# ENGINEERING TEST REPORT

## V-Flex 4G
## Model No.: 4GFXU1P

## FCC ID: QC4-4GFLEXP

*Applicant:*

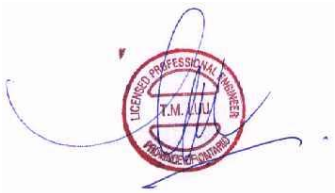
**Bioscrypt, Inc.**
505 Cochrane Drive
Markham, Ontario
Canada L3R 8E3

***In Accordance With***
**Federal Communications Commission (FCC)**
**Part 15, Subpart C, Section 15.209**

**UltraTech's File No.: MYT-130F15C209**

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: March 31, 2009




| Report Prepared by: Dan Huynh | Tested by: Hung Trinh, EMC/RFI Technician |
|---|---|
| Issued Date: March 31, 2009 | Test Dates: March 9, 10 & 18, 2009 |

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*


**UltraTech**

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| ANSI American National Standards Institute | FC | VCI | Industry Canada Industrie Canada Approved Test Facility | NVLAP | BSMI | Korea MIC-RRL |
|---|---|---|---|---|---|---|
| 0685 | 31040/SIT | C-1376 | 46390-2049 | 200093-0 | SL2-IN-E-1119R | 2005-82 & 83 |

# TABLE OF CONTENTS

# EXHIBIT 1. INTRODUCTION

## 1.1. SCOPE

| | |
|---|---|
| **Reference:** | FCC Part 15, Subpart C |
| **Title:** | Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15 |
| **Purpose of Test:** | To gain FCC Equipment Certification for section 15.209. |
| **Test Procedures:** | Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |
| **Environmental Classification:** | Commercial, industrial or business environment |

## 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

## 1.3. NORMATIVE REFERENCES

| Publication | Year | Title |
|---|---|---|
| FCC 47 CFR 15 | 2008 | Code of Federal Regulations – Telecommunication |
| ANSI C63.4 | 2003 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz |
| CISPR 22<br>EN 55022 | 2008-09, Edition 6.0<br>2006 | Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement |
| CISPR 16-1-1<br>+A1<br>+A2 | 2006<br>2006<br>2007 | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 1-1: Measuring Apparatus |
| CISPR 16-1-2<br>+A1<br>+A2 | 2003<br>2004<br>2006 | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 1-2: Conducted disturbances |

# EXHIBIT 2. PERFORMANCE ASSESSMENT

## 2.1. CLIENT INFORMATION

| APPLICANT | |
|---|---|
| **Name:** | Bioscrypt, Inc. |
| **Address:** | 505 Cochrane Drive<br>Markham, Ontario<br>Canada L3R 8E3 |
| **Contact Person:** | Shiraz Kapadia<br>Phone #: 905-940-7750<br>Fax #: 905-940-7642<br>Email Address: shiraz.kapadia@bioscrypt.com |

| MANUFACTURER | |
|---|---|
| **Name:** | Knight Wah Technology Ltd. |
| **Address:** | Unit 16 - 19, 3/F Tower B,Regent Centre,<br>63-73 Wo Yi Hop Road, Kwai Chung, N. T.<br>Hong Kong |
| **Contact Person:** | Y.H. Chan<br>Phone #: (852) 2619 0162<br>Fax #: (852) 2619 0132<br>Email Address: yhchan@knightwah.com |

## 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

| | |
|---|---|
| **Brand Name:** | Bioscrypt, Inc. |
| **Product Name:** | V-Flex 4G |
| **Model Name or Number:** | 4GFXU1P |
| **Serial Number:** | Test sample |
| **Type of Equipment:** | Low Power Transceiver |
| **Input Power Supply Type:** | 12 VDC on DC Line or 48 VDC on PoE |
| **Primary User Functions of EUT:** | Enroll, verification, communication output |

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

| TRANSMITTER | |
|---|---|
| **Equipment Type:** | Mobile |
| **Intended Operating Environment:** | Commercial, light industry & heavy industry |
| **Power Supply Requirement:** | 4.75VDC – 16VDC |
| **RF Output Power Rating:** | 61.60 dBµV/m peak at 3m distance |
| **Operating Frequency Range:** | 125 kHz |
| **Duty Cycle:** | 20% duty cycle @ 100ms |
| **20 dB Bandwidth:** | 0.418 kHz |
| **Modulation Type:** | ASK 20% duty cycle @ 100ms |
| **Oscillator Frequencies:** | 125 kHz |
| **Antenna Connector Type:** | LC (Coil) Integral |

