# FCC/IC Test Report

**For:**

Proxfinity Inc.

Model Name:

CUE 2.0

Product Description:

CUE 2.0 SMART BADGE

FCC ID: 2AFPT-CUE020
IC ID: 22224-CUE020

Applied Rules and Standards:
47 CFR Parts: 15B, and ICES-003 Issue 6

REPORT #: EMC_PROXF-001-19001_FCC_15B

DATE: 2020-07-14

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**A2LA Accredited**

**IC recognized # 3462B-2**


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*CETECOM* Inc. is a Delaware Corporation with Corporation number: 2905571

## 1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 15B and ICES-003 Issue 6.

No deficiencies were ascertained.

| Company | Description | Model # |
|---|---|---|
| Proxfinity Inc. | CUE 2.0 SMART BADGE | CUE 2.0 |

**Responsible for Testing Laboratory:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2020-07-14 | Compliance | Cindy Li (EMC Lab Manager) | Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-07-15 16:50:12 |

**Responsible for the Report:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2020-07-14 | Compliance | Kevin Wang (Senior EMC Engineer) | Kevin Wang Digitally signed by: Kevin Wang DN: CN = Kevin Wang email = kevin.wang@cetecom.com C = US O = Cetecom Inc. Date: 2020.07.14 21:39:33 -07'00' |

# 2 Administrative Data

## 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

| | |
|---|---|
| **Company Name:** | CETECOM Inc. |
| **Department:** | Compliance |
| **Street Address:** | 411 Dixon Landing Road |
| **City/Zip Code** | Milpitas, CA 95035 |
| **Country** | USA |
| **Telephone:** | +1 (408) 586 6200 |
| **Fax:** | +1 (408) 586 6299 |
| **EMC Lab Manager:** | Cindy Li |
| **Responsible Project Leader:** | Rami Saman |

## 2.2 Identification of the Client

| | |
|---|---|
| **Client Firm/Name:** | PROXFINITY, INC. |
| **Street Address:** | 227 W. MONROE ST. SUITE 5200 |
| **City/Zip Code** | CHICAGO, IL 60606 |
| **Country** | United States |

## 2.3 Identification of the Manufacturer

| | |
|---|---|
| **Manufacturer's Name:** | Same as Client |
| **Manufacturers Address:** | ---------- |
| **City/Zip Code** | ---------- |
| **Country** | ---------- |

# 3 Equipment Under Test (EUT)

## 3.1 EUT Specifications

| | |
|---|---|
| **Model No** | CUE 2.0 |
| **HW Version** | 2.0 |
| **SW Version** | v1.04.37 |
| **FCC-ID** | 2AFPT-CUE020 |
| **IC-ID:** | 22224-CUE020 |
| **Operating Voltage Range** | 3.3 V (min) / 4.2 V (max) |
| **Operating Temperature Range** | Tmin: -10 ºC / Tmax: 85 ºC |
| **Radios included in the device** | Wi-Fi & Bluetooth Radio:<br>• Model Number: Murata LBEE5KL1DX-883<br>• FCC ID: VPYLB1DX<br>• IC ID: 772C-LB1DX<br>• Frequency of Operation: 2400-2483.5 MHz<br><br>NFC:<br>• Model Number: STMcroelectronics M24LR04E-RDW6T<br>• Frequency of Operation: 13.56 MHz +/- 7kHz<br><br>Zigbee/802.15.4:<br>• Model Number: Microchip Technology AT86RF233<br>• Frequency of Operation: 2400-2483.5MHz |
| **Sample Revision** | ☐Prototype ■Production ☐ Pre-Production |
| **EUT Dimensions** | 84mm x 84mm x 12mm |
| **Weight** | 112 grams |
| **EUT Diameter** | ■ < 60 cm ☐ Other _____ |

## 3.2 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Comments |
|---|---|---|---|---|
| **1** | #1 | 2.0 | v1.04.37 | Zigbee conducted sample #1 |
| **2** | #2 | 2.0 | v1.04.37 | Zigbee conducted sample #2, Bluetooth radiated sample |
| **3** | #3 | 2.0 | v1.04.37 | Zigbee radiated sample #3, WiFi sample, 15B sample |

### 3.3 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | Serial Number |
|---|---|---|---|---|
| 1 | ---------- | ---------- | ---------- | ---------- |

### 3.4 Support Equipment (SE) details

| SE # | Type | Model | Manufacturer | Serial Number |
|---|---|---|---|---|
| 1 | AC/DC Adaptor | ---------- | ---------- | ---------- |
| 2 | USB cable | ---------- | ---------- | ---------- |

### 3.5 Test Sample Configuration

| Set-up # | EUT / AE used for set-up | Comments |
|---|---|---|
| 1 | EUT#3 + SE#1 +SE#2 | |

# 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 parts 15B and ICES-003 Issue 6.

## 4.1 Date of Testing:

04/30/2020 – 05/04/2020

## 4.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

| | |
|---|---|
| 9 kHz to 30MHz | ±2.5 dB (Magnetic Loop Antenna) |
| 30 MHz to 1000 MHz | ±2.0 dB (Biconilog Antenna) |
| 1 GHz to 40 GHz | ±2.3 dB (Horn Antenna) |

Conducted measurement

| | |
|---|---|
| 150 kHz to 30 MHz | ±0.7 dB (LISN) |
| RF conducted measurement | ±0.5 dB |

## 4.3 Environmental Conditions during Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

Deviating test conditions are indicated at individual test description where applicable.

