

# Finalmouse

## TEST REPORT FOR

**Wireless Gaming Mouse**  
**Models: ULXM (Ultralight X – Lion) and**  
**ULXL (Ultralight X – Tiger)**

### Tested to The Following Standards:

**FCC Part 15 Subpart C Section(s)**

**15.247**  
**(DTS 2400-2483.5 MHz)**

**Report No.: 109545-4**

**Date of issue: April 2, 2024**



**Test Certificate # 803.01**

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## Administrative Information

### Test Report Information

**REPORT PREPARED FOR:**

Finalmouse  
505 San Juan Ave 4  
Venice, CA 90291

Representative: : Maxime Vincent  
Customer Reference Number: CKC1

**REPORT PREPARED BY:**

Viviana Prado  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 109545

**DATE OF EQUIPMENT RECEIPT:**

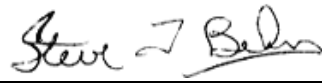
March 14, 2024

**DATE(S) OF TESTING:**

March 14, 2024

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink that reads "Steve Behm".

**Steve Behm**  
**Director of Quality Assurance & Engineering Services**  
**CKC Laboratories, Inc.**

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable, and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
Canyon Park  
22116 23rd Drive S.E., Suite A  
Bothell, WA 98021

## Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions                     | 5.03.20 |

## Site Registration & Accreditation Information

| Location                 | *NIST CB # | FCC    | Canada | Japan  |
|--------------------------|------------|--------|--------|--------|
| Canyon Park, Bothell, WA | US0103     | US1024 | 3082C  | A-0136 |
| Brea, CA                 | US0103     | US1024 | 3082D  | A-0136 |
| Fremont, CA              | US0103     | US1024 | 3082B  | A-0136 |
| Mariposa, CA             | US0103     | US1024 | 3082A  | A-0136 |

\*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

## Summary of Results

### Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

| Test Procedure | Description                        | Modifications | Results |
|----------------|------------------------------------|---------------|---------|
| 15.247(a)(2)   | 6dB Bandwidth                      | NA            | NP      |
| 15.247(b)(3)   | Output Power                       | NA            | NP      |
| 15.247(d)      | RF Conducted Emissions & Band Edge | NA            | NP      |
| 15.247(d)      | Radiated Emissions                 | NA            | Pass    |
| 15.247(d)      | Radiated Band Edge                 | NA            | NP      |
| 15.247(e)      | Power Spectral Density             | NA            | NP      |
| 15.207         | AC Conducted Emissions             | NA            | NP      |

NA = Not Applicable

NP = CKC Laboratories was not contracted to perform test.

#### ISO/IEC 17025 Decision Rule

The equipment sample utilized for testing is selected by the manufacturer. The declaration of pass or fail herein is a binary statement for simple acceptance rule (ILAC G8) based upon assessment to the specification(s) listed above, without consideration of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

## Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

#### Summary of Conditions

No modifications were made during testing.

**Modifications listed above must be incorporated into all production units.**

## Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

#### Summary of Conditions

None

## Equipment Under Test (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

#### *Equipment Tested:*

| Device                | Manufacturer | Model #                     | S/N  |
|-----------------------|--------------|-----------------------------|------|
| Wireless Gaming Mouse | Finalmouse   | ULXM (Ultralight X – Lion)  | None |
| Wireless Gaming Mouse | Finalmouse   | ULXL (Ultralight X – Tiger) | None |

#### *Support Equipment:*

| Device     | Manufacturer | Model #      | S/N            |
|------------|--------------|--------------|----------------|
| Laptop     | HP           | ProtectSmart | CKCAN3512      |
| Laptop PSU | HP           | PPP009A      | WFTLK0FGM961LE |

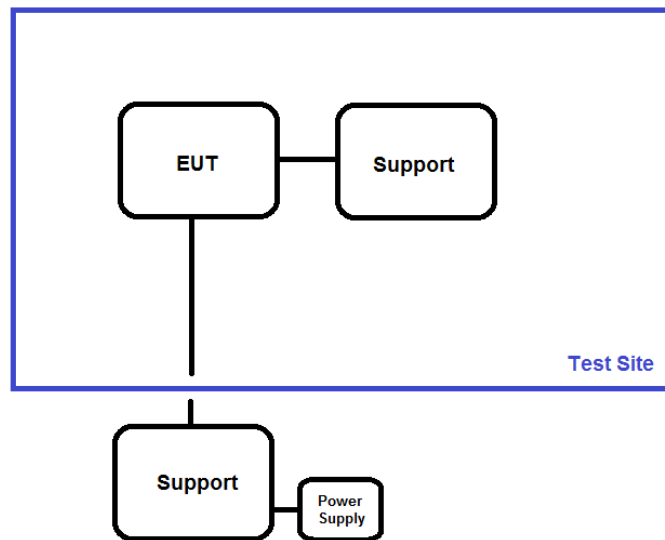
## General Product Information:

| Description of EUT                                                                                                                      |                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wireless Gaming Mouse                                                                                                                   |                                                                                                                                                                                    |
| Product Information                                                                                                                     | Manufacturer-Provided Details                                                                                                                                                      |
| Operating Frequencies Tested:                                                                                                           | 2402-2480 MHz                                                                                                                                                                      |
| Equipment Type:                                                                                                                         | Stand-Alone Equipment                                                                                                                                                              |
| Type of Wideband System:                                                                                                                | DTS                                                                                                                                                                                |
| Maximum Duty Cycle:                                                                                                                     | 100% (Tested worst-case)                                                                                                                                                           |
| Modulation Type(s):                                                                                                                     | GFSK                                                                                                                                                                               |
| Number of TX Chains:                                                                                                                    | 1                                                                                                                                                                                  |
| Beamforming Type:                                                                                                                       | NA                                                                                                                                                                                 |
| Antenna Type(s) and Gain:                                                                                                               | <p>inverted F PCB trace antenna</p> <p>Medium Mouse:<br/>Average Gain: -7.73 dBi<br/>Max Gain: 1.32 dBi</p> <p>Large Mouse:<br/>Average Gain: -7.39 dBi<br/>Max Gain: 1.80 dBi</p> |
| Antenna Connection Type:                                                                                                                | Integral                                                                                                                                                                           |
| Nominal Input Voltage:                                                                                                                  | 120VAC (Host) EUT 5VDC                                                                                                                                                             |
| Firmware / Software Version(s):                                                                                                         | v2.1.0                                                                                                                                                                             |
| Firmware / Software Description:                                                                                                        | Production release software                                                                                                                                                        |
| Firmware / Software Setting(s):                                                                                                         | Default or Radio Test mode, depending on tests                                                                                                                                     |
| Tune-up or Adjustment(s):                                                                                                               | None                                                                                                                                                                               |
| The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility. |                                                                                                                                                                                    |

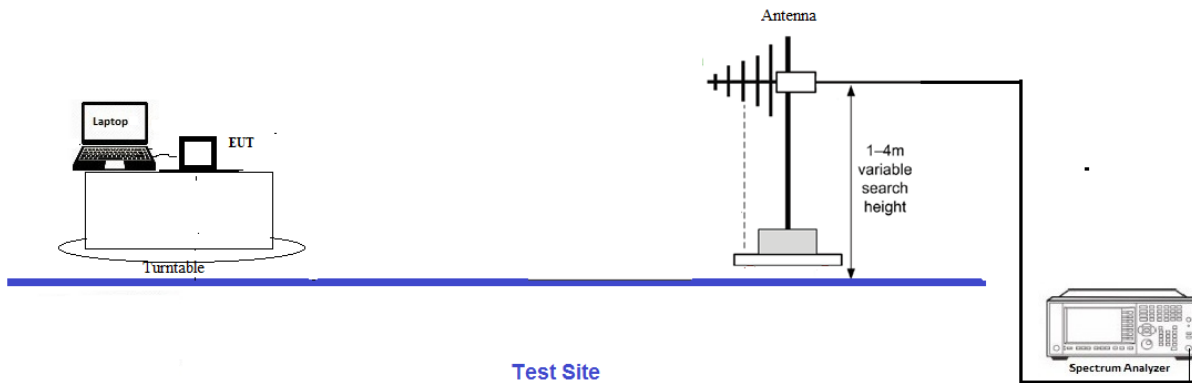
## Block Diagram of Test Setup(s)

| Config# | Setup Description of Block Diagram                                                                                                                                                    |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | EUT is setup in a tabletop configuration. It is connected to a Laptop via USB cable. Laptop is sitting on turntable. X, Y, and Z axis were investigated and worst-case data provided. |

### Test Setup Block Diagram



Radiated test setup





## FCC Part 15 Subpart C

### 15.247(d) Radiated Emissions

#### Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Finalmouse**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **109545** Date: 3/14/2024  
 Test Type: **Radiated Scan** Time: 15:23:35  
 Tested By: Matt Harrison Sequence#: 4  
 Software: EMITest 5.03.20

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

Test Environment Conditions:

Temperature: 21°C

Humidity: 35%

Pressure: 103.0kPa

Test Method: ANSI C63.10

Frequency Range: 9k-25GHz

Test Setup: EUT is set up in a Tabletop configuration. It is 150cm high above 1GHz and 0.8m high below 1GHz on a Styrofoam table. It is connected to a support laptop via USB Cable. Laptop is sitting 20cm above ground plane. Horizontal and Vertical Polarities along with X, Y, and Z axis investigated, worst-case data provided.

Notes:

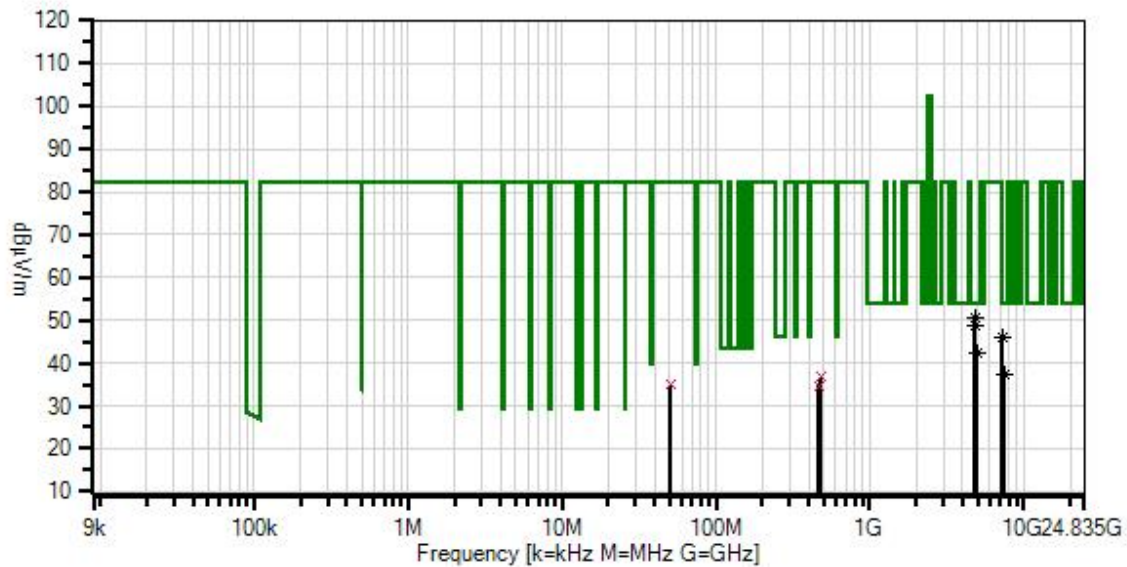
Large and Medium Mice

Transmitting on 2402 & 2480MHz

Output Power: 8dBm

No EUT Emissions found within 20dB of the limit above 10GHz or below 30MHz.

Finalmouse W/O#: 109545 Sequence#: 4 Date: 3/14/2024  
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



— Readings  
× QP Readings  
▼ Ambient  
— 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings  
\* Average Readings  
Software Version: 5.03.20

**Test Equipment:**

| ID | Asset #     | Description         | Model                   | Calibration Date | Cal Due Date |
|----|-------------|---------------------|-------------------------|------------------|--------------|
| T1 | AN02374ANSI | Horn Antenna        | RGA-60                  | 5/26/2023        | 5/26/2025    |
| T2 | ANP07504    | Cable               | CLU40-KMKM-02.00F       | 1/24/2023        | 1/24/2025    |
| T3 | ANP06011    | Cable               | Heliac                  | 11/16/2023       | 11/16/2025   |
| T4 | ANP06515    | Cable               | Heliac                  | 2/28/2024        | 2/28/2026    |
| T5 | AN03834     | Spectrum Analyzer   | E4448A                  | 11/8/2023        | 11/8/2025    |
| T6 | AN03540     | Preamp              | 83017A                  | 3/24/2023        | 3/24/2025    |
| T7 | AN02741     | Active Horn Antenna | AMFW-5F-12001800-20-10P | 5/26/2023        | 5/26/2025    |
| T8 | AN02742     | Active Horn Antenna | AMFW-5F-18002650-20-10P | 11/18/2022       | 11/18/2024   |
| T9 | AN02763-69  | Waveguide           | Multiple                | 1/9/2024         | 1/9/2026     |
|    | AN02307     | Preamp              | 8447D                   | 8/9/2023         | 8/9/2025     |
|    | AN03824     | Biconilog Antenna   | 3142E                   | 5/9/2023         | 5/9/2025     |
|    | ANP05333    | Cable               | Heliac                  | 8/8/2023         | 8/8/2025     |
|    | ANP05360    | Cable               | RG214                   | 8/8/2023         | 8/8/2025     |
|    | AN00052     | Loop Antenna        | 6502                    | 5/11/2022        | 5/11/2024    |

