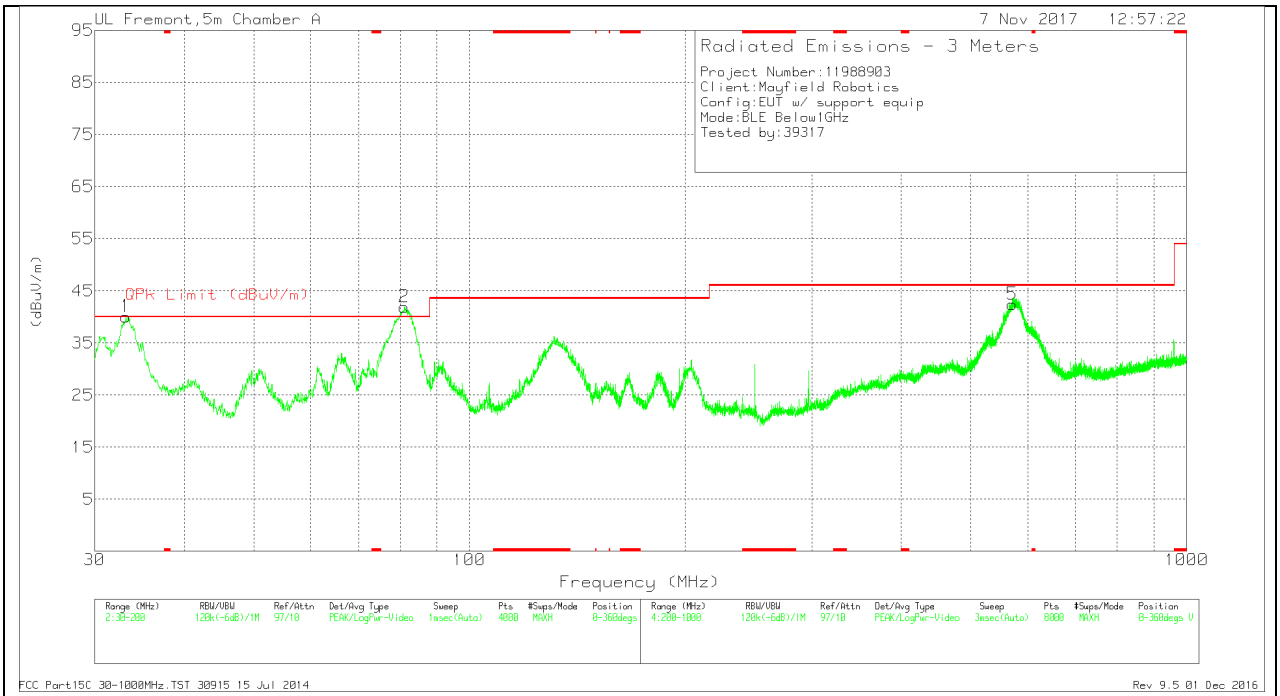
## 9.2. WORST-CASE BELOW 1 GHz




**HORIZONTAL**




**VERTICAL**

**Below 1GHz DATA**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T130 (dB/m) | Amp/Cbl (dB/m) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | * 130.1559 | 40.03 | Qp | 18 | -26 | 32.03 | 43.52 | -11.49 | 100 | 201 | H |
| 1 | 33.1883 | 38.56 | Qp | 22.9 | -27.2 | 34.26 | 40 | -5.74 | 217 | 129 | V |
| 3 | 80.418 | 48.38 | Qp | 11.5 | -26.6 | 33.28 | 40 | -6.72 | 34 | 241 | H |
| 2 | 81.0982 | 52.85 | Qp | 11.4 | -26.6 | 37.65 | 40 | -2.35 | 332 | 107 | V |
| 5 | 570.9482 | 39.18 | Qp | 22.7 | -25.2 | 36.68 | 46.02 | -9.34 | 161 | 209 | V |
| 6 | 573.3485 | 42.42 | Pk | 22.7 | -25.2 | 39.92 | 46.02 | -6.1 | 0-360 | 200 | H |