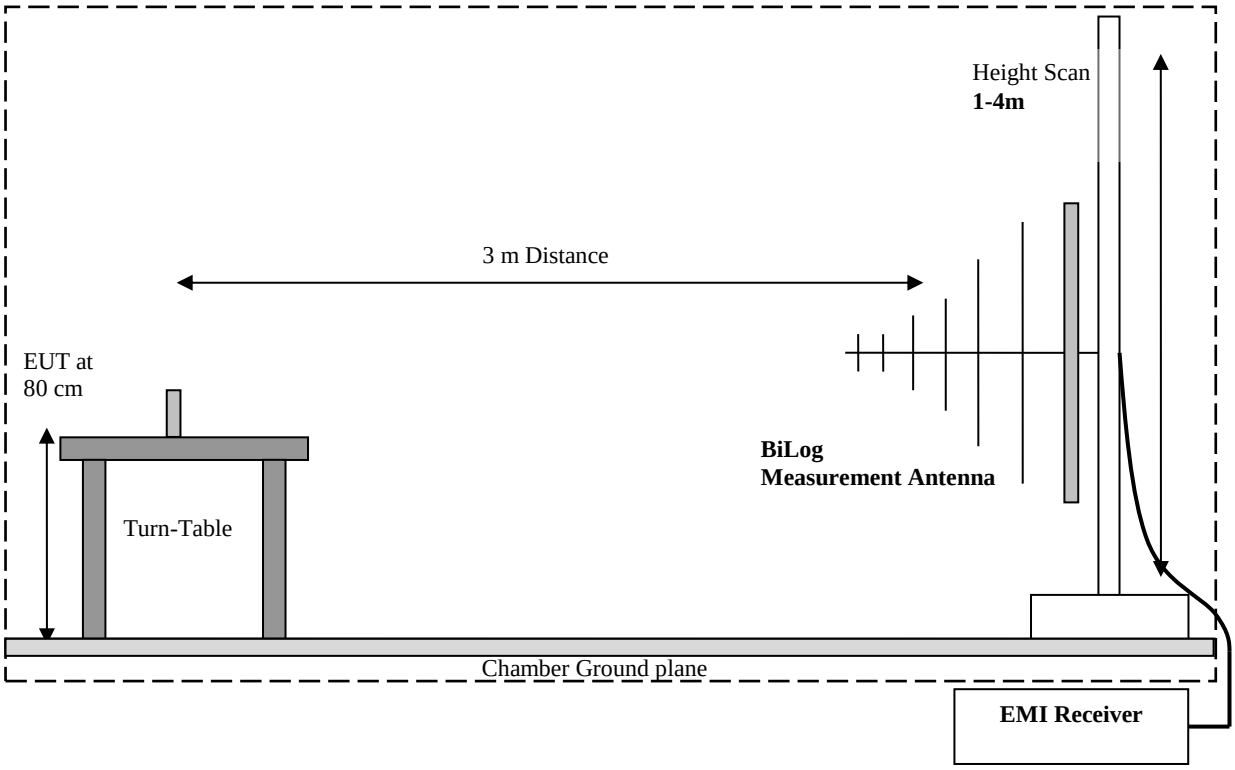
# 5 Measurement Procedures

Testing is performed according to the guidelines provided in ANSI C63.4-2014 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

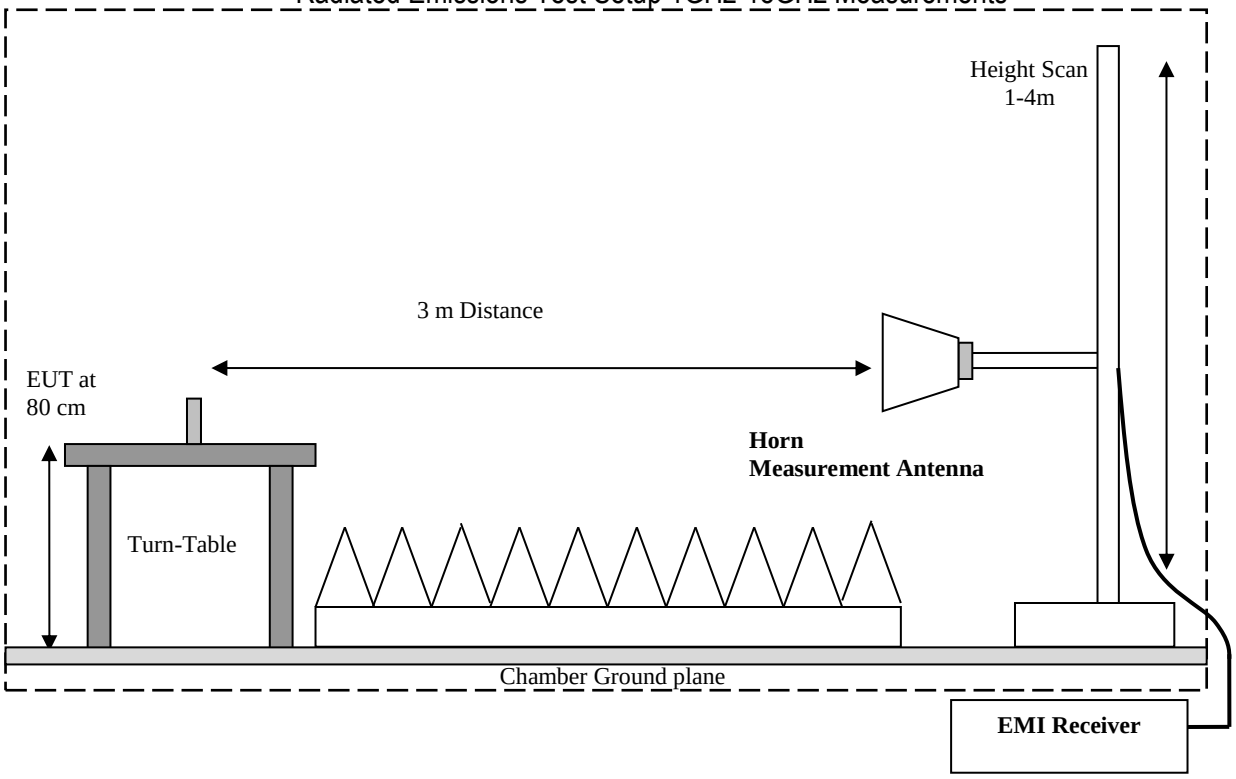
## 5.1 Radiated Measurement for EUT with diameter less than 60 cm

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

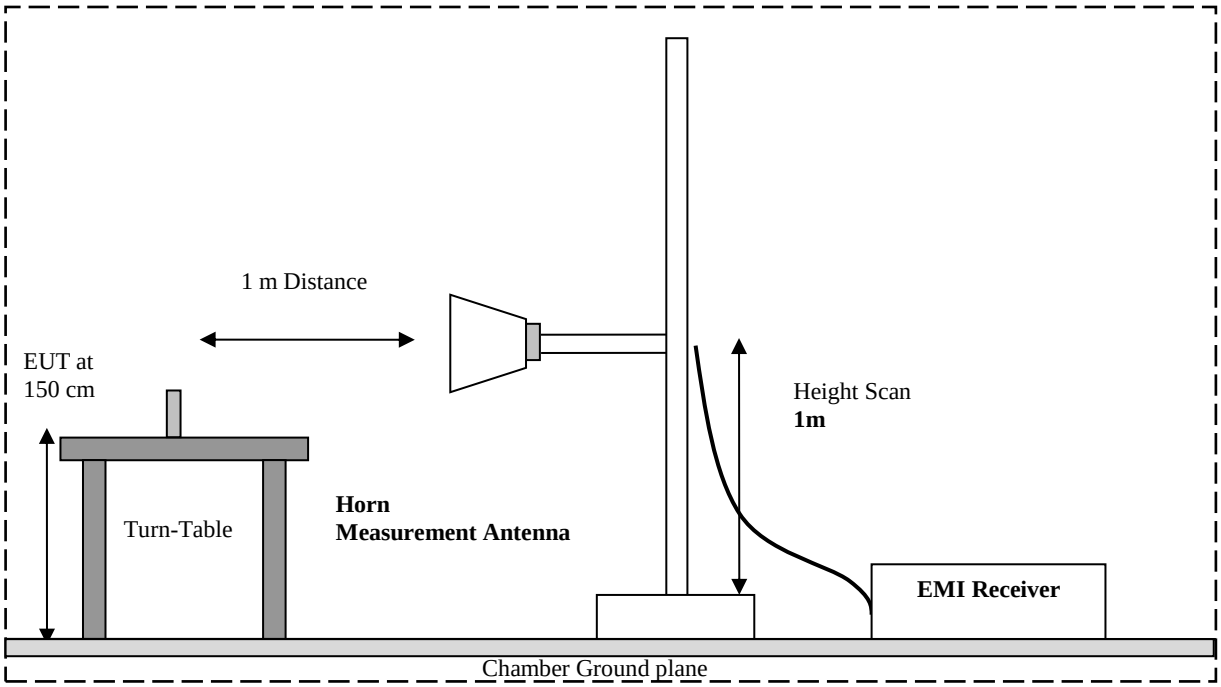
Radiated Emissions Test Setup 30MHz-1GHz Measurements




