



**FCC 47 CFR PART 15 SUBPART C  
ISED CANADA RSS-247 ISSUE 2**

**CLASS 2 PERMISSIVE CHANGE REPORT  
FOR**

**WAFERSENSE AUTO MULTI-SENSOR**

**MODEL NUMBER: AMS-300C, AMS-200C, AMS-150C**

**FCC ID: SPD003  
IC: 6210A-003**

**REPORT NUMBER: R11616692-E1C**

**ISSUE DATE: 2017-10-27**

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**NVLAP LAB CODE 200246-0**

Revision History

| <u>Ver.</u> | <u>Issue<br/>Date</u> | <u>Revisions</u> | <u>Revised By</u> |
|-------------|-----------------------|------------------|-------------------|
| 1           | 2017-10-27            | Initial Issue    | Brian T. Kiewra   |

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# 1. DATA REUSE

## 1.1. INTRODUCTION

This testing is to support a Class II Permissive Change for the addition of a new antenna configuration. The manufacture is changing the chip antenna to a trace antenna. No other changes have been made to the radio. The EUT contains a Mitsumi Bluetooth Transceiver, Model WML-40, which has been certified under FCC IDs: POOWML-C40 and SPD003.

The AMS300C, AMS200C, and AMS150C use a carbon fiber composite housing and differ only in diameter.

CyberOptics Corporation takes full responsibility that previous data referenced under FCC IDs: POOWML-C40 and SPD003 represent compliance.

## 1.2. TESTING PERFORMED

Radiated Spurious Emissions testing will be performed to demonstrate the new antenna configuration is compliant to FCC 15.247. All other testing is covered under previous test reports for FCC IDs: P00WML-C40 and SPD003

## 1.3. REFERENCE DETAIL SECTION

| Equipment Class | Reference FCC ID   | Type Grant | Grant Date | Report Number |
|-----------------|--------------------|------------|------------|---------------|
| FHSS            | FCC ID: POOWML-C40 | New        | 2006-05-01 | EF/2006/10010 |
| FHSS            | FCC ID: SPD003     | C2PC       | 2008-03-19 | CYBR0077.1    |

## 2. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** CyberOptics Corporation  
5900 Golden Hills Drive  
Minneapolis, Minnesota 55416, USA

**EUT DESCRIPTION:** WaferSense Auto Multi-Sensor

**MODEL:** AMS-300C, AMS-200C, AMS-150C

**SERIAL NUMBER:** AM000583

**DATE TESTED:** 2017-08-22 to 2017-08-23

| APPLICABLE STANDARDS        |              |
|-----------------------------|--------------|
| STANDARD                    | TEST RESULTS |
| CFR 47 Part 15 Subpart C    | Pass         |
| ISED CANADA RSS-247 Issue 2 | Pass         |
| ISED CANADA RSS-GEN Issue 4 | Pass         |

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

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

Approved & Released  
For UL LLC By:



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UL – Consumer Technology Division

Prepared By:



Brian T. Kiewra  
Project Engineer  
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### 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, RSS-GEN Issue 4, RSS-247 Issue 2.

### 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA.

|                                    |
|------------------------------------|
| 12 Laboratory Dr., RTP, NC 27709   |
| <input type="checkbox"/> Chamber A |
| <input type="checkbox"/> Chamber C |

|   |
|---|
| 2800 Suite B Perimeter Park Dr.,<br>Morrisville, NC 27560 |
| <input checked="" type="checkbox"/> Chamber NORTH         |
| <input type="checkbox"/> Chamber SOUTH                    |

The onsite chambers are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://www.nist.gov/nvlap/>.

## 5. CALIBRATION AND UNCERTAINTY

### 5.1. 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.

### 5.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 5.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER                         | UNCERTAINTY | Required by standard |
|-----------------------------------|-------------|----------------------|
| Occupied Channel Bandwidth        | 2.00%       | ±5 %                 |
| RF output power, conducted        | 1.3 dB      | ±1,5 dB              |
| Power Spectral Density, conducted | 2.47 dB     | ±3 dB                |
| Unwanted Emissions, conducted     | 2.94 dB     | ±3 dB                |
| All emissions, radiated           | 5.36 dB     | ±6 dB                |
| Temperature                       | 2.26 °C     | ±3 °C                |
| Supply voltages                   | 2.40%       | ±3 %                 |
| Time                              | 3.39%       | ±5 %                 |

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

## **6. EQUIPMENT UNDER TEST**

### **6.1. DESCRIPTION OF EUT**

The EUT is a Bluetooth transceiver used for measuring real-time Leveling, vibration and humidity within a Semiconductor Process. The AMS300C, AMS200C, and AMS150C use a carbon fiber composite housing and differ only in diameter.

### **6.2. MAXIMUM OUTPUT POWER**

Power not measured, covered in report CYBR0077.1. A default power setting was used as dictated by Cyberoptics. This power setting was for a target power of 11-12dBm.

### **6.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The radio utilizes an inverted-F (IFA) PCB trace antenna, with a maximum gain of -0.4 dBi.

### **6.4. SOFTWARE AND FIRMWARE**

The firmware installed in the EUT during testing was BC4 v26.4279

The test utility software used during testing was BlueTest3 v1.24.



## 6.5. WORST-CASE CONFIGURATION AND MODE

An XYZ investigation was performed on all models (AMS-150C, 200C, 300C). The AMS-300C was found to be worst-case unit.

Radiated emissions 1-18GHz were performed with the EUT set to transmit on low, mid, and high channels. Radiated emissions 0.009 – 1000MHz and 18-26GHz were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

Unless noted in the test report, all tests were performed with the DH5 packet size as this was considered worst-case.

## 6.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT & PERIPHERALS

| SUPPORT EQUIPMENT & PERIPHERALS LIST |              |         |               |
|--------------------------------------|--------------|---------|---------------|
| Description                          | Manufacturer | Model   | Serial Number |
| Laptop                               | Dell         | PP18L   | 27L7KC1       |
| WaferSense Sensor (Carbon)           | CyberOptics  | 8023729 | HXC01706      |
| WaferSense Sensor (Quartz)           | CyberOptics  | 8023729 | HXC01709      |