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



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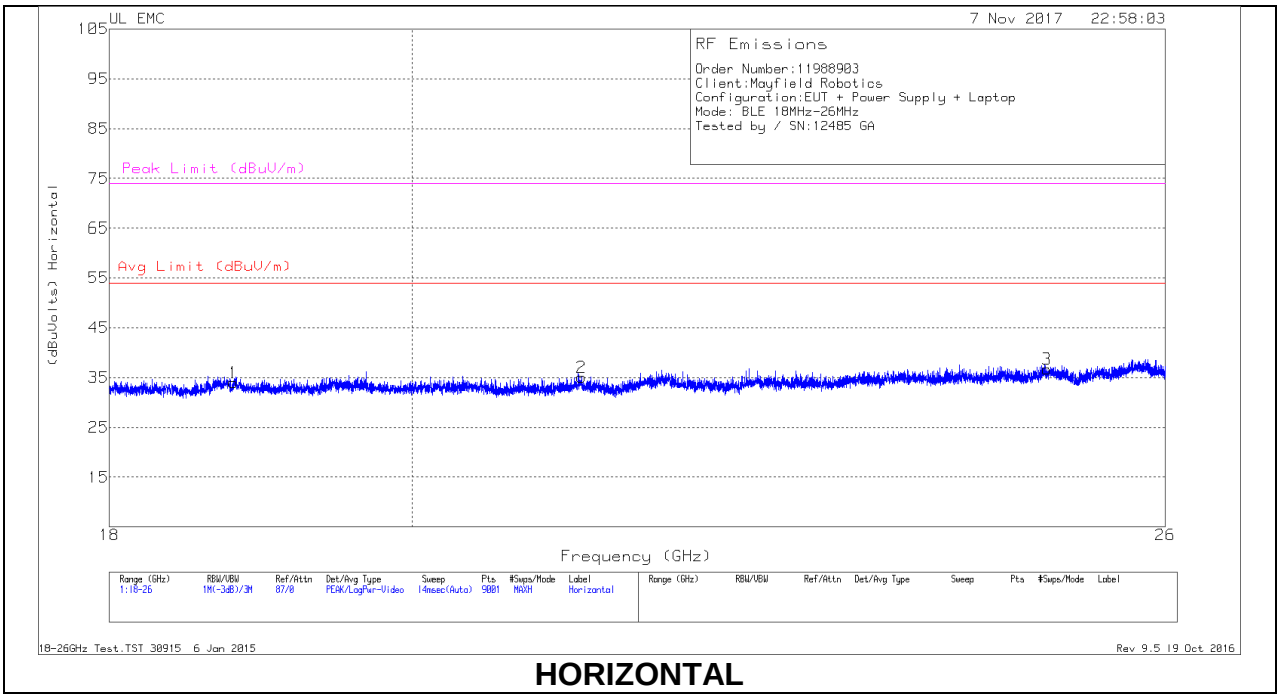
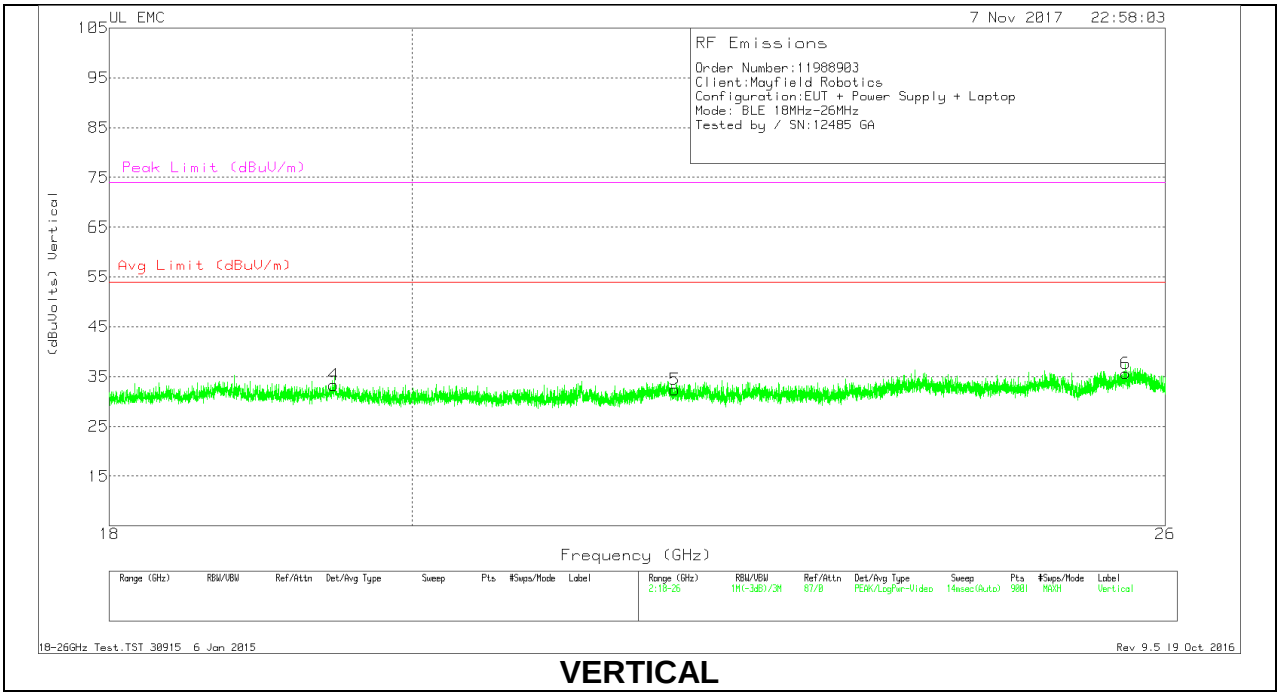
## 9.3. WORST-CASE 18-26GHz