Radiated Emissions Test Setup 1GHz-18GHz Measurements



Radiated Emissions Test Setup 18GHz-40GHz Measurements




## 5.2 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

- Measured reading in dBµV
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

| Frequency (MHz) | Measured SA (dBµV) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dBµV/m) |
|---|---|---|---|---|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

## 6 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | Fail | NA | NP | Result |
|---|---|---|---|---|---|---|---|---|
| FCC §15.109<br>ICES-003, §6.2 | Radiated Emissions | Nominal | RX Mode | ■ | ☐ | ☐ | ☐ | Complies |
| FCC §15.107<br>ICES-003, §6.1 | Conducted Emissions | Nominal | RX Mode | ■ | ☐ | ☐ | ☐ | Complies |

**Note 1:** NA= Not Applicable; NP= Not Performed.

# 7 Test Result Data

## 7.1 Radiated Emissions Measurement according to CFR 47 Part 15.109 and ICES-003 6.2

| Spectrum Analyzer settings | | |
|---|---|---|
| **Sweep Frequency Range** | 30 MHz – 1 GHz | 1 GHz – 40 GHz |
| **Resolution Bandwidth** | 120 kHz | 1 MHz |
| **Detector (Exploratory Measurements)** | Peak | Peak, Average |
| **Detector (Final Measurements)** | Quasi-Peak | Peak, Average |
| **Trace Mode** | Max Hold | Max Hold |
| **Step Size** | 40 kHz | 800 kHz |
| **Measurement Time (Exploratory Measurements)** | 2 ms | 2 ms |
| **Measurement Time (Final Measurements)** | 100 ms | 100 ms |

### 7.1.1 Limits:

| Class A Limits | | |
|---|---|---|
| **Frequency of emission (MHz)** | **Field Strength @ 10 m (µV/m)** | **Field Strength @ 3 m (dBµV/m)** |
| 30-88 | 90 | 49.5 |
| 88-216 | 150 | 54 |
| 216-960 | 210 | 56.9 |
| Above 960 | 300 | 60 |

| Class B Limits | | |
|---|---|---|
| **Frequency of emission (MHz)** | **Field Strength @ 3 m (µV/m)** | **Field Strength @ 3 m (dBµV/m)** |
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

**Note:** For measurements below 1 GHz, the limits above use a quasi-peak detector. For measurements above 1 GHz, the limits above use an average detector.

### 7.1.2 Test Summary:

| Environmental Conditions | |
|---|---|
| Ambient Temperature: | 24.6°C |
| Relative Humidity: | 45.1% |
| Atmospheric Pressure: | 1010 mbar |

| Test Results | | | | | | |
|---|---|---|---|---|---|---|
| **Plot #** | **EUT Set-Up #** | **EUT operating mode** | **Scan Frequency** | **Power Supply Input** | **Comments** | **Result** |
| 1 - 3 | 1 | Idle Mode | 30 MHz – 18 GHz | 120 VAC | Final measurement | Pass |
| 4 - 6 | 2 | IrDa Mode | 30 MHz – 18 GHz | 120 VAC | Final measurement | Pass |

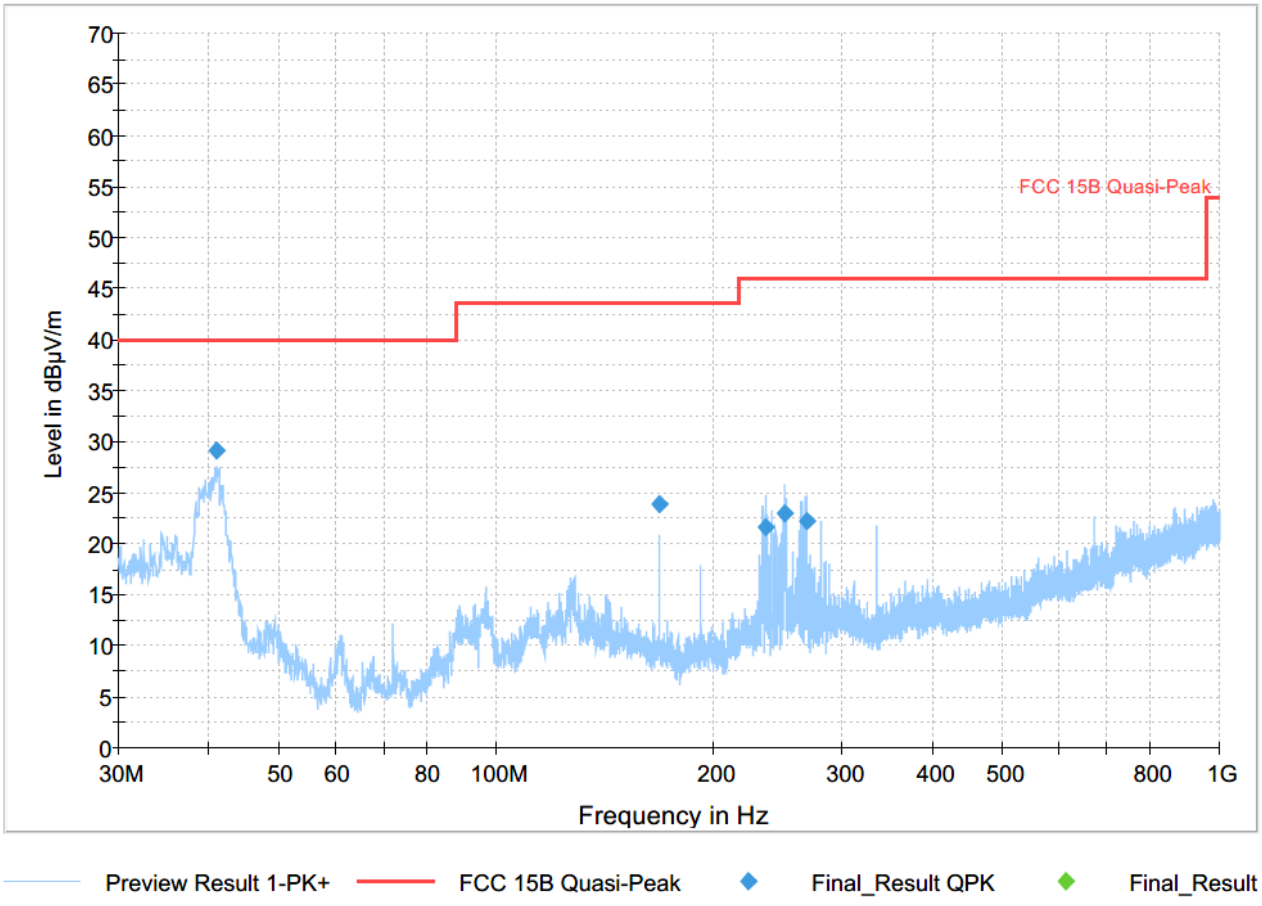
### 7.1.3 Measurement Plots:

**Plot # 1**

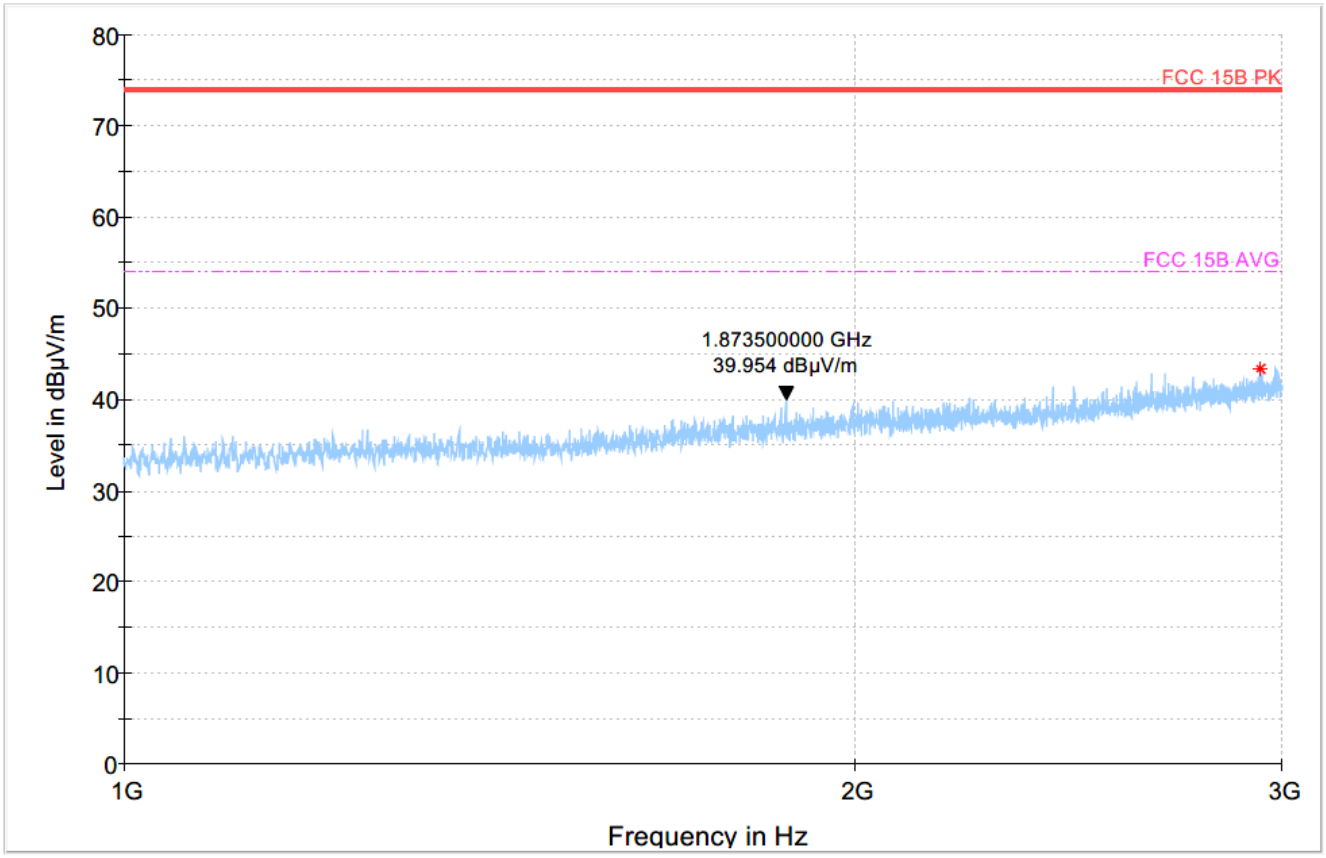
## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|---|---|---|---|---|---|---|---|---|
| 40.950738 | 29.14 | --- | 40.00 | 10.86 | 500.0 | 120.000 | 108.0 | V |
| 167.999916 | 23.89 | --- | 43.52 | 19.63 | 500.0 | 120.000 | 258.0 | H |
| 236.142172 | 21.59 | --- | 46.02 | 24.44 | 500.0 | 120.000 | 132.0 | H |
| 250.168406 | 22.96 | --- | 46.02 | 23.06 | 500.0 | 120.000 | 143.0 | H |
| 268.542616 | 22.20 | --- | 46.02 | 23.82 | 500.0 | 120.000 | 100.0 | H |

*Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.*

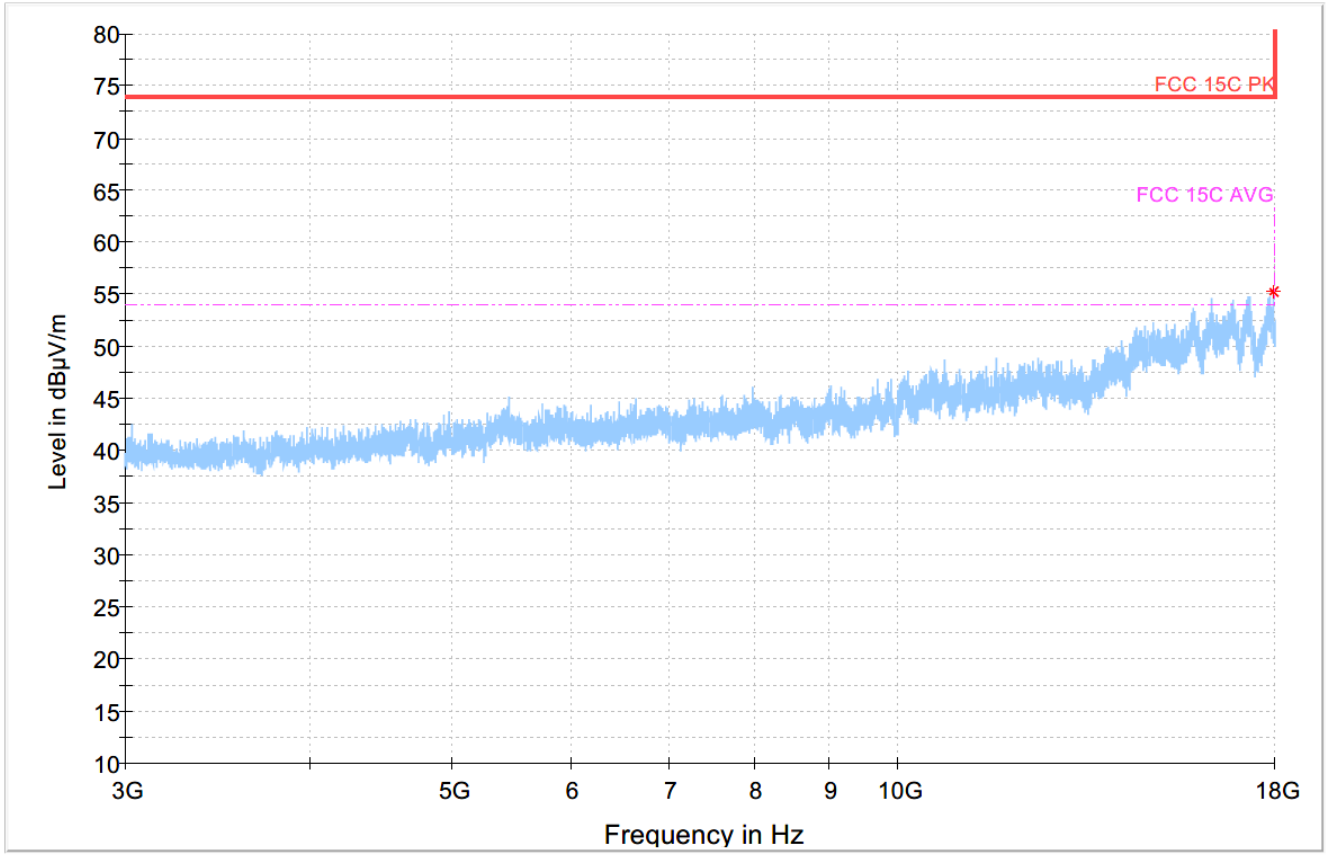


## Plot # 2




Preview Result 1-PK+ Critical_Freqs PK+ FCC 15B PK
FCC 15B AVG Final_Result PK+ Final_Result RMS

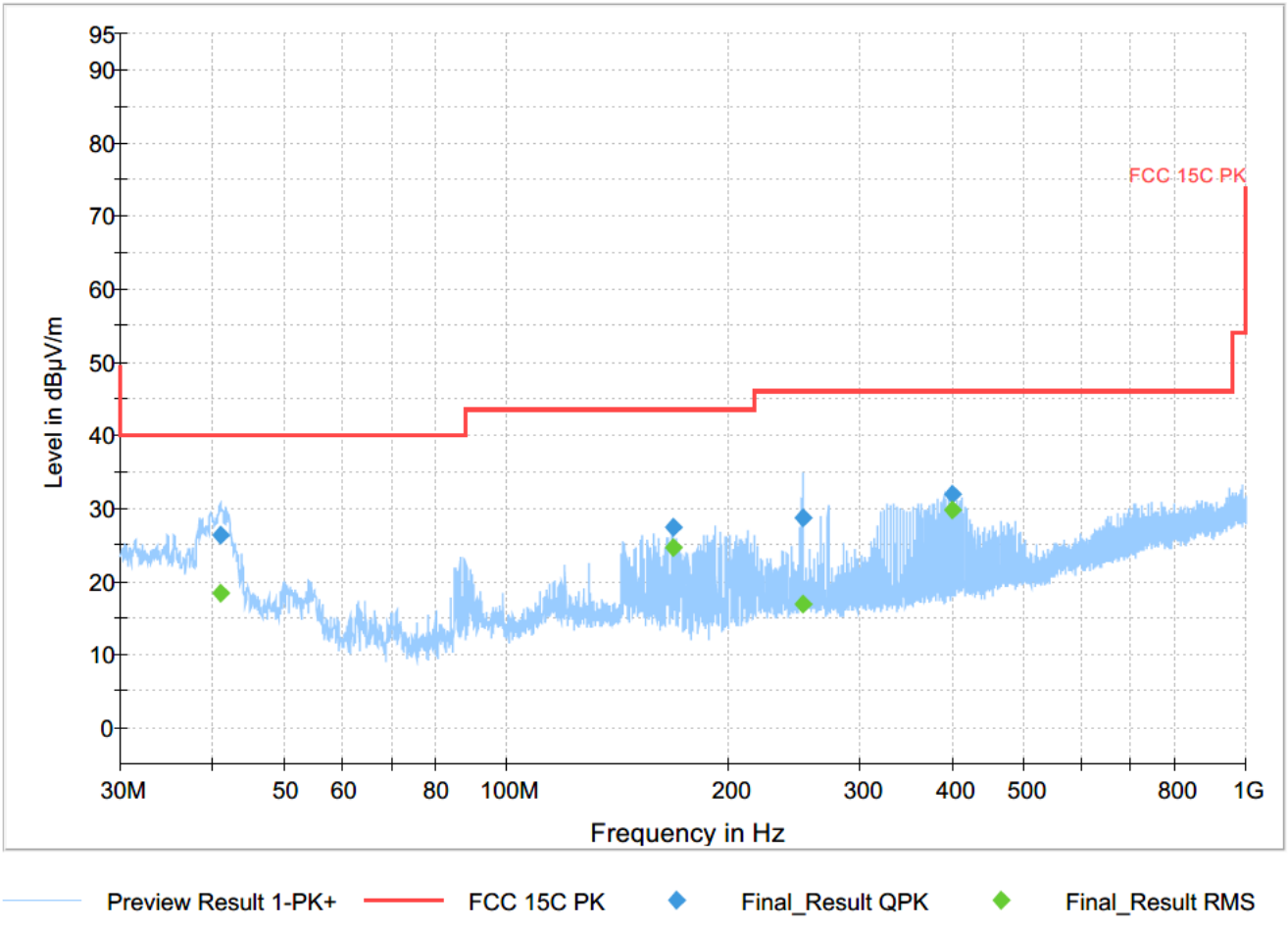
## Plot # 3


80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Level in dBµV/m
FCC 15C PK
FCC 15C AVG
3G
5G
6
7
8
9
10G
18G
Frequency in Hz
Preview Result 1-PK+
FCC 15C AVG
Critical_Freqs PK+
Final_Result PK+
FCC 15C PK
Final_Result RMS