| <b>Measurement Data:</b> |                  |      | Reading listed by margin. |               |               |               | Test Distance: 3 Meters |        |        |        |       |
|--------------------------|------------------|------|---------------------------|---------------|---------------|---------------|-------------------------|--------|--------|--------|-------|
| #                        | Freq             | Rdng | T1<br>T5<br>T9            | T2<br>T6      | T3<br>T7      | T4<br>T8      | Dist                    | Corr   | Spec   | Margin | Polar |
|                          | MHz              | dBμV | dB                        | dB            | dB            | dB            | Table                   | dBμV/m | dBμV/m | dB     | Ant   |
| 1                        | 4803.450M<br>Ave | 44.5 | +33.1<br>+0.0<br>+0.0     | +1.5<br>-33.8 | +1.3<br>+0.0  | +4.0<br>+0.0  | +0.0                    | 50.6   | 54.0   | -3.4   | Horiz |
| ^                        | 4803.450M        | 54.7 | +33.1<br>+0.0<br>+0.0     | +1.5<br>-33.8 | +1.3<br>+0.0  | +4.0<br>+0.0  | +0.0                    | 60.8   | 54.0   | +6.8   | Horiz |
| 3                        | 50.930M<br>QP    | 49.3 | +0.1<br>+0.3<br>+0.5      | +0.0<br>+0.5  | -27.7<br>+0.5 | +12.4<br>+0.5 | +0.0                    | 34.9   | 40.0   | -5.1   | Vert  |
| ^                        | 50.930M          | 53.3 | +0.1<br>+0.3<br>+0.5      | +0.0<br>+0.5  | -27.7<br>+0.5 | +12.4<br>+0.5 | +0.0                    | 38.9   | 40.0   | -1.1   | Vert  |
| 5                        | 4804.840M<br>Ave | 42.8 | +33.1<br>+0.0<br>+0.0     | +1.5<br>-33.8 | +1.3<br>+0.0  | +4.0<br>+0.0  | +0.0                    | 48.9   | 54.0   | -5.1   | Vert  |
| ^                        | 4804.840M        | 53.6 | +33.1<br>+0.0<br>+0.0     | +1.5<br>-33.8 | +1.3<br>+0.0  | +4.0<br>+0.0  | +0.0                    | 59.7   | 54.0   | +5.7   | Vert  |
| 7                        | 479.990M<br>QP   | 37.3 | +0.3<br>+1.1<br>+1.9      | +0.0<br>+1.9  | -27.8<br>+1.9 | +24.0<br>+1.9 | +0.0                    | 36.8   | 46.0   | -9.2   | Horiz |
| ^                        | 479.990M         | 40.4 | +0.3<br>+1.1<br>+1.9      | +0.0<br>+1.9  | -27.8<br>+1.9 | +24.0<br>+1.9 | +0.0                    | 39.9   | 46.0   | -6.1   | Horiz |
| 9                        | 467.996M<br>QP   | 35.2 | +0.3<br>+1.1<br>+1.8      | +0.0<br>+1.8  | -27.8<br>+1.8 | +24.1<br>+1.8 | +0.0                    | 34.7   | 46.0   | -11.3  | Horiz |
| ^                        | 467.996M         | 41.6 | +0.3<br>+1.1<br>+1.8      | +0.0<br>+1.8  | -27.8<br>+1.8 | +24.1<br>+1.8 | +0.0                    | 41.1   | 46.0   | -4.9   | Horiz |
| 11                       | 4960.130M<br>Ave | 36.4 | +33.7<br>+0.0<br>+0.0     | +1.2<br>-33.8 | +1.1<br>+0.0  | +3.9<br>+0.0  | +0.0                    | 42.5   | 54.0   | -11.5  | Horiz |
| ^                        | 4960.130M        | 51.8 | +33.7<br>+0.0<br>+0.0     | +1.2<br>-33.8 | +1.1<br>+0.0  | +3.9<br>+0.0  | +0.0                    | 57.9   | 54.0   | +3.9   | Horiz |