**HORIZONTAL**




**VERTICAL**

**18-26GHz DATA**

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | T89 AF (dB/m) | Amp/Cbl (dB) | Dist Corr (dB) | Corrected Reading (dBuVolts) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.795 | 35.89 | Pk | 32.5 | -24.9 | -9.5 | 33.99 | 54 | -20.01 | 74 | -40.01 |
| 2 | 21.216 | 36.15 | Pk | 33.1 | -24.7 | -9.5 | 35.05 | 54 | -18.95 | 74 | -38.95 |
| 3 | 24.949 | 36.56 | Pk | 34.1 | -24.5 | -9.5 | 36.66 | 54 | -17.34 | 74 | -37.34 |
| 4 | 19.462 | 34.9 | Pk | 32.5 | -24.6 | -9.5 | 33.3 | 54 | -20.7 | 74 | -40.7 |
| 5 | 21.916 | 33.79 | Pk | 33.3 | -25.2 | -9.5 | 32.39 | 54 | -21.61 | 74 | -41.61 |
| 6 | 25.644 | 36.24 | Pk | 34 | -25.1 | -9.5 | 35.64 | 54 | -18.36 | 74 | -38.36 |

Pk - Peak detector



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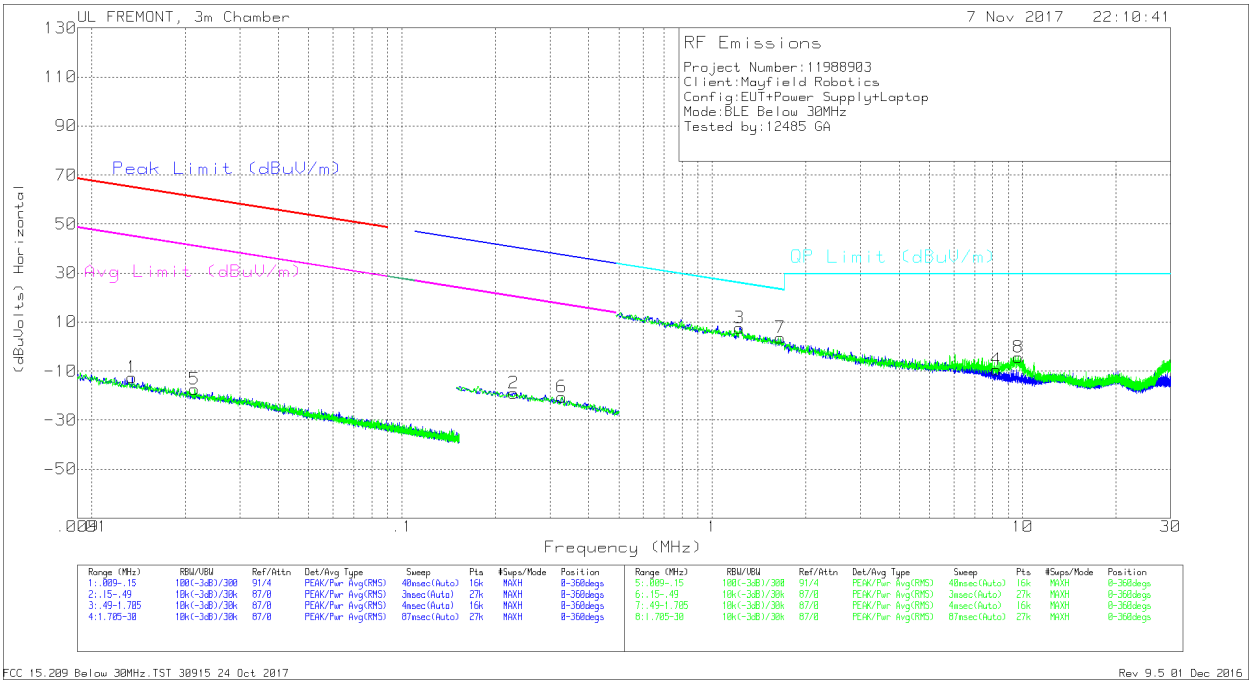
## 9.4. WORST-CASE BELOW 30 MHz

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

HORIZONTAL AND VERTICAL PLOTS




NOTE: KDB 414788 OATS and Chamber Correlation Justification

- Based 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.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 300m | Corrected Reading (dBuVolts) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .01352 | 50.67 | Pk | 15.3 | 1.4 | -80 | -12.63 | 64.97 | -77.6 | 44.97 | -57.6 | - | - | - | - | 0-360 |
| 5 | .02148 | 46.34 | Pk | 14.8 | 1.4 | -80 | -17.46 | 60.94 | -78.4 | 40.94 | -58.4 | - | - | - | - | 0-360 |
| 2 | .22918 | 45.51 | Pk | 13.9 | 1.5 | -80 | -19.09 | - | - | - | - | 40.41 | -59.5 | 20.41 | -39.5 | 0-360 |
| 6 | .32763 | 44.12 | Pk | 13.8 | 1.5 | -80 | -20.58 | - | - | - | - | 37.3 | -57.88 | 17.3 | -37.88 | 0-360 |

Pk - Peak detector

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 30m | Corrected Reading (dBuVolts) | QP Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1.22329 | 31.81 | Pk | 14.3 | 1.5 | -40 | 7.61 | 25.88 | -18.27 | 0-360 |
| 7 | 1.65698 | 27.62 | Pk | 14.4 | 1.5 | -40 | 3.52 | 23.25 | -19.73 | 0-360 |
| 4 | 8.22251 | 14.67 | Pk | 14.4 | 1.5 | -40 | -9.43 | 29.5 | -38.93 | 0-360 |
| 8 | 9.69705 | 19.44 | Pk | 14.6 | 1.5 | -40 | -4.46 | 29.5 | -33.96 | 0-360 |

Pk - Peak detector

# 10. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

| Frequency of Emission (MHz) | Conducted Limit (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 * | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