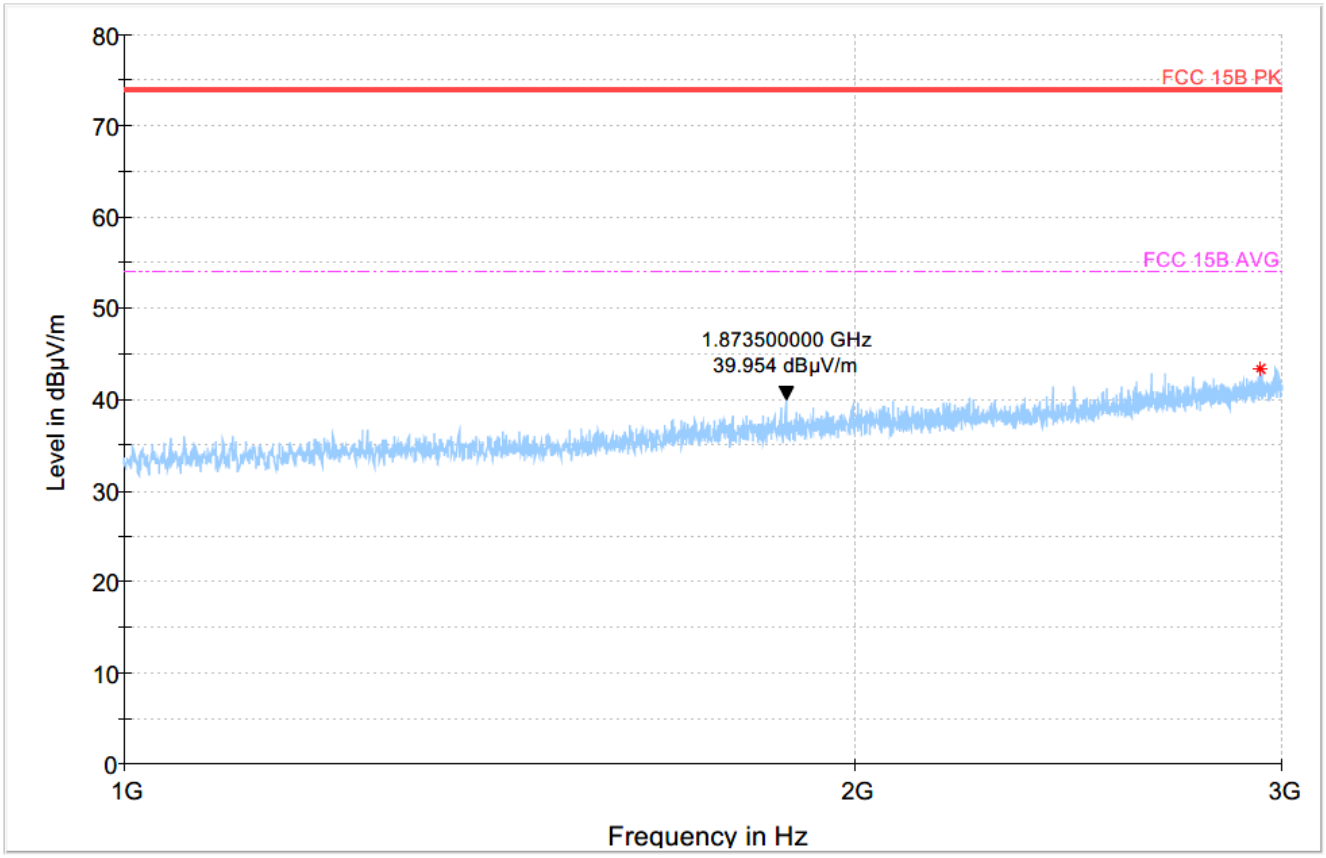
**Plot # 4**

## Final_Result

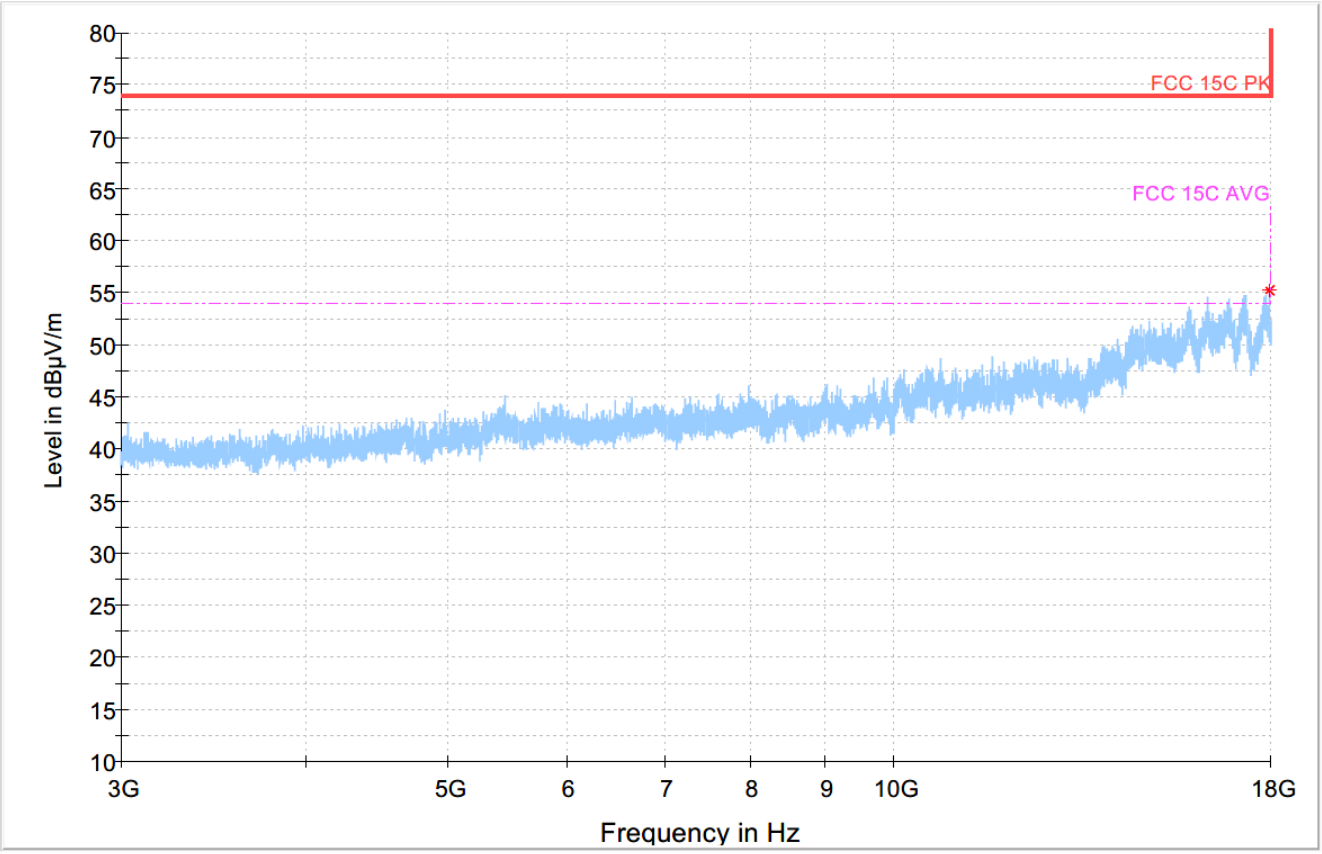
| Frequency (MHz) | QuasiPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|---|---|---|---|---|---|---|---|---|
| 41.030186 | 26.34 | --- | 40.00 | 13.66 | 500.0 | 120.000 | 100.0 | V |
| 41.030186 | --- | 18.45 | --- | --- | 500.0 | 120.000 | 100.0 | V |
| 168.002881 | 27.49 | --- | 43.50 | 16.01 | 500.0 | 120.000 | 100.0 | V |
| 168.002881 | --- | 24.66 | --- | --- | 500.0 | 120.000 | 100.0 | V |
| 251.326055 | 28.79 | --- | 46.00 | 17.21 | 500.0 | 120.000 | 178.0 | H |
| 251.326055 | --- | 16.89 | --- | --- | 500.0 | 120.000 | 178.0 | H |
| 399.836736 | 31.88 | --- | 46.00 | 14.12 | 500.0 | 120.000 | 100.0 | H |
| 399.836736 | --- | 29.69 | --- | --- | 500.0 | 120.000 | 100.0 | H |