## 2.4. LIST OF EUT'S PORTS

| Port Number | EUT's Port Description | Number of Identical Ports | Connector Type | Cable Type (Shielded/Non-shielded) |
|---|---|---|---|---|
| 1 | Ethernet 100-BASE TX | 1 | RJ45 | Non shielded |
| 2 | Host RS-485 | 1 | Header | Non shielded |
| 3 | Host RS-232 | 1 | Header | Non shielded |
| 4 | Power | 2 | Bullet & Header | Non shielded |
| 5 | WIEGAND I/O | 1 | Header | Non shielded |
| 6 | General Purpose I/O | 1 | Header | Non shielded |
| 7 | Relay Control | 1 | Header | Non shielded |
| 8 | NOTE: Auxiliary Port | 1 | USB-Micro-AB | Shielded |

## 2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

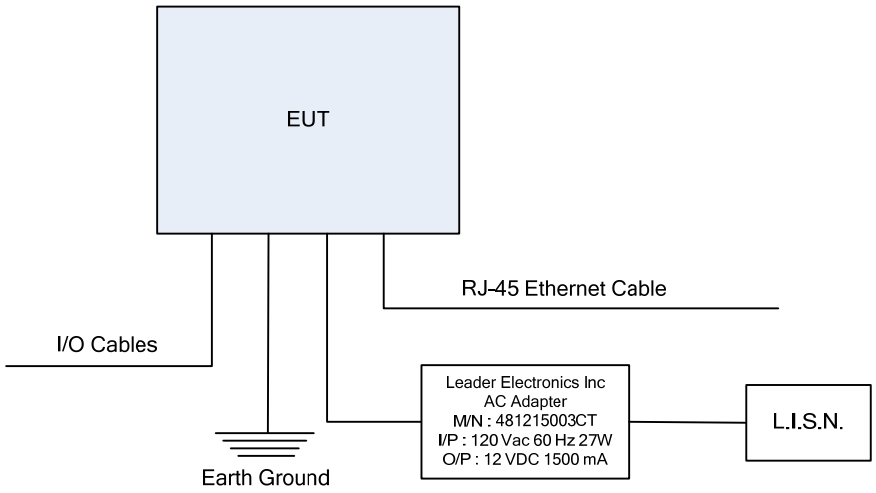
| **Ancillary Equipment # 1** | |
|---|---|
| Description: | AC Adaptor |
| Brand Name: | Leader Electronics Inc. |
| Model Name or Number: | 481215003CT |
| Serial Number: | N/A |
| Cable Length & Type: | < 3 m, Non-shielded |
| Connected to EUT's Port: | Power Connector |

| **Ancillary Equipment # 2** | |
|---|---|
| Description: | PoE Injector |
| Brand Name: | Allied Telesis |
| Model Name or Number: | AT-6101 |
| Serial Number: | A03784G080700814A1 |
| Cable Length & Type: | > 3 m, Non-shielded |
| Connected to EUT's Port: | Ethernet |