**TEST PROCEDURE**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

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

**RESULTS**



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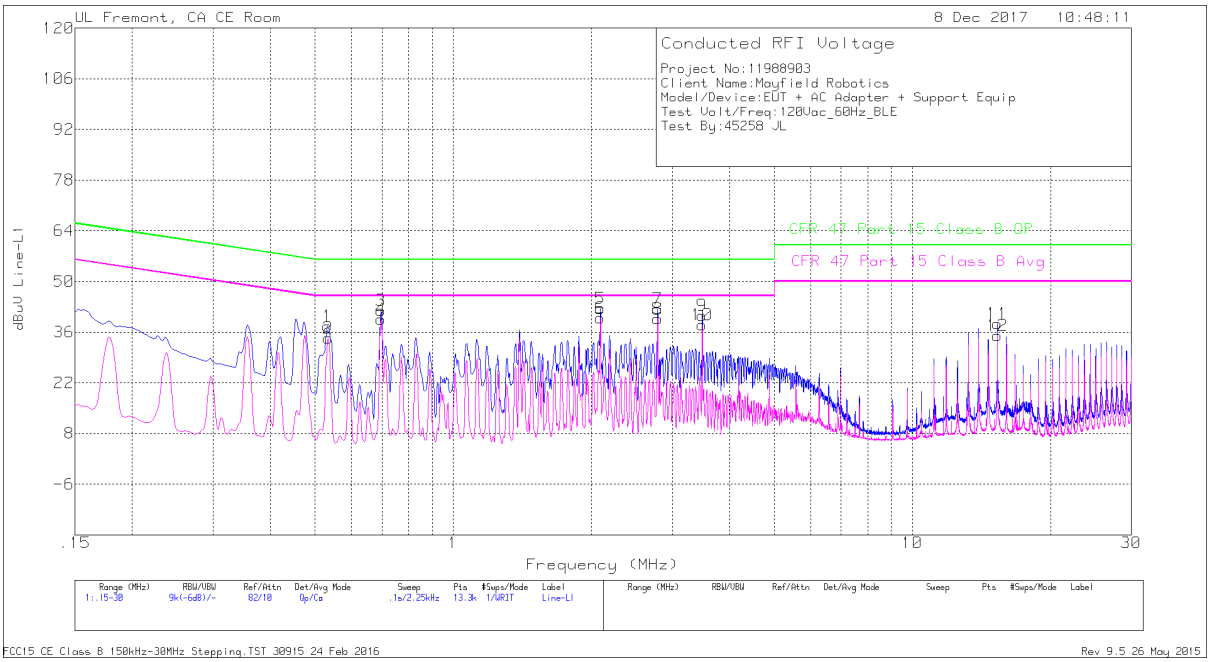
# LINE 1 RESULTS