## Plot # 5


80
70
60
50
40
30
20
10
0
FCC 15B PK
FCC 15B AVG
1.873500000 GHz
39.954 dBµV/m
Level in dBµV/m
1G
2G
3G
Frequency in Hz
Preview Result 1-PK+
FCC 15B AVG
Critical_Freqs PK+
Final_Result PK+
FCC 15B PK
Final_Result RMS

## Plot # 6




Preview Result 1-PK+
FCC 15C AVG
Critical_Freqs PK+
Final_Result PK+
FCC 15C PK
Final_Result RMS

## 7.2 AC Power line Conducted Emissions according to CFR 47 Part 15.107 and ICES-003 6.1

| Spectrum Analyzer Setting | |
|---|---|
| **Frequency band** | 150 kHz – 30 MHz |
| **Resolution Bandwidth** | 9 kHz |
| **Detector (Exploratory Measurements)** | Peak, Average |
| **Detector (Final Measurements)** | Quasi-Peak, Average |
| **Trace Mode** | Max Hold |
| **Step Size** | 4 kHz |
| **Measurement Time** | 20 ms |

### 7.2.1 Measurement Procedure:

- The EUT and accessories are placed on a non-conducting table 80 cm above the horizontal ground plane and 40 cm from the vertical ground plane.
- Cables that hang closer than 40 cm to the ground plane are gathered into a 30 cm to 40 cm long bundle.
- The power cable of the EUT is connected to the LISN.
- The 6 highest emissions within 20 dB of the limit are noted.

### 7.2.2 Limits:

| Class A Limits | | |
|---|---|---|
| **Frequency of emission (MHz)** | **Conducted Limit (dBµV)** | |
| | **Quasi-peak** | **Average** |
| 0.15-0.5 | 79 | 66 |
| 0.5-30 | 73 | 60 |

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

*Decreases with the logarithm of the frequency

### 7.2.3 Test Summary:

| Environmental Conditions | |
|---|---|
| Ambient Temperature: | 21.8° C |
| Relative Humidity: | 40.4% |
| Atmospheric Pressure: | 1010 mbar |

| Test Results | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Plot #** | **EUT Set-Up #** | **EUT operating mode** | **Detector (Peak / AVG / QP)** | **Line Under Test** | **Power Supply Input** | **Comments** | **Result** |
| 1 | 1 | Idle Mode | Peak & AVG | Line & Neutral | 120V AC | Final measurement | Pass |
| 2 | 2 | IrDa Mode | Peak & AVG | Line & Neutral | 120V AC | Final measurement | Pass |

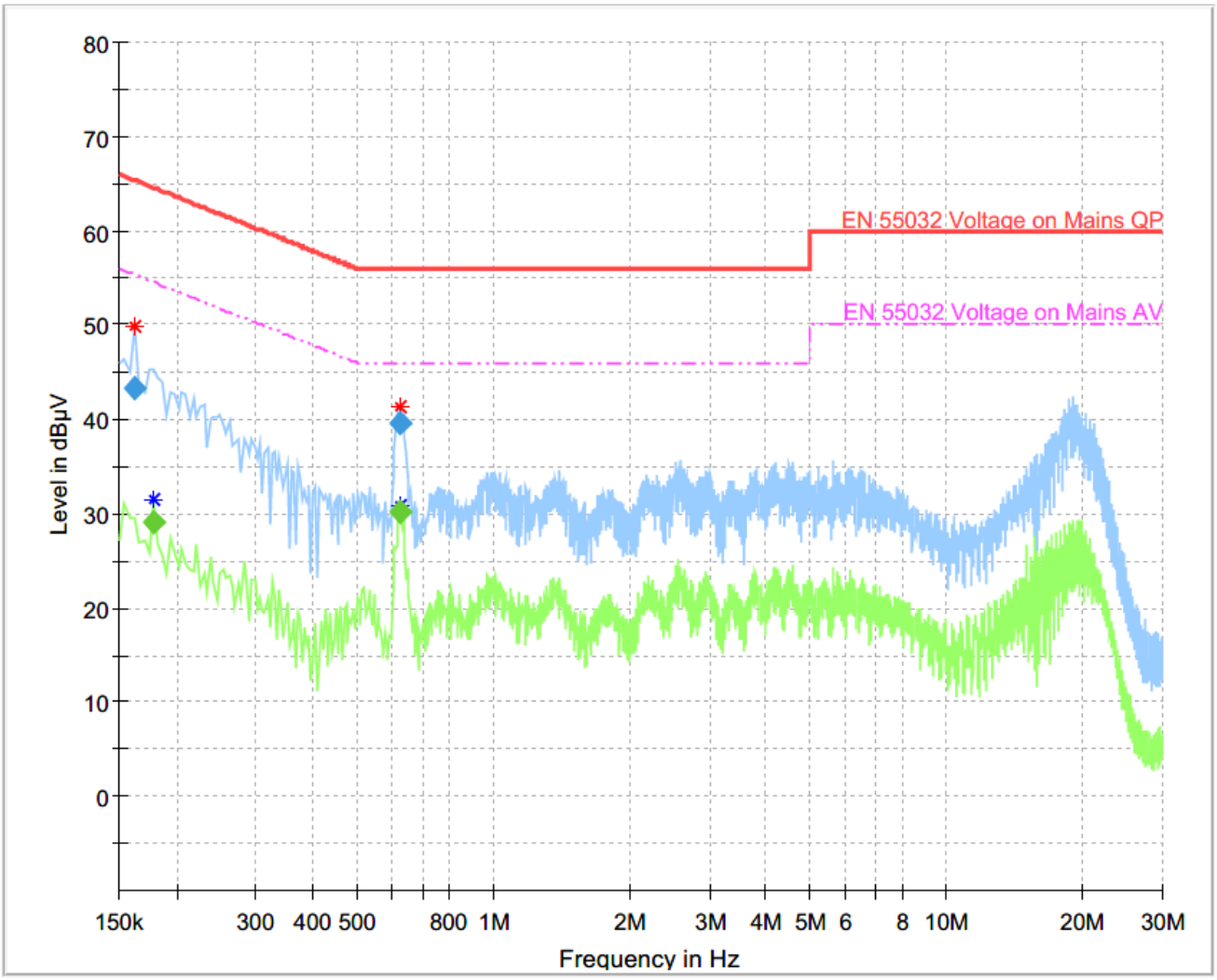
### 7.2.4 Measurement Plots:

**Plot # 1**

## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 0.162 | 43.35 | --- | 65.36 | 22.01 | 500.0 | 9.000 | L1 | GND | 10.8 |
| 0.178 | --- | 29.00 | 54.58 | 25.58 | 500.0 | 9.000 | N | GND | 10.5 |
| 0.622 | --- | 30.21 | 46.00 | 15.79 | 500.0 | 9.000 | N | GND | 10.2 |
| 0.622 | 39.64 | --- | 56.00 | 16.36 | 500.0 | 9.000 | N | GND | 10.2 |

*Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.*

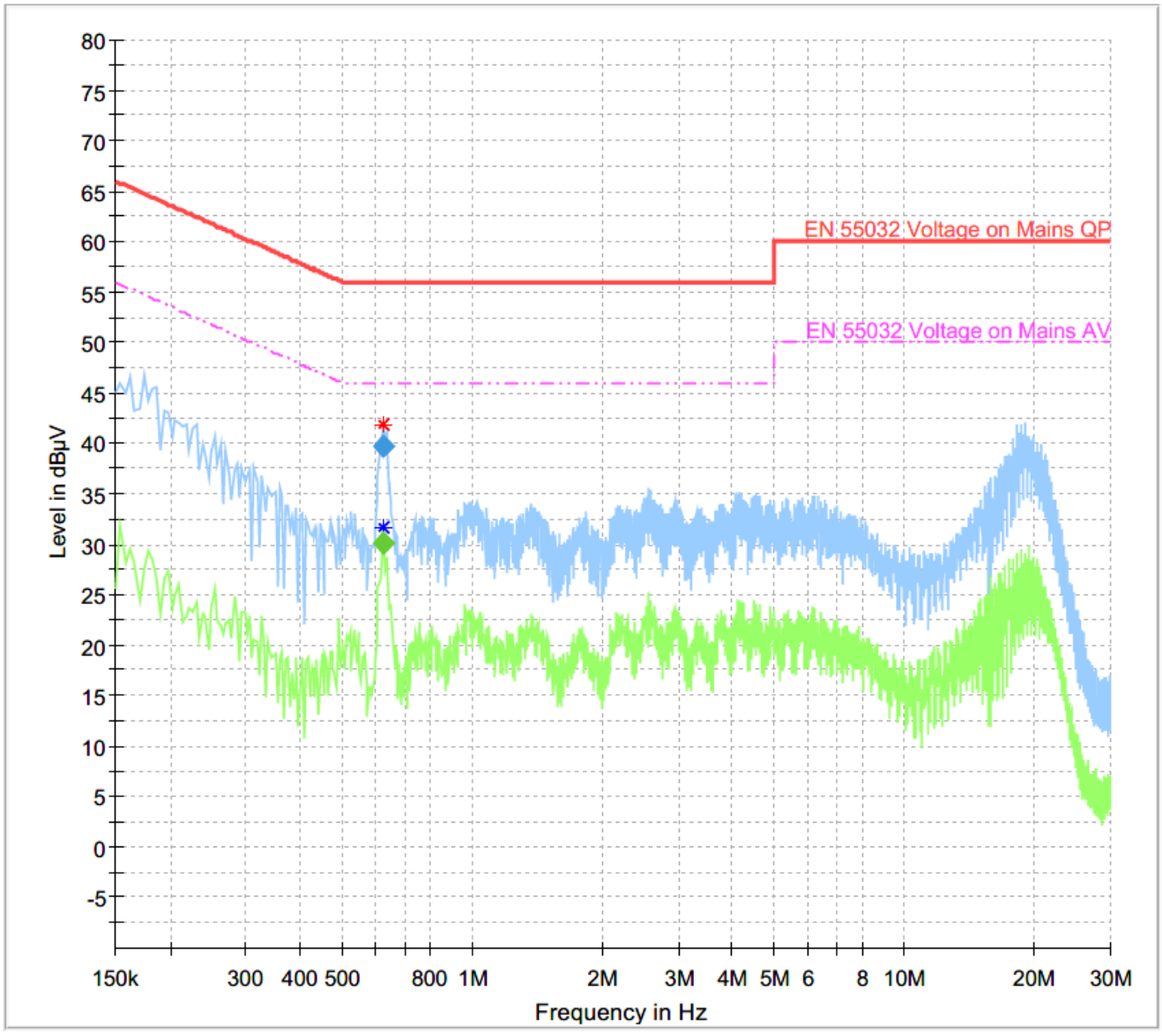


**Plot # 2**

## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 0.622 | --- | 30.21 | 46.00 | 15.79 | 500.0 | 9.000 | N | GND | 10.2 |
| 0.622 | 39.66 | --- | 56.00 | 16.34 | 500.0 | 9.000 | N | GND | 10.2 |

*Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.*



## 8 Test setup photos

Setup photos are included in supporting file name: “EMC_PROXF-001-19001_FCC_Setup_Photos”

## 9 Test Equipment And Ancillaries Used For Testing

| Item Name | Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|---|---|---|---|---|---|---|
| Antenna Biconilog 3142E | Biconlog Antenna | EMCO | 3142E | 166067 | 3 years | 6/27/2017 |
| Magnetic Loop Antenna | Loop Antenna | ETS Lindgren | 6512 | 164698 | 3 years | 7/28/2017 |
| Antenna Horn 3115 SN 35111 | Horn Antenna | EMCO | 3115 | 35111 | 3 years | 7/31/2017 |
| Antenna Horn 3116 | Horn Antenna | ETS Lindgren | 3116 | 70497 | 3 years | 10/31/2017 |
| Antenna Horn 3117 | Horn Antenna | ETS Lindgren | 3117-PA | 159547 | 3 years | 8/8/2017 |
| FSU26 | Spectrum Analyzer | R&S | FSU26 | 200302 | 3 years | 7/16/2019 |
| LISN | Line Impedance Stabilization Network | FCC | FCC-LISN-50-25-2-08 | 8014 | 1 Year | 7/19/2019 |
| Thermometer Humidity | Thermometer Humidity | Control Company | 36934-164 | 191871994 | 2 Year | 1/10/2019 |

**Note:** Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

## 10 Revision History

| Date | Report Name | Changes to report | Report prepared by |
|---|---|---|---|
| 2020-07-14 | EMC_PROXF-001-19001_FCC_15B | Initial Version | Kevin Wang |
| | | | |

<<< The End >>>