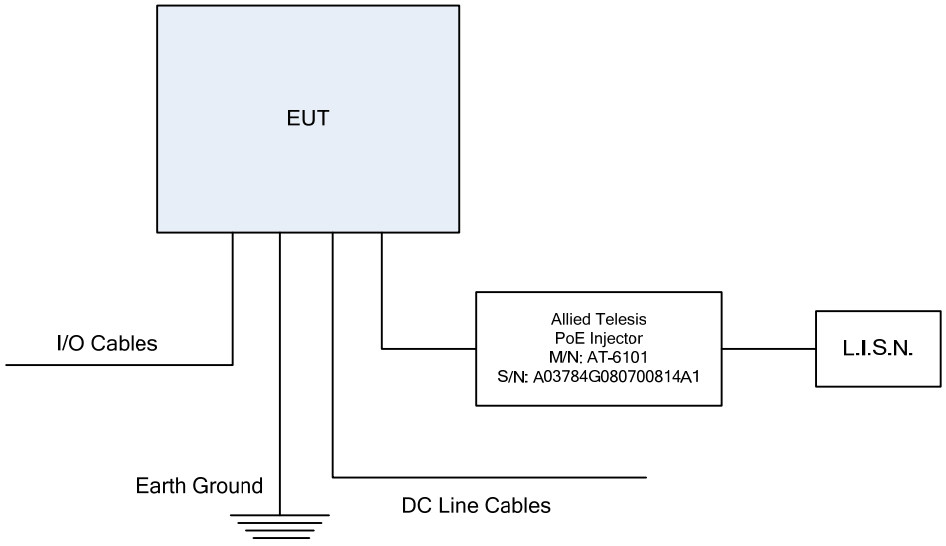
## 2.6. TEST SETUP BLOCK DIAGRAM

### 2.6.1. Power Line Conducted Emission Test Setup

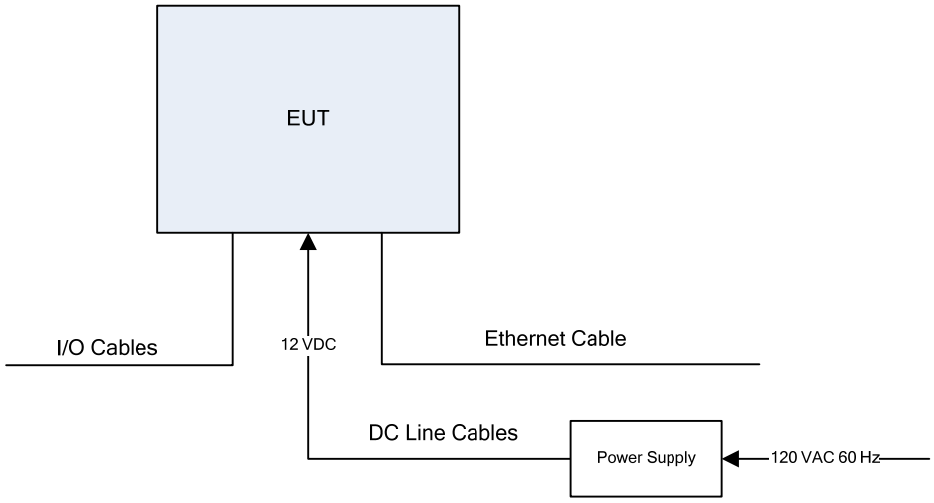
Test Configuration 1: External Wall Plug-in Adapter




Test Configuration 2: Power Over Ethernet (PoE) Injector



## 2.6.2. Radiated Emission Test Setup



# EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

## 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

| | |
|---|---|
| Temperature: | 21°C |
| Humidity: | 51% |
| Pressure: | 102 kPa |
| Power input source: | 12 VDC (from AC adapter)<br>48 VDC (from PoE) |

## 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

| | |
|---|---|
| **Operating Modes:** | The EUT was configured for continuous transmission for the duration of testing. |
| **Special Test Software:** | N/A |
| **Special Hardware Used:** | N/A |
| **Transmitter Test Antenna:** | The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment. |

| **Transmitter Test Signals** | |
|---|---|
| **Frequency Band(s):** | 125 kHz |
| **Test Frequency(ies):** | 125 kHz |
| **RF Power Output:** | 61.60 dBµV/m peak at 3m distance |
| **Normal Test Modulation:** | ASK |
| **Modulating Signal Source:** | Internal |

# EXHIBIT 4. SUMMARY OF TEST RESULTS

## 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date of Site Calibration: May 17, 2009.

## 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

| FCC Section(s) | Test Requirements | Compliance (Yes/No) |
|---|---|---|
| 15.203 | Antenna Requirement | Yes |
| 15.207(a) | Power Line Conducted Emissions | Yes |
| 15.209(a) | 20 dB Bandwidth | Yes |
| 15.209 | Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions | Yes |

## 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

The following modifications were made for compliance:

1) A Steward ferrite clamp (P/N: 28A2432-0A2) was installed as close to the device as possible on the Ethernet cable.
2) A Steward ferrite clamp (P/N: 28A4155-0A2) was installed as close to the device as possible on the DC & I/O Lines.

# EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

## 5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and Ultratech's test procedures ULTR-P001-2004.

## 5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

## 5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

## 5.4. ANTENNA REQUIREMENTS [47 CFR § 15.203]

### 5.4.1. Requirements

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

N**otes**: This requirement does not apply to carrier current devices operated under the provisions of @ 15.211, 15.213, 15.217, 17.219 or 15.221.

### 5.4.2. Engineering Analysis

The antenna is an integral part of the EUT; it is soldered onto the radio printed circuit board and located inside the enclosure.