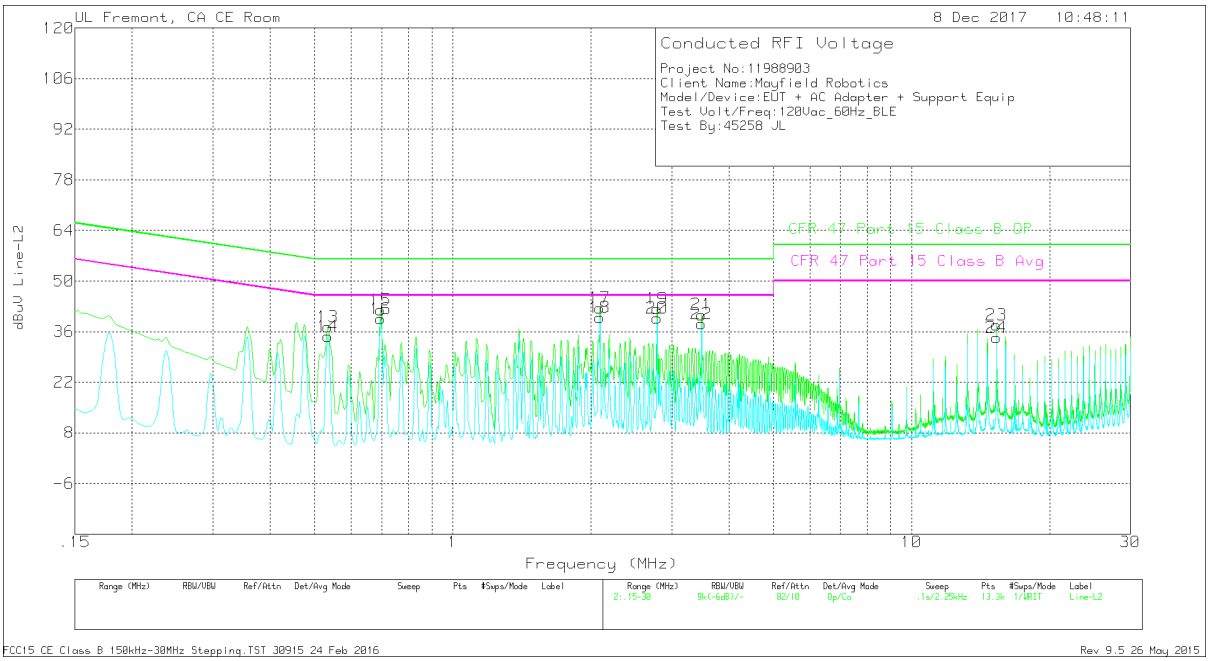



| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 1 | .5325 | 27.49 | Qp | 0 | 0 | 10.1 | 37.59 | 56 | -18.41 | - | - |
| 2 | .53475 | 24.18 | Ca | 0 | 0 | 10.1 | 34.28 | - | - | 46 | -11.72 |
| 3 | .69675 | 31.93 | Qp | 0 | 0 | 10.1 | 42.03 | 56 | -13.97 | - | - |
| 4 | .69675 | 29.44 | Ca | 0 | 0 | 10.1 | 39.54 | - | - | 46 | -6.46 |
| 5 | 2.09175 | 32.39 | Qp | 0 | .1 | 10.1 | 42.59 | 56 | -13.41 | - | - |
| 6 | 2.09175 | 29.66 | Ca | 0 | .1 | 10.1 | 39.86 | - | - | 46 | -6.14 |
| 7 | 2.78925 | 32.14 | Qp | 0 | .1 | 10.1 | 42.34 | 56 | -13.66 | - | - |
| 8 | 2.78925 | 29.51 | Ca | 0 | .1 | 10.1 | 39.71 | - | - | 46 | -6.29 |
| 9 | 3.48675 | 30.24 | Qp | 0 | .1 | 10.2 | 40.54 | 56 | -15.46 | - | - |
| 10 | 3.48675 | 27.68 | Ca | 0 | .1 | 10.2 | 37.98 | - | - | 46 | -8.02 |
| 11 | 15.33525 | 27.71 | Qp | 0 | .3 | 10.3 | 38.31 | 60 | -21.69 | - | - |
| 12 | 15.3375 | 24.5 | Ca | 0 | .3 | 10.3 | 35.1 | - | - | 50 | -14.9 |

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS




| Range 2: Line-L2 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 13 | .53475 | 27.19 | Qp | 0 | 0 | 10.1 | 37.29 | 56 | -18.71 | - | - |
| 14 | .53475 | 24.54 | Ca | 0 | 0 | 10.1 | 34.64 | - | - | 46 | -11.36 |
| 15 | .69675 | 31.96 | Qp | 0 | 0 | 10.1 | 42.06 | 56 | -13.94 | - | - |
| 16 | .69675 | 29.44 | Ca | 0 | 0 | 10.1 | 39.54 | - | - | 46 | -6.46 |
| 17 | 2.09175 | 32.4 | Qp | 0 | .1 | 10.1 | 42.6 | 56 | -13.4 | - | - |
| 18 | 2.09175 | 29.68 | Ca | 0 | .1 | 10.1 | 39.88 | - | - | 46 | -6.12 |
| 19 | 2.78925 | 32.19 | Qp | 0 | .1 | 10.1 | 42.39 | 56 | -13.61 | - | - |
| 20 | 2.78925 | 29.59 | Ca | 0 | .1 | 10.1 | 39.79 | - | - | 46 | -6.21 |
| 21 | 3.48675 | 30.4 | Qp | 0 | .1 | 10.2 | 40.7 | 56 | -15.3 | - | - |
| 22 | 3.48675 | 27.83 | Ca | 0 | .1 | 10.2 | 38.13 | - | - | 46 | -7.87 |
| 23 | 15.3375 | 27.22 | Qp | 0 | .3 | 10.3 | 37.82 | 60 | -22.18 | - | - |
| 24 | 15.33975 | 23.78 | Ca | 0 | .3 | 10.3 | 34.38 | - | - | 50 | -15.62 |

Qp - Quasi-Peak detector

Ca - CISPR average detection