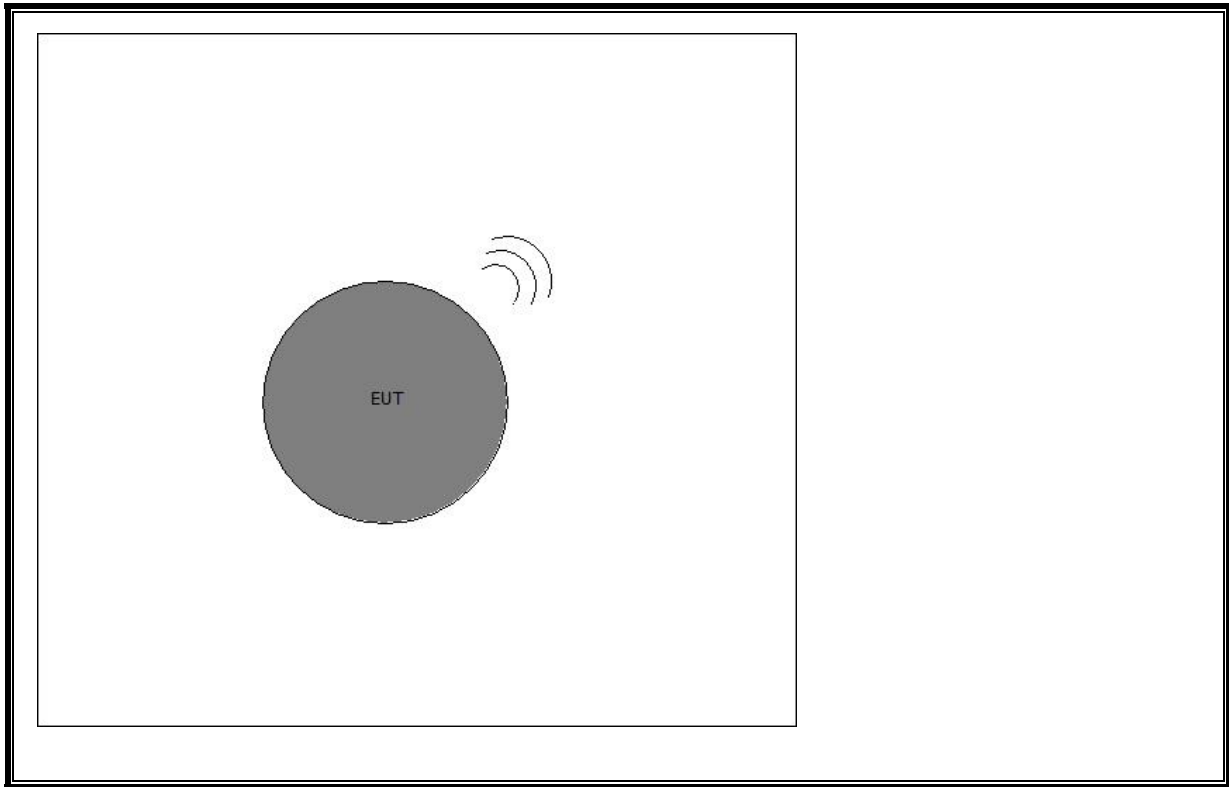
### I/O CABLES

| I/O CABLE LIST |      |                      |                |            |                |         |
|----------------|------|----------------------|----------------|------------|----------------|---------|
| Cable No.      | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length m | Remarks |
| 1              | AC   | 1                    | AC             | AC Mains   | >3m            | None    |

### TEST SETUP

The EUT was installed in a typical configuration. The customer provided test software to exercise the EUTs during test. Refer to the following diagram.

**SETUP DIAGRAM FOR TESTS**



## 7. 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.  |
|----------------------------------|---|----------------------|--------------|------------|------------|
| <b>0.009-30MHz</b>               |   |                      |              |            |            |
| AT0079                           | Active Loop Antenna                               | ETS-Lindgren         | 6502         | 2016-12-28 | 2017-12-31 |
| <b>30-1000 MHz</b>               |   |                      |              |            |            |
| AT0074                           | Hybrid Broadband Antenna                          | Sunol Sciences Corp. | JB3          | 2017-06-15 | 2018-06-15 |
| <b>1-18 GHz</b>                  |   |                      |              |            |            |
| AT0072                           | Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz | ETS Lindgren         | 3117         | 2017-04-05 | 2018-04-05 |
| <b>18-40 GHz</b>                 |   |                      |              |            |            |
| AT0076                           | Horn Antenna, 18-26.5GHz                          | ARA                  | MWH-1826/B   | 2016-09-06 | 2017-09-06 |
| <b>Gain-Loss Chains</b>          |   |                      |              |            |            |
| N-SAC01                          | Gain-loss string: 0.009-30MHz                     | Various              | Various      | 2016-10-04 | 2017-10-04 |
| N-SAC02                          | Gain-loss string: 30-1000MHz                      | Various              | Various      | 2017-06-11 | 2018-06-11 |
| N-SAC03                          | Gain-loss string: 1-18GHz                         | Various              | Various      | 2017-08-18 | 2018-08-18 |
| N-SAC04                          | Gain-loss string: 18-40GHz                        | Various              | Various      | 2017-03-03 | 2018-03-03 |
| <b>Receiver &amp; Software</b>   |   |                      |              |            |            |
| SA0027                           | Spectrum Analyzer                                 | Agilent              | N9030A       | 2017-03-16 | 2018-03-16 |
| SA0026 (18-40GHz RSE)            | Spectrum Analyzer                                 | Agilent              | N9030A       | 2017-02-17 | 2018-02-28 |
| SOFTEMI                          | EMI Software                                      | UL                   | Version 9.5  | NA         | NA         |
| <b>Additional Equipment used</b> |   |                      |              |            |            |
| s/n 161024690                    | Environmental Meter                               | Fisher Scientific    | 15-077-963   | 2016-12-21 | 2018-12-21 |

## 8. MEASUREMENT METHODS

Duty Cycle: KDB 558074 Zero-Span Spectrum Analyzer Method

Out-of-band emissions in restricted bands: ANSI C63.10:2013 Sections 6.3-6.6



## 10. RADIATED TEST RESULTS

### 10.1. LIMITS AND PROCEDURE LIMITS

FCC §15.205 and §15.209  
IC RSS-GEN Clause 8.9 (Transmitter)

| 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 below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

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

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was by measuring using a Peak detector with the resolution bandwidth set to 1MHz and a reduced video bandwidth, based on  $1/T_{on}$  where  $T_{on}$  is the transmit on time.

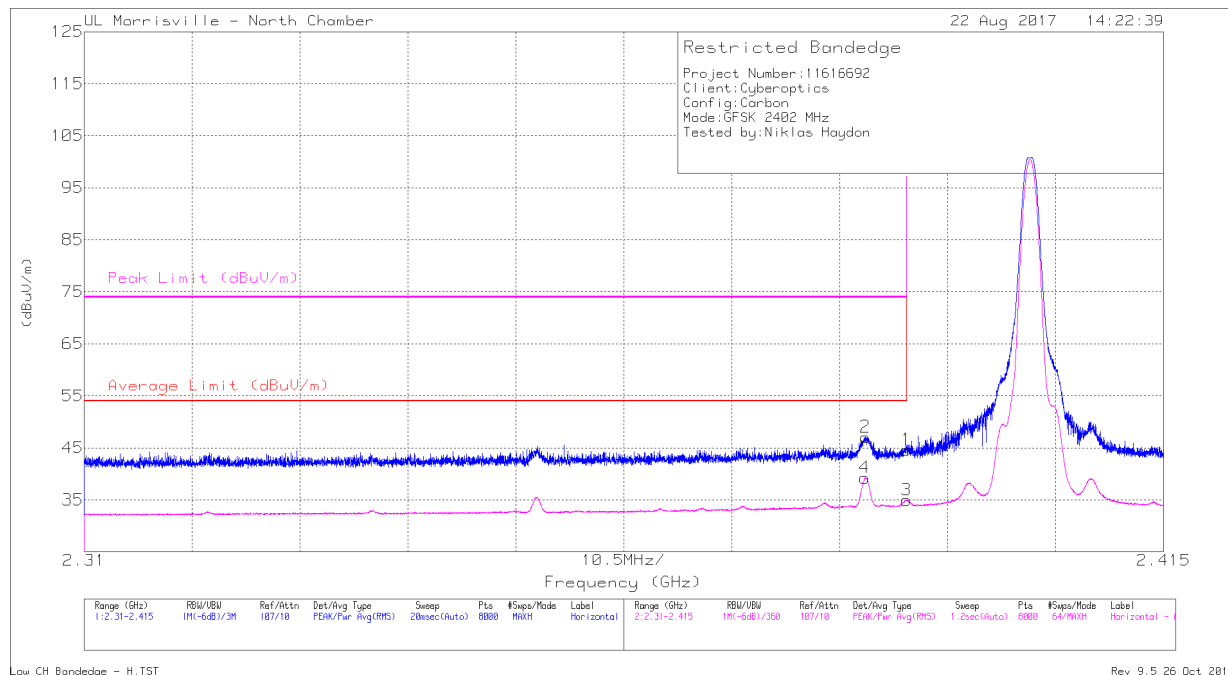
The spectrum from 1 to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. For 9kHz to 1000 MHz and 18 to 26 GHz investigation, the worst-case channel was selected.

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.

## 10.2. TRANSMITTER ABOVE 1 GHz

### 10.2.1. BASIC DATA RATE GFSK MODULATION

#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



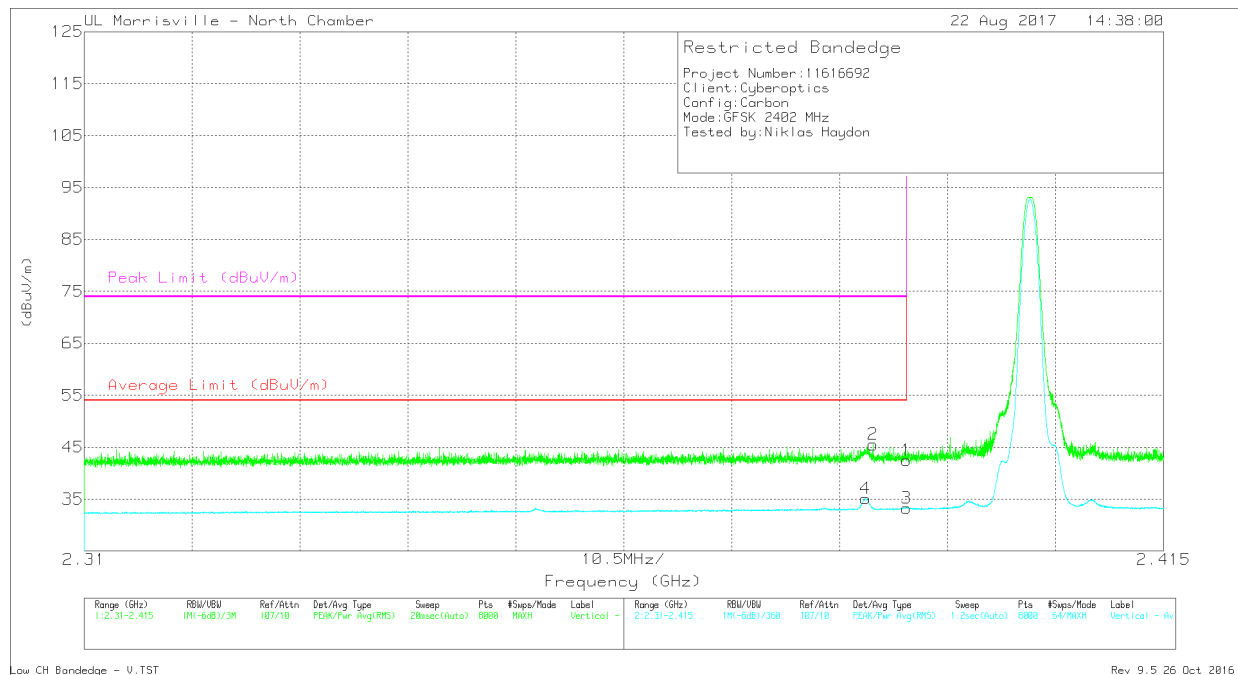
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|------------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 36.72                | Pk   | 31.8             | -23.9                  | 44.62                      | -                      | -           | 74                  | -29.38         | 109            | 102         | H        |
| 2      | * 2.386         | 39.17                | Pk   | 31.8             | -23.9                  | 47.07                      | -                      | -           | 74                  | -26.93         | 109            | 102         | H        |
| 3      | * 2.39          | 27.03                | V1TR | 31.8             | -23.9                  | 34.93                      | 54                     | -19.07      | -                   | -              | 109            | 102         | H        |
| 4      | * 2.386         | 31.33                | V1TR | 31.8             | -23.9                  | 39.23                      | 54                     | -14.77      | -                   | -              | 109            | 102         | H        |

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

Pk - Peak detector

V1TR: VB=1/Ton, AVG where: Ton is packet duration

**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/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          | 34.56                | Pk   | 31.8             | -23.9                  | 42.46                      | -                      | -           | 74                  | -31.54         | 38             | 253         | V        |
| 2      | * 2.387         | 37.6                 | Pk   | 31.8             | -23.9                  | 45.5                       | -                      | -           | 74                  | -28.5          | 38             | 253         | V        |
| 3      | * 2.39          | 25.38                | V1TR | 31.8             | -23.9                  | 33.28                      | 54                     | -20.72      | -                   | -              | 38             | 253         | V        |
| 4      | * 2.386         | 27.21                | V1TR | 31.8             | -23.9                  | 35.11                      | 54                     | -18.89      | -                   | -              | 38             | 253         | V        |

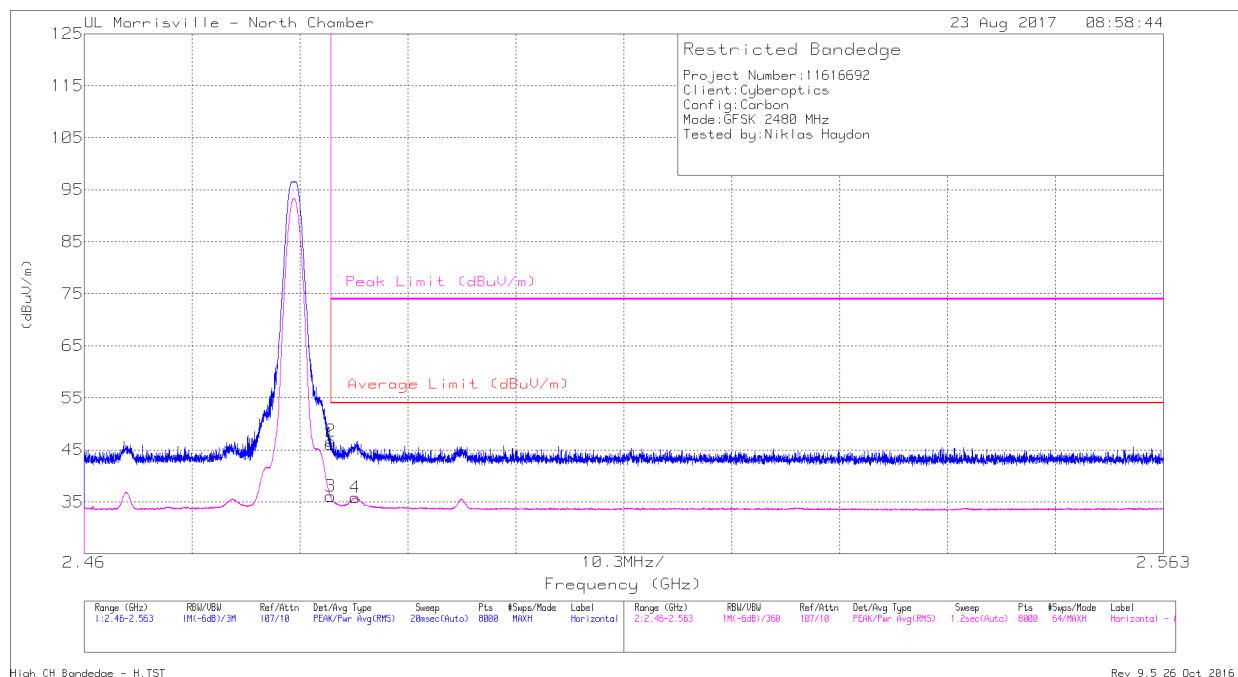
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR: VB=1/Ton, AVG where: Ton is packet duration



# **RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



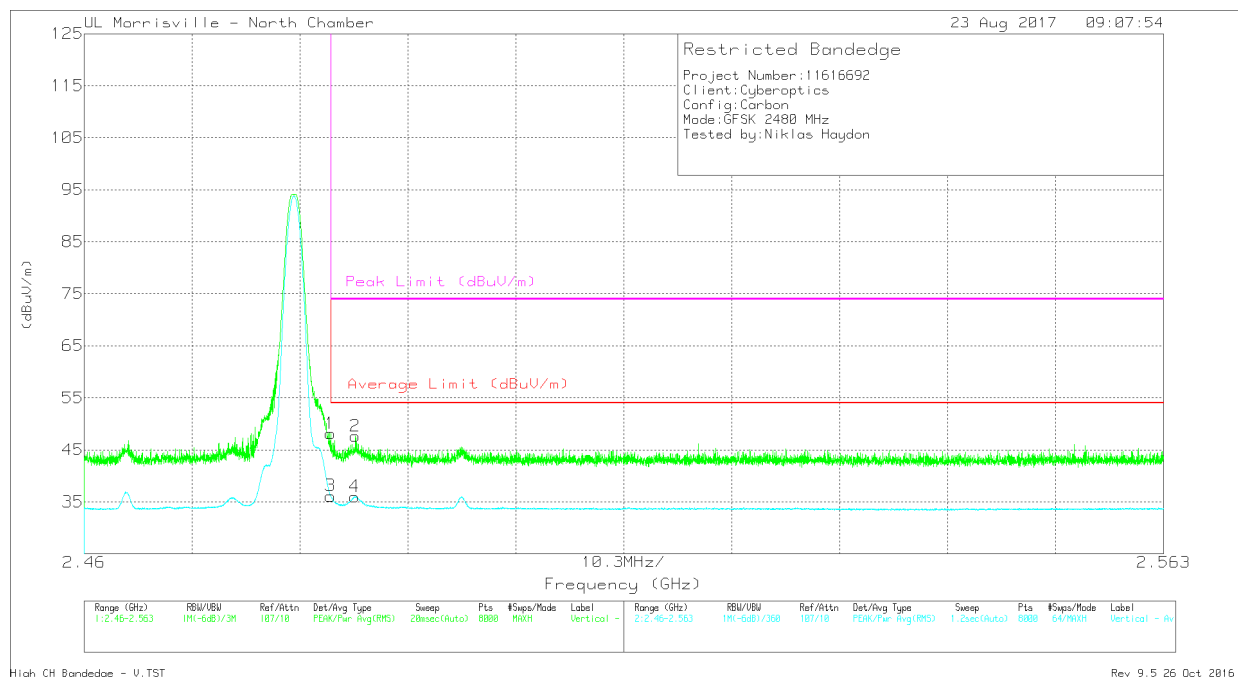
| Marker | Frequency (GHz) | Meter Reading (dBUV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBUV/m) | Average Limit (dBUV/m) | Margin (dB) | Peak Limit (dBUV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|------------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 37.59                | Pk   | 32.3             | -23.8                  | 46.09                      | -                      | -           | 74                  | -27.91         | 32             | 198         | H        |
| 2      | * 2.484         | 38.19                | Pk   | 32.3             | -23.8                  | 46.69                      | -                      | -           | 74                  | -27.31         | 32             | 198         | H        |
| 3      | * 2.484         | 27.55                | V1TR | 32.3             | -23.8                  | 36.05                      | 54                     | -17.95      | -                   | -              | 32             | 198         | H        |
| 4      | * 2.486         | 27.35                | V1TR | 32.3             | -23.8                  | 35.85                      | 54                     | -18.15      | -                   | -              | 32             | 198         | H        |

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

Pk - Peak detector

V1TR: VB=1/Ton, AVG where: Ton is packet duration

# **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



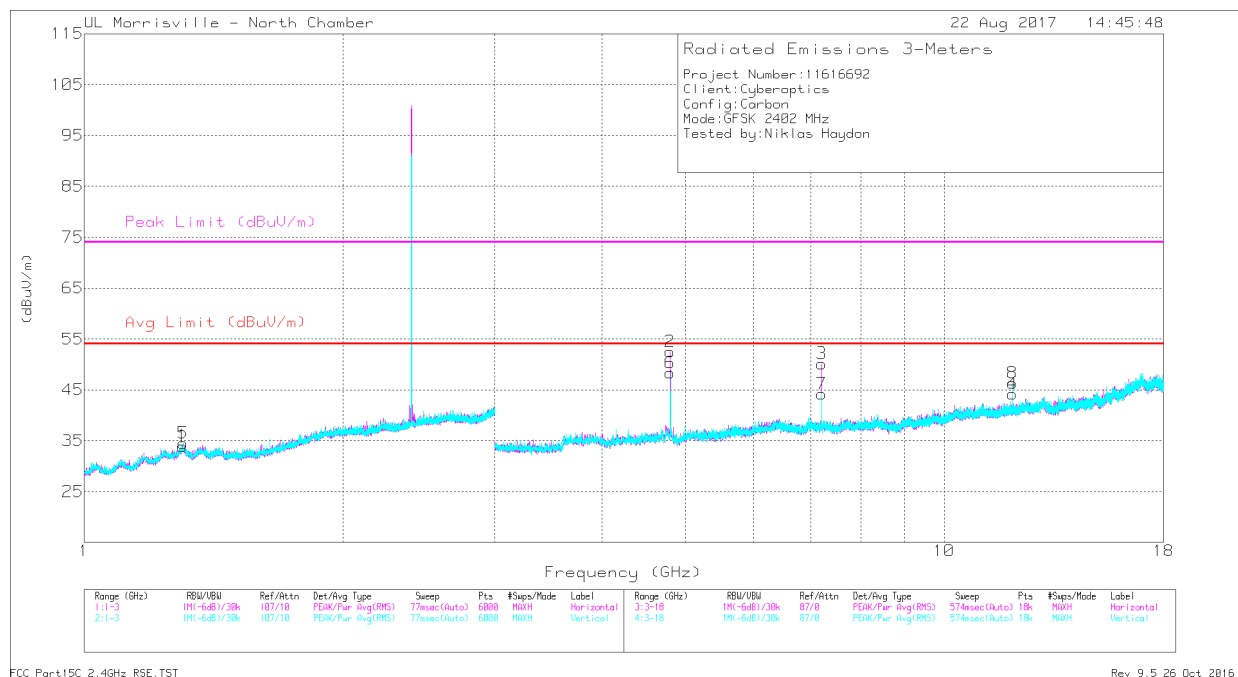
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|------------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 39.64                | Pk   | 32.3             | -23.8                  | 48.14                      | -                      | -           | 74                  | -25.86         | 31             | 217         | V        |
| 2      | * 2.486         | 39.12                | Pk   | 32.3             | -23.8                  | 47.62                      | -                      | -           | 74                  | -26.38         | 31             | 217         | V        |
| 3      | * 2.484         | 27.65                | V1TR | 32.3             | -23.8                  | 36.15                      | 54                     | -17.85      | -                   | -              | 31             | 217         | V        |
| 4      | * 2.486         | 27.5                 | V1TR | 32.3             | -23.8                  | 36                         | 54                     | -18         | -                   | -              | 31             | 217         | V        |

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

Pk - Peak detector

V1TR: VB=1/Ton, AVG where: Ton is packet duration

## HARMONICS AND SPURIOUS EMISSIONS



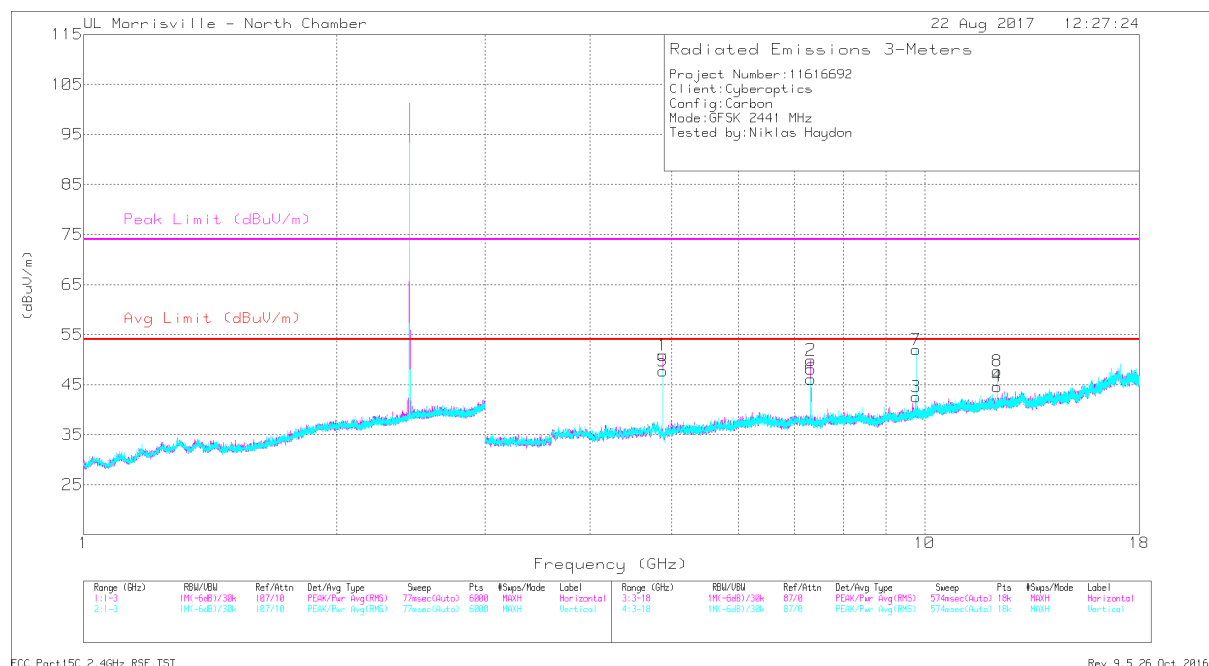
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|------------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 1.301         | 37.09                | PK-U | 29.3             | -25.2                  | 41.19                      | -                  | -           | 74                  | -32.81         | 331            | 235         | H        |
|        | * 1.301         | 24.91                | V1TR | 29.3             | -25.2                  | 29.01                      | 54                 | -24.99      | -                   | -              | 331            | 235         | H        |
| 2      | * 4.804         | 52.48                | PK-U | 34.1             | -31.1                  | 55.48                      | -                  | -           | 74                  | -18.52         | 6              | 111         | H        |
|        | * 4.804         | 49.11                | V1TR | 34.1             | -31.1                  | 52.11                      | 54                 | -1.89       | -                   | -              | 6              | 111         | H        |
| 4      | * 12.009        | 37.06                | PK-U | 38.7             | -25.5                  | 50.26                      | -                  | -           | 74                  | -23.74         | 338            | 159         | H        |
|        | * 12.011        | 27.35                | V1TR | 38.7             | -25.5                  | 40.55                      | 54                 | -13.45      | -                   | -              | 338            | 159         | H        |
| 5      | * 1.302         | 36.45                | PK-U | 29.3             | -25.1                  | 40.65                      | -                  | -           | 74                  | -33.35         | 71             | 280         | V        |
|        | * 1.301         | 24.81                | V1TR | 29.3             | -25.2                  | 28.91                      | 54                 | -25.09      | -                   | -              | 71             | 280         | V        |
| 6      | * 4.804         | 48.25                | PK-U | 34.1             | -31.1                  | 51.25                      | -                  | -           | 74                  | -22.75         | 11             | 246         | V        |
|        | * 4.804         | 43.65                | V1TR | 34.1             | -31.1                  | 46.65                      | 54                 | -7.35       | -                   | -              | 11             | 246         | V        |
| 8      | * 12.011        | 39.64                | PK-U | 38.7             | -25.5                  | 52.84                      | -                  | -           | 74                  | -21.16         | 55             | 127         | V        |
|        | * 12.011        | 31.38                | V1TR | 38.7             | -25.5                  | 44.58                      | 54                 | -9.42       | -                   | -              | 55             | 127         | V        |
| 3      | 7.206           | 43.94                | Pk   | 35.6             | -29.4                  | 50.14                      | -                  | -           | -                   | -              | 0-360          | 199         | H        |
| 7      | 7.206           | 37.98                | Pk   | 35.6             | -29.4                  | 44.18                      | -                  | -           | -                   | -              | 0-360          | 102         | V        |

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

Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, AVG where: Ton is packet duration



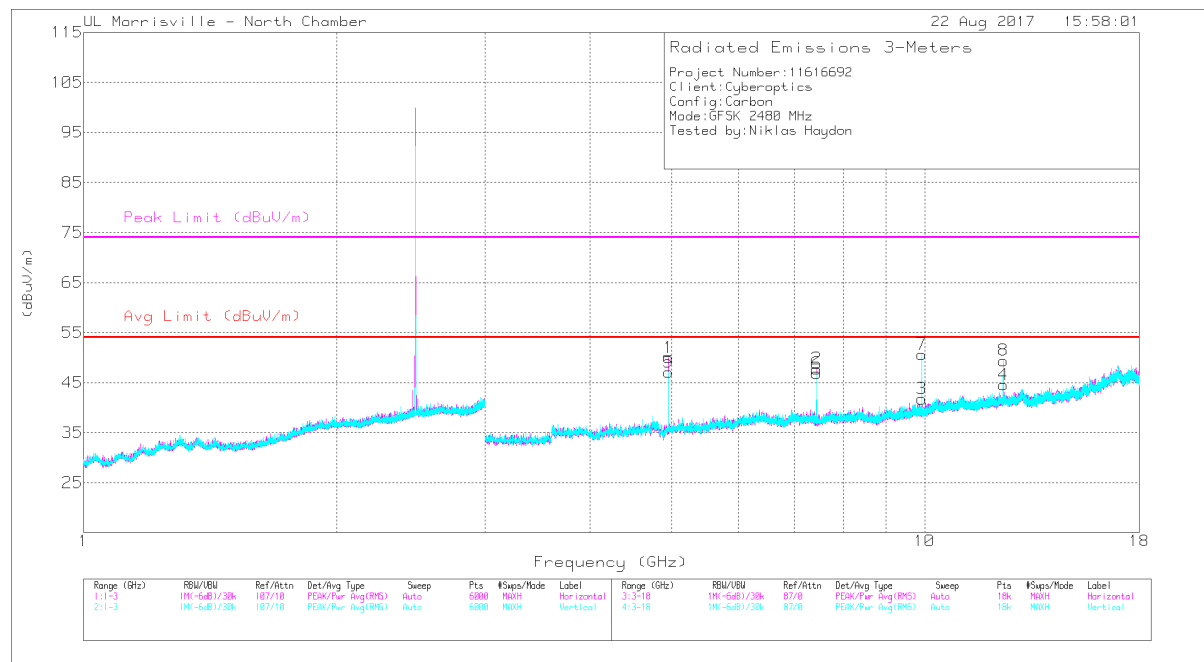
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|------------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 4.882         | 49.76                | PK-U | 34               | -31                    | 52.76                      | -                  | -           | 74                  | -21.24         | 7              | 106         | H        |
|        | * 4.882         | 46.58                | V1TR | 34               | -31                    | 49.58                      | 54                 | -4.42       | -                   | -              | 7              | 106         | H        |
| 2      | * 7.322         | 46.34                | PK-U | 35.6             | -28.6                  | 53.34                      | -                  | -           | 74                  | -20.66         | 4              | 382         | H        |
|        | * 7.323         | 40.83                | V1TR | 35.6             | -28.6                  | 47.83                      | 54                 | -6.17       | -                   | -              | 4              | 382         | H        |
| 4      | * 12.204        | 38.51                | PK-U | 38.9             | -26.4                  | 51.01                      | -                  | -           | 74                  | -22.99         | 352            | 191         | H        |
|        | * 12.206        | 29.05                | V1TR | 38.9             | -26.4                  | 41.55                      | 54                 | -12.45      | -                   | -              | 352            | 191         | H        |
| 5      | * 4.882         | 46.62                | PK-U | 34               | -31                    | 49.62                      | -                  | -           | 74                  | -24.38         | 0              | 194         | V        |
|        | * 4.882         | 42.01                | V1TR | 34               | -31                    | 45.01                      | 54                 | -8.99       | -                   | -              | 0              | 194         | V        |
| 6      | * 7.324         | 46.37                | PK-U | 35.6             | -28.6                  | 53.37                      | -                  | -           | 74                  | -20.63         | 44             | 318         | V        |
|        | * 7.323         | 40.45                | V1TR | 35.6             | -28.6                  | 47.45                      | 54                 | -6.55       | -                   | -              | 44             | 318         | V        |
| 8      | * 12.206        | 40.82                | PK-U | 38.9             | -26.4                  | 53.32                      | -                  | -           | 74                  | -20.68         | 42             | 159         | V        |
|        | * 12.206        | 33.12                | V1TR | 38.9             | -26.4                  | 45.62                      | 54                 | -8.38       | -                   | -              | 42             | 159         | V        |
| 3      | 9.765           | 32.78                | Pk   | 36.8             | -27                    | 42.58                      | -                  | -           | -                   | -              | 0-360          | 103         | H        |
| 7      | 9.765           | 42.16                | Pk   | 36.8             | -27                    | 51.96                      | -                  | -           | -                   | -              | 0-360          | 199         | V        |

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

Pk - Peak detector

PK-U: Maximum Peak

V1TR: VB=1/Ton, AVG where: Ton is packet duration



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AT0072 AF (dB/m) | Amp/Cbl/Filtr/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      | * 4.96          | 51.89                | PK-U | 34.1             | -31.8                  | 54.19                      | -                  | -           | 74                  | -19.81         | 4              | 275         | H        |
|        | * 4.96          | 48.48                | V1TR | 34.1             | -31.8                  | 50.78                      | 54                 | -3.22       | -                   | -              | 4              | 275         | H        |
| 2      | * 7.439         | 44.32                | PK-U | 35.6             | -28.5                  | 51.42                      | -                  | -           | 74                  | -22.58         | 24             | 178         | H        |
|        | * 7.44          | 38.1                 | V1TR | 35.6             | -28.6                  | 45.1                       | 54                 | -8.9        | -                   | -              | 24             | 178         | H        |
| 4      | * 12.401        | 37.47                | PK-U | 38.9             | -26.2                  | 50.17                      | -                  | -           | 74                  | -23.83         | 348            | 217         | H        |
|        | * 12.401        | 28.11                | V1TR | 38.9             | -26.2                  | 40.81                      | 54                 | -13.19      | -                   | -              | 348            | 217         | H        |
| 5      | * 4.96          | 47.24                | PK-U | 34.1             | -31.8                  | 49.54                      | -                  | -           | 74                  | -24.46         | 7              | 198         | V        |
|        | * 4.96          | 42.68                | V1TR | 34.1             | -31.8                  | 44.98                      | 54                 | -9.02       | -                   | -              | 7              | 198         | V        |
| 6      | * 7.44          | 44.41                | PK-U | 35.6             | -28.5                  | 51.51                      | -                  | -           | 74                  | -22.49         | 41             | 336         | V        |
|        | * 7.44          | 38.31                | V1TR | 35.6             | -28.6                  | 45.31                      | 54                 | -8.69       | -                   | -              | 41             | 336         | V        |
| 8      | * 12.399        | 40.83                | PK-U | 38.9             | -26.2                  | 53.53                      | -                  | -           | 74                  | -20.47         | 69             | 110         | V        |
|        | * 12.401        | 32.65                | V1TR | 38.9             | -26.2                  | 45.35                      | 54                 | -8.65       | -                   | -              | 69             | 110         | V        |
| 3      | 9.92            | 32.26                | Pk   | 37               | -27.5                  | 41.76                      | -                  | -           | -                   | -              | 0-360          | 102         | H        |
| 7      | 9.919           | 41.16                | Pk   | 37               | -27.5                  | 50.66                      | -                  | -           | -                   | -              | 0-360          | 102         | V        |

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

Pk - Peak detector

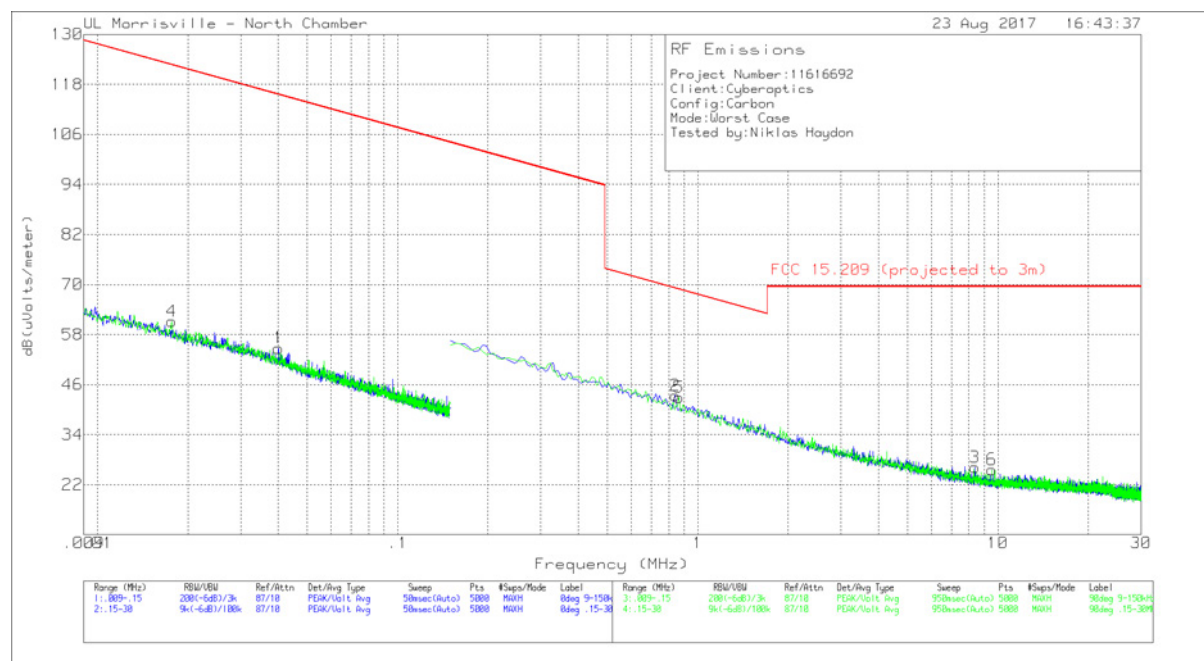
PK-U: Maximum Peak

V1TR: VB=1/Ton, AVG where: Ton is packet duration

### 10.3. WORST-CASE BELOW 1 GHz SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)

**Note:** All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance 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 (specification distance / test distance).

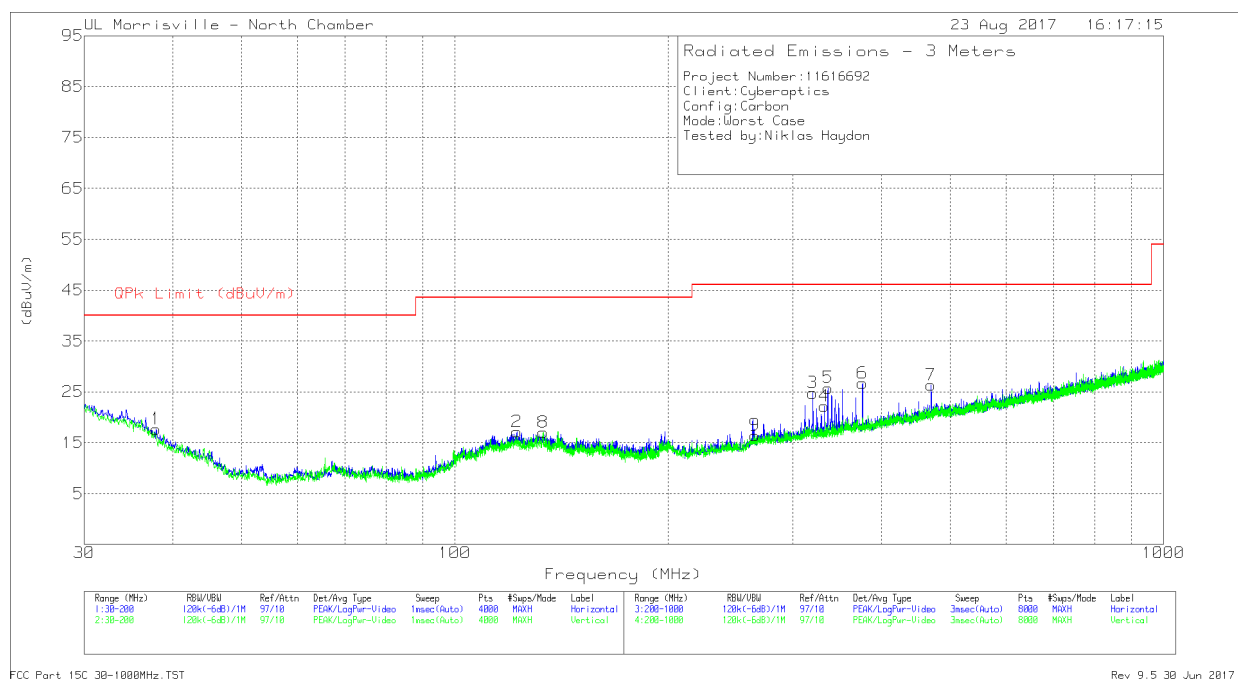
Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0079 AF (dB/m) | Cbl (dB) | Corrected Reading dB(uVolts/meter) | FCC 15.209 (projected to 3m) | Margin (dB) | Azimuth (Degs) |
|--------|-----------------|----------------------|-----|------------------|----------|------------------------------------|------------------------------|-------------|----------------|
| 4      | .01768          | 46.07                | Pk  | 15               | .1       | 61.17                              | 122.66                       | -61.49      | 0-360          |
| 1      | .04008          | 42.27                | Pk  | 12.4             | .1       | 54.77                              | 115.55                       | -60.78      | 0-360          |
| 2      | .84264          | 32.62                | Pk  | 10.7             | .1       | 43.42                              | 69.09                        | -25.67      | 0-360          |
| 5      | .86652          | 32                   | Pk  | 10.8             | .1       | 42.9                               | 68.85                        | -25.95      | 0-360          |
| 3      | 8.39595         | 15.13                | Pk  | 10.6             | .5       | 26.23                              | 69.54                        | -43.31      | 0-360          |
| 6      | 9.54835         | 14.64                | Pk  | 10.5             | .5       | 25.64                              | 69.54                        | -43.9       | 0-360          |

Pk - Peak detector

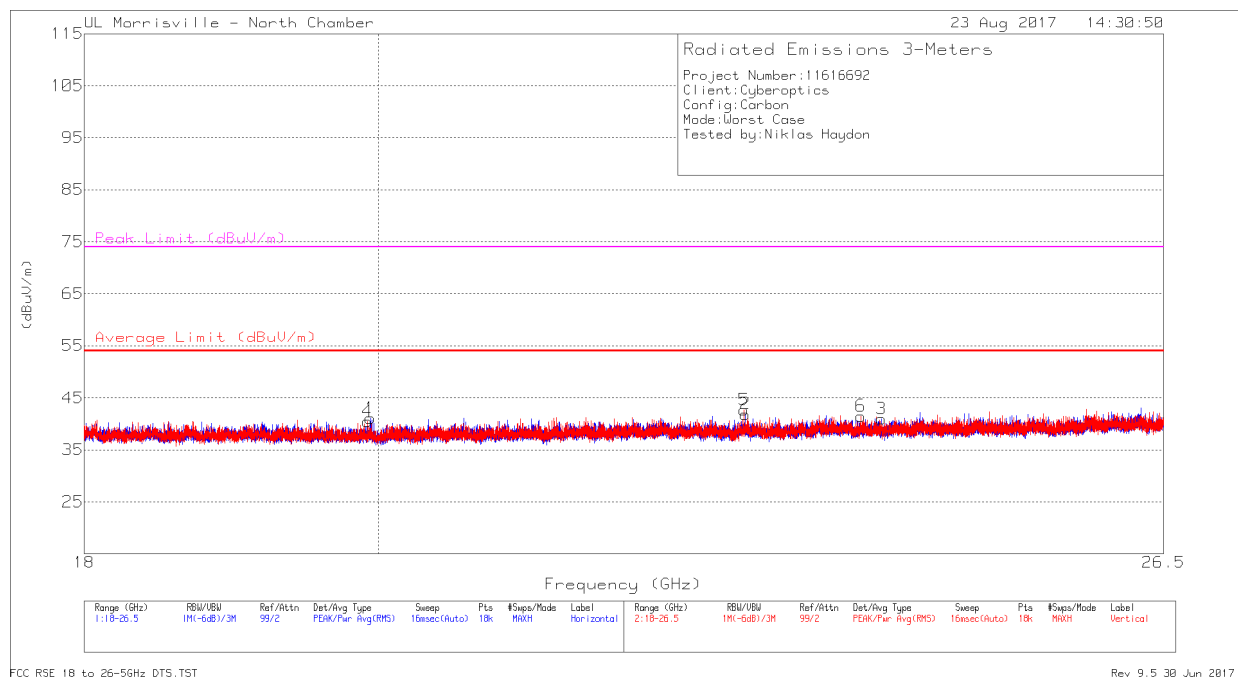
# **SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)**



| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AT0074 AF (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 1      | * 37.907        | 29.3                 | Pk  | 20.1             | -31.7        | 17.7                       | 40                 | -22.3       | 0-360          | 299         | H        |
| 2      | * 122.3339      | 29.69                | Pk  | 18.2             | -30.7        | 17.19                      | 43.52              | -26.33      | 0-360          | 199         | H        |
| 8      | * 133.2592      | 29.62                | Pk  | 18.1             | -30.7        | 17.02                      | 43.52              | -26.5       | 0-360          | 102         | V        |
| 4      | * 331.9171      | 32.8                 | Pk  | 18.7             | -29.3        | 22.2                       | 46.02              | -23.82      | 0-360          | 102         | H        |
| 9      | * 265.1085      | 28.66                | Pk  | 17.5             | -29.7        | 16.46                      | 46.02              | -29.56      | 0-360          | 302         | V        |
| 3      | 319.9156        | 35.48                | Pk  | 18.7             | -29.4        | 24.78                      | 46.02              | -21.24      | 0-360          | 102         | H        |
| 5      | 336.0177        | 36.07                | Pk  | 18.9             | -29.2        | 25.77                      | 46.02              | -20.25      | 0-360          | 102         | H        |
| 6      | 376.0229        | 35.88                | Pk  | 19.8             | -29          | 26.68                      | 46.02              | -19.34      | 0-360          | 199         | H        |
| 7      | 469.9351        | 33.16                | Pk  | 21.8             | -28.6        | 26.36                      | 46.02              | -19.66      | 0-360          | 199         | H        |

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

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



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF AT0076 (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      | * 19.943        | 49.35                | Pk  | 33               | -41.3        | 41.05                      | 54                     | -12.95      | 74                  | -32.95      | 0-360          | 251         | H        |
| 2      | * 22.812        | 49.08                | Pk  | 33.7             | -40.9        | 41.88                      | 54                     | -12.12      | 74                  | -32.12      | 0-360          | 251         | H        |
| 3      | * 23.951        | 47.58                | Pk  | 33.9             | -40.5        | 40.98                      | 54                     | -13.02      | 74                  | -33.02      | 0-360          | 102         | H        |
| 4      | * 19.922        | 48.75                | Pk  | 33               | -41.3        | 40.45                      | 54                     | -13.55      | 74                  | -33.55      | 0-360          | 103         | V        |
| 5      | * 22.799        | 49.87                | Pk  | 33.7             | -40.9        | 42.67                      | 54                     | -11.33      | 74                  | -31.33      | 0-360          | 148         | V        |
| 6      | * 23.774        | 47.89                | Pk  | 34               | -40.4        | 41.49                      | 54                     | -12.51      | 74                  | -32.51      | 0-360          | 103         | V        |

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