## 5.5. POWERLINE CONDUCTED EMISSION [47 CFR 15.207(a)]

### 5.5.1. Limit(s)

The equipment shall meet the limits of the following table:

| Frequency of emission (MHz) | Conducted Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15–0.5 .....…….. | 66 to 56* ..... | 56 to 46* |
| 0.5–5 .....…….. | 56 ..... | 46 |
| 5-30 …….. | 60 ...…….. | 50 |

*Decreases linearly with the logarithm of the frequency

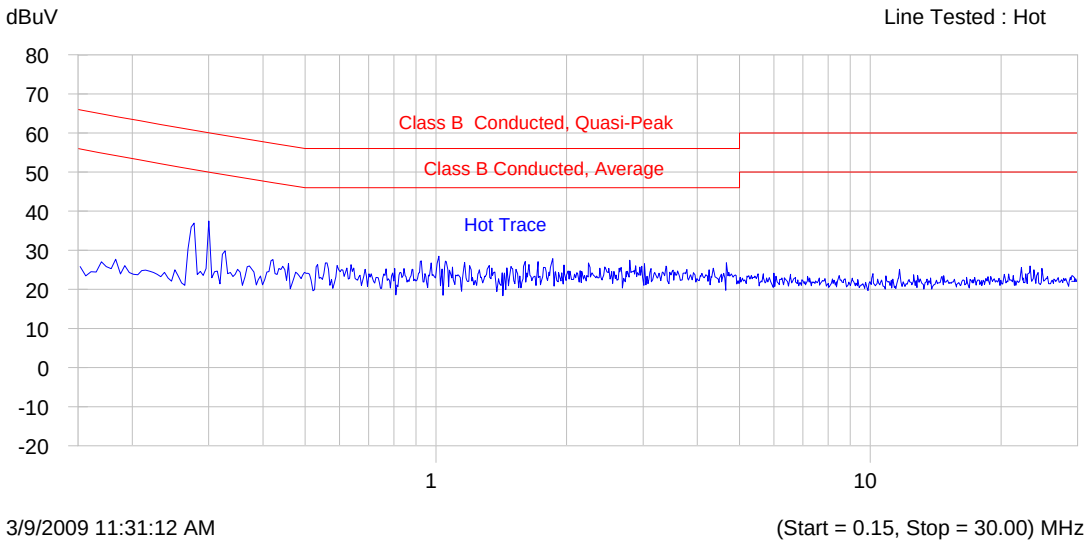
### 5.5.2. Method of Measurements

Refer to ANSI C63.4.

## 5.5.3. Test Data

Plot 5.5.3.1 Power Line Conducted Emission
Test Configuration 1: External Wall Plug-in Adapter
Line Voltage: 120VAC 60Hz
Line Tested: Hot

**Current Graph**

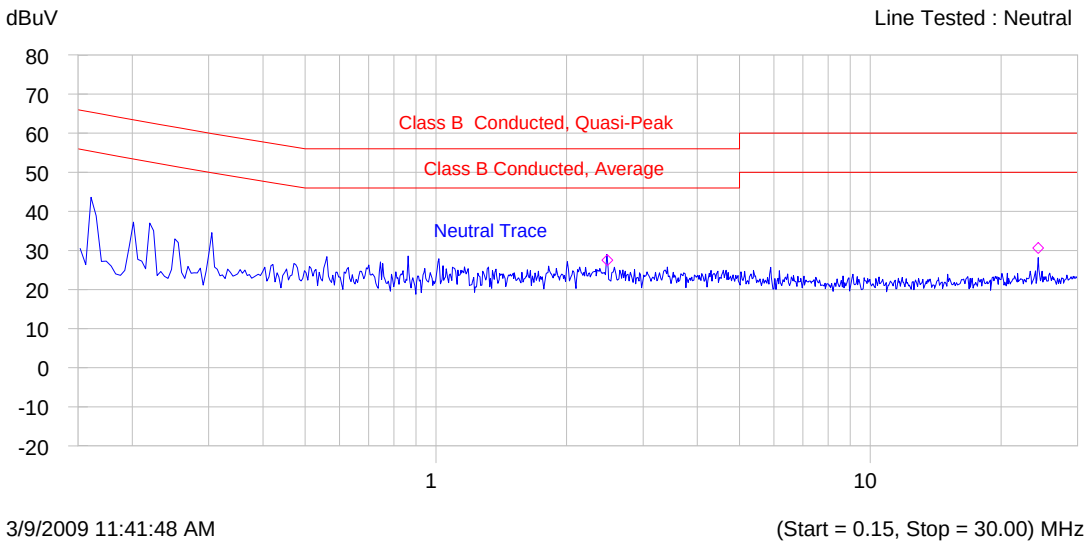



**Current List**

| Frequency MHz | Peak dBuV | QP dBuV | Delta Qp-Qp Limit dB | Avg dBuV | Delta Avg-Avg Limit dB | Trace Name |
|---|---|---|---|---|---|---|
| 0.283 | 38.7 | 29.1 | -31.6 | 16.4 | -34.3 | Hot Trace |
| 0.286 | 38.2 | 29.2 | -31.4 | 15.9 | -34.8 | Hot Trace |
| 0.314 | 35.5 | 25.1 | -34.8 | 16.9 | -33.0 | Hot Trace |
| 4.667 | 26.4 | 20.5 | -35.5 | 14.0 | -32.0 | Hot Trace |