|    |           |      |       |       |      |      |      |      |      |       |       |
|----|-----------|------|-------|-------|------|------|------|------|------|-------|-------|
| 13 | 7439.320M | 27.4 | +37.4 | +1.2  | +1.5 | +5.1 | +0.0 | 37.5 | 54.0 | -16.5 | Horiz |
|    | Ave       |      | +0.0  | -35.1 | +0.0 | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  |       |      |      |      |      |      |       |       |
| ^  | 7439.320M | 44.1 | +37.4 | +1.2  | +1.5 | +5.1 | +0.0 | 54.2 | 54.0 | +0.2  | Horiz |
|    |           |      | +0.0  | -35.1 | +0.0 | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  |       |      |      |      |      |      |       |       |
| 15 | 7207.060M | 36.6 | +36.7 | +1.3  | +1.4 | +4.9 | +0.0 | 45.9 | 82.3 | -36.4 | Horiz |
|    | Ave       |      | +0.0  | -35.0 | +0.0 | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  |       |      |      |      |      |      |       |       |
| ^  | 7207.060M | 48.6 | +36.7 | +1.3  | +1.4 | +4.9 | +0.0 | 57.9 | 82.3 | -24.4 | Horiz |
|    |           |      | +0.0  | -35.0 | +0.0 | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  |       |      |      |      |      |      |       |       |

**Test Setup Photo(s)**



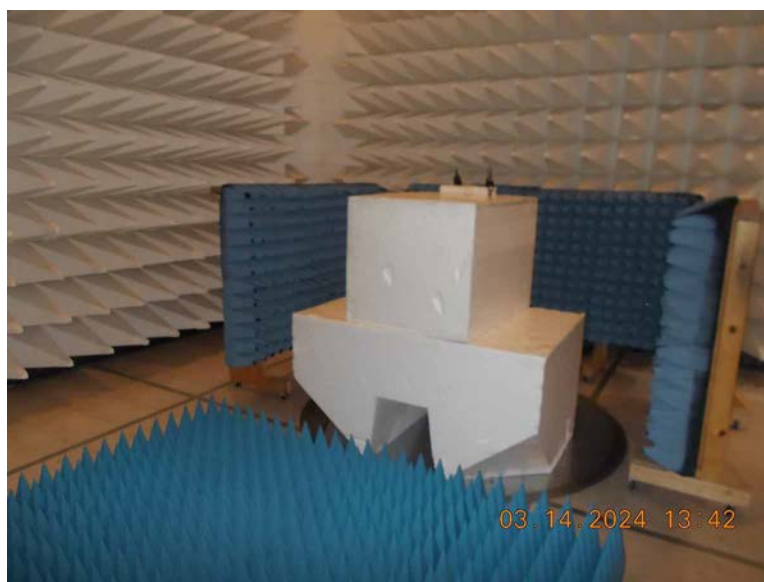
Below 1GHz, 0.8m; View 1



Below 1GHz, 0.8m; View 2



Above 1GHz with USB; View 1



Above 1GHz with USB; View 2





Medium + Large with USB; X-Axis



Medium + Large with USB; Y-Axis



Medium + Large with USB; Z-Axis



## Supplemental Information

### Measurement Uncertainty

| Uncertainty Value      | Parameter                 |
|------------------------|---------------------------|
| 5.77 dB                | Radiated Emissions        |
| 0.673 dB               | RF Conducted Measurements |
| $5.77 \times 10^{-10}$ | Frequency Deviation       |
| 0.00005 s              | Time Deviation            |
| 3.18 dB                | Mains Conducted Emissions |

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ . Compliance is deemed to occur provided measurements are below the specified limits.

### Emissions Test Details

#### TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

#### CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in  $\text{dB}\mu\text{V}/\text{m}$ , the spectrum analyzer reading in  $\text{dB}\mu\text{V}$  was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

| SAMPLE CALCULATIONS |                     |                                     |
|---------------------|---------------------|-------------------------------------|
|                     | Meter reading       | ( $\text{dB}\mu\text{V}$ )          |
| +                   | Antenna Factor      | ( $\text{dB}/\text{m}$ )            |
| +                   | Cable Loss          | ( $\text{dB}$ )                     |
| -                   | Distance Correction | ( $\text{dB}$ )                     |
| -                   | Preamplifier Gain   | ( $\text{dB}$ )                     |
| =                   | Corrected Reading   | ( $\text{dB}\mu\text{V}/\text{m}$ ) |

## TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE |                     |                  |                   |
|------------------------------------------------------------|---------------------|------------------|-------------------|
| TEST                                                       | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS                                        | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS                                         | 9 kHz               | 150 kHz          | 200 Hz            |
| RADIATED EMISSIONS                                         | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS                                         | 30 MHz              | 1000 MHz         | 120 kHz           |
| RADIATED EMISSIONS                                         | 1000 MHz            | >1 GHz           | 1 MHz             |

## SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

### Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

### Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

### Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.

**\*End of Report\***