Plot 5.5.3.2 Power Line Conducted Emission
Test Configuration 1: External Wall Plug-in Adapter
Line Voltage: 120VAC 60Hz
Line Tested: Neutral

**Current Graph**

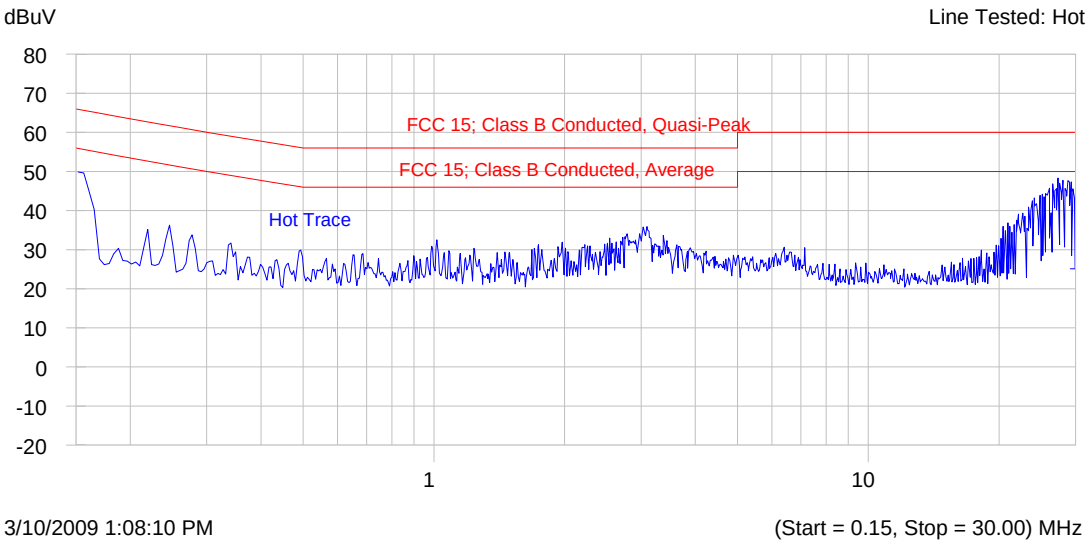



**Current List**

| Frequency MHz | Peak dBuV | QP dBuV | Delta Qp-Qp Limit dB | Avg dBuV | Delta Avg-Avg Limit dB | Trace Name |
|---|---|---|---|---|---|---|
| 0.193 | 44.0 | 37.2 | -26.7 | 16.4 | -37.5 | Neutral Trace |
| 0.200 | 44.6 | 35.9 | -27.7 | 16.0 | -37.6 | Neutral Trace |
| 0.291 | 38.3 | 29.2 | -31.3 | 15.4 | -35.1 | Neutral Trace |
| 2.482 | 27.5 | 22.3 | -33.7 | 15.6 | -30.4 | Neutral Trace |
| 24.359 | 30.6 | 27.0 | -33.0 | 22.9 | -27.1 | Neutral Trace |

Plot 5.5.3.3 Power Line Conducted Emission
Test Configuration 2: Power over Ethernet (PoE) Injector
Line Voltage: 120VAC 60Hz
Line Tested: Hot

**Current Graph**

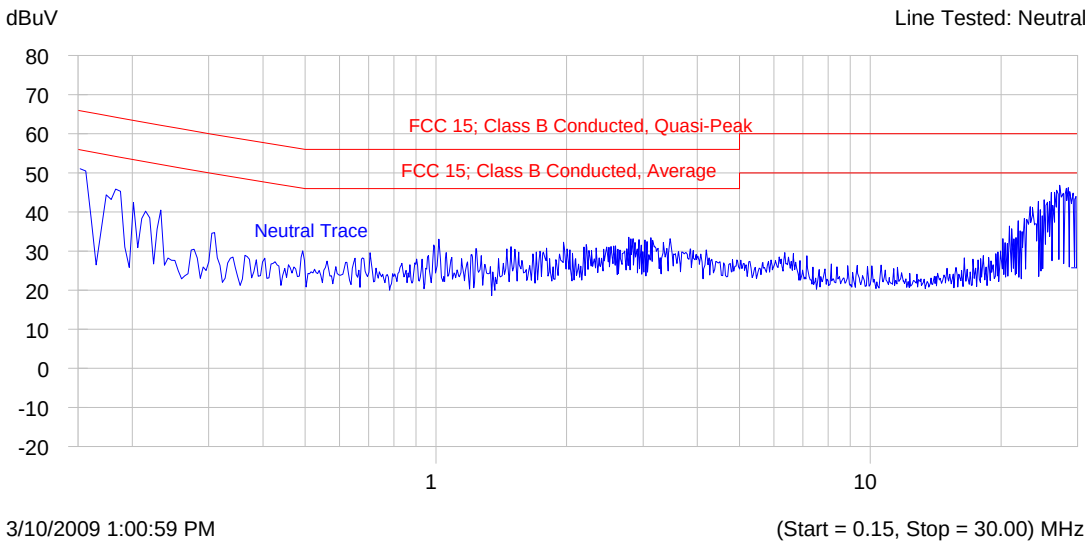



**Current List**

| Frequency MHz | Peak dBuV | QP dBuV | Delta QP-QP Limit dB | Avg dBuV | Delta Avg-Avg Limit dB | Trace Name |
|---|---|---|---|---|---|---|
| 0.248 | 44.1 | 39.7 | -22.1 | 30.8 | -21.0 | Hot Trace |
| 1.009 | 32.0 | 32.1 | -23.9 | 27.4 | -18.6 | Hot Trace |
| 3.031 | 36.5 | 33.9 | -22.1 | 30.8 | -15.2 | Hot Trace |
| 26.590 | 46.3 | 41.9 | -18.1 | 27.0 | -23.0 | Hot Trace |
| 27.329 | 47.7 | 43.6 | -16.4 | 29.8 | -20.2 | Hot Trace |

Plot 5.5.3.4 Power Line Conducted Emission
Test Configuration 2: Power over Ethernet (PoE) Injector
Line Voltage: 120VAC 60Hz
Line Tested: Neutral

**Current Graph**




**Current List**

| Frequency MHz | Peak dBuV | QP dBuV | Delta QP-QP Limit dB | Avg dBuV | Delta Avg-Avg Limit dB | Trace Name |
|---|---|---|---|---|---|---|
| 0.184 | 48.9 | 44.9 | -19.4 | 29.2 | -25.1 | Neutral Trace |
| 0.186 | 48.0 | 45.2 | -19.1 | 29.3 | -24.9 | Neutral Trace |
| 1.010 | 35.4 | 32.3 | -23.7 | 27.5 | -18.5 | Neutral Trace |
| 26.108 | 45.8 | 43.6 | -16.4 | 38.4 | -11.6 | Neutral Trace |
| 27.300 | 48.2 | 45.2 | -14.8 | 31.0 | -19.0 | Neutral Trace |

## 5.6. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.209 & 15.205]

### 5.6.1. Limit(s)

§ 15.209:

(a) The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

**47 CFR 15.209(a) General Field Strength Limits**

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 – 88 | 100 ** | 3 |
| 88 – 216 | 150 ** | 3 |
| 216 – 960 | 200 ** | 3 |
| Above 960 | 500 | 3 |
| ** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241. | | |

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

### 5.6.2. Method of Measurements

Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods.

### 5.6.3. Test Data

**Remarks:**

- The measuring receiver shall be tuned over the frequency range 9 kHz to 1 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT was initially tested a 10m, signal was not detected at this distance, and test distance was reduced to 3m. The value measured at 3m shall be extrapolated as applicable to compare with limit and measurement distance specified in section 15.209(a).
- Extrapolation factor of 40dB/decade shall be used for frequencies below 30 MHz.

#### 5.6.3.1. Fundamental Emissions

**Remarks:**
- Field strength limit of the fundamental 125 kHz at 300m distance is 20*log(2400/125) = 25.7 dBµV/m
- For frequency band 0.009- 0.490 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 300m E-Field Level (column 3) using the extrapolation factor of 40*log(3/300) = -80 dB

| Frequency (MHz) | Peak E-Field @ 3m (dBµV/m) | Extrapolated E-Field Level @ 300m (dBµV/m) | Antenna Plane (H/V) | § 15.209 (a) Limits @ 300m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|
| 0.125 | 61.60 | -18.40 | V | 25.7 | -44.1 |
| 0.125 | 53.30 | -26.70 | H | 25.7 | -52.4 |

### 5.6.3.2. Harmonic/Spurious Emissions

**Remarks:**

- For frequency band 0.009- 0.490 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 300m E-Field Level (column 3) using the extrapolation factor of 40*log(3/300) = -80 dB
- For frequency bands 0.490-1.705 MHz and 1.705-30.0 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 30m E-Field Level (column 3) using the extrapolation factor of 40*log(3/30) = -40 dB

| Frequency (MHz) | Peak E-Field @ 3m (dBµV/m) | Extrapolated E-Field Level (dBµV/m) | Antenna Plane (H/V) | § 15.209 (a) Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|
| 0.009 - 0.490 | * | * | H / V | 25.7 | * |
| 0.490 - 1.705 | * | * | H / V | 45.7 | * |
| 1.705 - 30.0 | * | * | H / V | 29.5 | * |
| 30 - 88 | * | * | H / V | 40.0 | * |
| 88 - 216 | * | * | H / V | 43.5 | * |
| 216 - 960 | * | * | H / V | 46.0 | * |
| 960 - 1000 | * | * | H / V | 54.0 | * |

* No emission found.

# 5.7. 20 dB BANDWIDTH [47 CFR 15.209 (a)]

## 5.7.1. Limit(s)

Emission bandwidth shall not be located in the restricted bands in 15.205 and the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

## 5.7.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4:2003.

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna. The bandwidth of the fundamental frequency was measured with the spectrum analyzer, with the resolution BW set to 1% to 3 % of the approximate emission width and video BW set to 3 times the resolution BW.

## 5.7.3. Test Data

| Channel Frequency (MHz) | 20 dB Bandwidth (kHz) |
|---|---|
| 125 kHz | 0.418 |

See the following plot for details.

Plot 5.7.3.1: 20 dB Bandwidth
Fc: 125 kHz

ROHDE&SCHWARZ

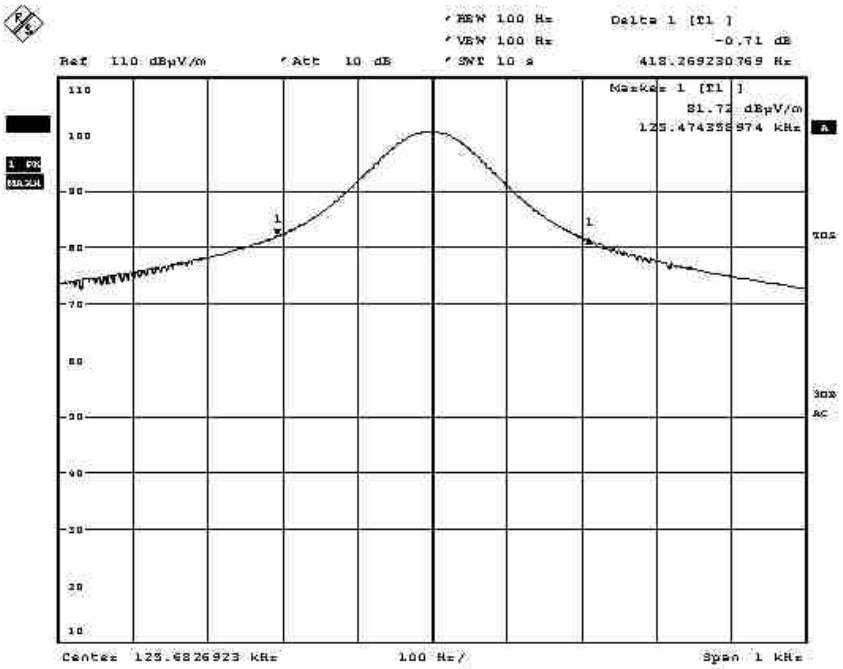
**UltraTech Group of Labs** 18 .Mar 0904 :23

| | |
|---|---|
| **MeasType** | 20dB Bandwidth TDK Chamber |
| **Equipment under Test** | V-Flex4G(U1.P), Model. 4GFXU1P |
| **Manufacturer** | Bioscrypt Inc. |
| **OPCondition** | |
| **Operator** | Hung Trinh |

**TestSpec**
FCC 15.209, RSS 210 & ETSI 300 330

**Sweep Settings ScreenA**

| | | | | | |
|---|---|---|---|---|---|
| Center Frequency | 125 .682692 | kHz | Ref Level | 110 .000 | dBµV /m |
| Frequency Offset | 0.000000 | Hz | Ref Level Offset | 0.000 | dB |
| Span | 1.000000 | kHz | Ref Position | 100 .000 | % |
| Start Frequency | 125 .182692 | kHz | Level Range | 100 .000 | dB |
| Stop Frequency | 126 .182692 | kHz | RF Att | 10 .000 | dB |
| RBW | 100 .000000 | Hz | | | |
| VBW | 100 .000000 | Hz | X-Axis | LIN | |
| Sweep Time | 10 .00 s | | Y-Axis | LOG | |



# EXHIBIT 6. TEST EQUIPMENT LIST

| Test Instruments | Manufacturer | Model No. | Serial No. | Operating Range |
|---|---|---|---|---|
| EMI Receiver System/ Spectrum Analyzer with built-in Amplifier | Hewlett Packard | HP 8546A | 3520A00248 | 9KHz-5.6GHz, 50 Ohms |
| Transient Limiter | Hewlett Packard | 11947A | 310701998 | 9 kHz – 200 MHz 10 dB attenuation |
| L.I.S.N. | EMCO | 3825/2 | 89071531 | 9 kHz – 200 MHz 50 Ohms / 50 μH |
| 12'x16'x12' RF Shielded Chamber | RF Shielding | … | .. | … |
| EMI-Test Receiver | Rohde & Schwarz | ESU40 | 100037 | 20 Hz- 40 GHz Build in amplifier |
| Spectrum Analyzer | Rohde & Schwarz | FSEK30 | 100077 | 20 Hz- 40 GHz |
| Loop Antenna | Emco | 6502 | 2611 | 10 kHz – 30 MHz |
| Biconilog Anenna | Emco | 3142 | 10005 | 26 – 3000 MHz |
| Biconilog Anenna | Emco | 3142B | 1575 | 26 – 2000 MHz |
| Log Periodic | Emco | 93148 | 1101 | 0.2 – 2 GHz |
| Log Periodic | Emco | 3148 | 23845 | 0.2 – 2 GHz |
| Horn Antenna | Emco | 3115 | 6570 | 1 – 18 GHz |
| Horn Antenna | Emco | 3115 | 5955 | 1 – 18 GHz |
| RF Amplifier | Com-Power | PA-103A | 161243 | 10 MHz – 1000 MHz |
| RF Amplifier | Hewlett Packard | 84498 | 3008A00769 | 1 – 26.5 GHz |
| Temperature & Humidity Chamber | Tenney | T5 | 9723B | -40°C - +80°C range |

# EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

## 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION (Line Conducted) | PROBABILITY DISTRIBUTION | UNCERTAINTY (dB) | |
|---|---|---|---|
| | | 9-150 kHz | 0.15-30 MHz |
| EMI Receiver specification | Rectangular | ±1.5 | ±1.5 |
| LISN coupling specification | Rectangular | ±1.5 | ±1.5 |
| Cable and Input Transient Limiter calibration | Normal (k=2) | ±0.3 | ±0.5 |
| Mismatch: Receiver VRC $\Gamma_1$ = 0.03<br>LISN VRC $\Gamma_R$ = 0.8(9 kHz) 0.2 (30 MHz)<br>Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$) | U-Shaped | ±0.2 | ±0.3 |
| System repeatability | Std. deviation | ±0.2 | ±0.05 |
| Repeatability of EUT | -- | -- | -- |
| Combined standard uncertainty | Normal | ±1.25 | ±1.30 |
| Expanded uncertainty U | Normal (k=2) | ±2.50 | ±2.60 |

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30$ dB

$U = 2u_c(y) = \pm 2.6$ dB

## 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION (Radiated Emissions) | PROBABILITY DISTRIBUTION | UNCERTAINTY (± dB) | |
|---|---|---|---|
| | | 3 m | 10 m |
| Antenna Factor Calibration | Normal (k=2) | ±1.0 | ±1.0 |
| Cable Loss Calibration | Normal (k=2) | ±0.3 | ±0.5 |
| EMI Receiver specification | Rectangular | ±1.5 | ±1.5 |
| Antenna Directivity | Rectangular | +0.5 | +0.5 |
| Antenna factor variation with height | Rectangular | ±2.0 | ±0.5 |
| Antenna phase center variation | Rectangular | 0.0 | ±0.2 |
| Antenna factor frequency interpolation | Rectangular | ±0.25 | ±0.25 |
| Measurement distance variation | Rectangular | ±0.6 | ±0.4 |
| Site imperfections | Rectangular | ±2.0 | ±2.0 |
| Mismatch: Receiver VRC $\Gamma_1$ = 0.2<br>Antenna VRC $\Gamma_R$ = 0.67(Bi) 0.3 (Lp)<br>Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$) | U-Shaped | +1.1<br>-1.25 | ±0.5 |
| System repeatability | Std. Deviation | ±0.5 | ±0.5 |
| Repeatability of EUT | | - | - |
| Combined standard uncertainty | Normal | +2.19 / -2.21 | +1.74 / -1.72 |
| Expanded uncertainty U | Normal (k=2) | +4.38 / -4.42 | +3.48 / -3.44 |

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB