



FCC PART 15.247 PERMISSIVE CHANGE TEST REPORT

for the

**GPS Tag Series 200
FCC ID: 2BKI8-201A**

WLL REPORT# 19407-01 REV 0

Prepared for:

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FCC ID: 2BKI8-201A

WLL Report# 19407-01 Rev 0

September 22, 2025

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Reviewed by:

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Abstract

This report has been prepared on behalf of United Mesh Solutions to support the attached application for a permissive change authorization under FCC Part 15.247. The test report and application are submitted for incorporating a patch antenna into the device. The information provided within this report is only applicable to the device herein documented as the EUT.

For this permissive change, the device is the GPS Tag Series 200. Please note that the EUT is currently certified under FCC ID: 2BKI8-201A.

Radiated testing was performed in the Semi Anechoic Chamber Test-site (SAC) 3m chamber of Washington Laboratories, Ltd., located at: 4840 Winchester Boulevard, Suite 5., Frederick, MD 21703. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The United Mesh Solutions, GPS TAG SERIES 200 complies with the requirements for a Digital Transmission System (DTS) transmitter device under FCC Part 15.247.

Revision History	Description of Change	Date
Rev 0	Initial Release	September 22, 2025



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1 Introduction

1.1 Compliance Statement

The United Mesh Solutions, GPS Tag Series 200 complies with the requirements for a Digital Transmission System (DTS) transmitter device under FCC Part 15.247.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with the 2020 version of ANSI C63.10. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	United Mesh Solutions c/o MPR Associates, Inc
Purchase Order Number:	1758-0006-PO-010
Quotation Number:	75266

1.4 Test and Support Personnel

Washington Laboratories, LTD:	Kent Geerlings
Customer Representative:	Luis Caban

1.5 Testing Algorithm

The GPS Tag Series 200 was provided in a steady TX ON mode for testing. The EUT sample was loaded with test-mode software/firmware to allow individual channels to dwell, hop, sweep, and/or receive only as needed for required testing. The EUT was tested in a powered on, steady state. The 2.4GHz ISM radio was exercised as necessary to meet the requirements of the testing. For conducted methods of measurement, the radio was observed through the uFl antenna port. For radiated emissions the EUT was set to transmit at the low channel of 2405MHz mode. Only the worst-case emissions are provided throughout this report. Additionally, for transmit power setting, or transmit gain setting, please note that the test-mode software was set to a value of “70”. This setting was maintained for all testing.



1.6 Test Location

All measurements herein were performed by Washington Laboratories in Frederick, Maryland. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

1.7 Customer Supplied Data or EUT Information

Please note that the applicant has provided the information regarding the EUT antenna change. The test laboratory is not responsible for verifying the accuracy of this information.

1.8 Software Employed by the Test Laboratory

The following test and measurement software were used by the Laboratory:

- (1) Amplifier Research, EMCWare Software Suite v7.0.4
- (2) Keysight 2019, Update Rev. A.25.08
- (3) Keysight 2023, Update Rev. A.33.03

1.9 Deviations to the Standard or Test Plan

There were no deviations to the requirements of the standard(s).

1.10 Reason for Permissive Change

This permissive change was performed due to a new patch antenna being incorporated into the EUT. The details of the new patch antenna are as follows: Manufacturer: Molex; P/N: 212498 Series; Max Gain: 3.7dBi; Type: Patch, U.FL

Please note that the EUT is currently certified under FCC ID: 2BKI8-201A. The unit was certified with an Abracon AMCA31-2R450G-S1F-T3 Ceramic chip antenna with 2.3 dBi gain.

1.11 Testing Dates

9/12/2025 to 9/15/2025



2 Equipment Under Test

2.1 EUT Identification

The results obtained relate only to the item(s) tested.

Table 1: EUT Device Summary

Grantee:	United Mesh Solutions (UMS)
EUT Manufacturer:	MPR Associates, Inc.
FCC ID:	2BKI8-201A
EUT Model:	GPS Tag Series 200
Part Number:	1758-2404-003
FCC Rule Parts:	§ 15.247
Frequency Range:	2405 to 2480 MHz
Peak Output Power:	5.46 dBm (0.0035 Watts)
FCC Emission Designator:	834KG1D
6dB Occupied Bandwidth:	834.1 kHz
Keying and Type of Information:	Automatic, Digital
Number of Channels:	16
Interface Cables:	None
Power Source & Voltage:	DC Battery (voltage not disclosed)
Software/Firmware Version:	<i>Declared Confidential by Applicant</i>
Testing Dates:	9/12/2025 and 9/15/2025



2.2 EUT Description

The UMS GPS Tag device receives signals and collects sensor data. The EUT is powered by a battery; the battery is not rechargeable.

2.3 EUT Configuration

The EUT was comprised of the following equipment, provided on the following page. All Modules, PCBs, etc. listed were considered as part of the EUT, as tested.

Table 2: EUT and Host Configuration List

EUT Description	Model	Part Number	Serial Number	Revision
Tag	Tag Series 200	1758-2404-003	--	0

Table 3: EUT Port and Cable Configuration

Ref. ID	EUT Port Name	Cable/Port Description	Qty.	Length (meters)	Shielded	Term.
--	--	--	--	--	--	--

Table 4: Support Equipment

Name/ Description	Manufacturer	Model Number
Supporting Device (from client, not to be tested)	UMS	--
Laptop with Terminal	--	--



3 Measurements

3.1 References

ANSI C63.2 (Jan-2016) Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 (Jan-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

EN 55032 (CISPR 32:2015) Electromagnetic compatibility of multimedia equipment – Emission Requirements

3.2 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSS Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm \sqrt{\frac{a^2}{div_a^2} + \frac{b^2}{div_b^2} + \frac{c^2}{div_c^2} + \dots}$$

Where:

uc	= standard uncertainty
a, b, c	= individual uncertainty elements
Div _a , Div _b , Div _c	= the individual uncertainty element divisor based on the probability distribution
Divisor	= 1.732 for rectangular distribution
Divisor	= 2 for normal distribution
Divisor	= 1.414 for trapezoid distribution



Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where

- U = expanded uncertainty
- k = coverage factor
- k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)
- uc = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 5 below.

Table 5: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR32, CISPR14, FCC Part 15	± 2.63 dB
Radiated Emissions	CISPR11, CISPR32, CISPR14, FCC Part 15	± 4.55 dB



3.3 Test Equipment List

Table 6 provides a list of the test equipment used for data measurements along with the calibration information.

Table 6: Test Equipment List

Test Name:	Radiated Emissions Testing	Test Date: 9/12/2025 to 9/13/2025	
Asset #	Manufacturer/Model	Description	Cal. Due
00993	KEYSIGHT N9020B	MXA SIGNAL ANALYZER	11/6/2025
00276	ELECTRO-METRICS BPA-1000	RF PRE-AMPLIFIER	4/18/2026
00644	SUNOL SCIENCES JB1	BICONALOG ANTENNA	12/2/2026
00865	STORM 874-0101-036	HF COAXIAL CABLE	6/6/2026
00825	CABLE ASSOCIATES MTC1010	SMA COAXIAL CABLE	6/17/2026
00806	MINI-CIRCUITS CBL-6FT-SMSM	6FT SMA -SMA	6/17/2026
00066	B&Z (HP)	HF PRE-AMPLIFIER 1-26.5GHZ	8/25/2026
00425	ARA DRG-118/A	ANTENNA DRG 1-18GHZ	6/25/2028
01029	RF-LAMDA RW62HORN20B	HORN ANTENNA	8/8/2027
00742	PENN ENGINEERING WR284	2.2-4.15GHZ BANDPASS FILTER	8/21/2027
00282	ITC 21X-3A1	WAVEGUIDE 6.8-15GHZ	8/21/2027
00283	ITC 21KU-3A1	WAVEGUIDE 9.8-20.5GHZ	8/21/2027
00281	ITC 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	8/21/2027
00280	ITC 21C-3A1	WAVEGUIDE	8/21/2027

3.4 Environmental Conditions During All Testing

Ambient Temperature	Between 16°C and 23°C
Relative Humidity	Between 39% and 60%



4 Test Results

The table below provides the compliance results for a DTS transmitter, in accordance with FCC Part 15.247. Full test results are shown in subsequent report sub-sections.

Table 7: Testing and Results Summary

FCC Rule Part	Method	Description	Result
15.247(a)(2)	Conducted	Occupied Channel Bandwidth	Pass
15.247 (b)(3)	Conducted	Transmit Output Power	Pass
15.247 (d)	Radiated	Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	Radiated	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen [8.8]	AC Conducted Emissions	N/A *

* the EUT is not subject to the provisions of 15.207.



4.1 Occupied (DTS) Bandwidth

For a DTS operating in the 2.4GHz band, FCC Rule Part 15.247(a)(2) requires the minimum 6dB bandwidth be at least 500 kHz. The 99% BW shall also be recorded.

For this permissive change, the transmitter OBW of the EUT shall closely resemble the original filing test data for the EUT.

The OBW data from the original filing is as follows:

OET Data:

Emissions Designator	Channel Frequency	6dB Bandwidth	99% Bandwidth
834KG1D	2405 MHz	835.3 kHz	2.2115 MHz

4.1.1 Measurement Method

This test was performed in accordance with Clause 11.8.2, Option 2, of ANSI C63.10-2020.

This test was performed as a conducted at the antenna port measurement.

4.1.2 Test Data

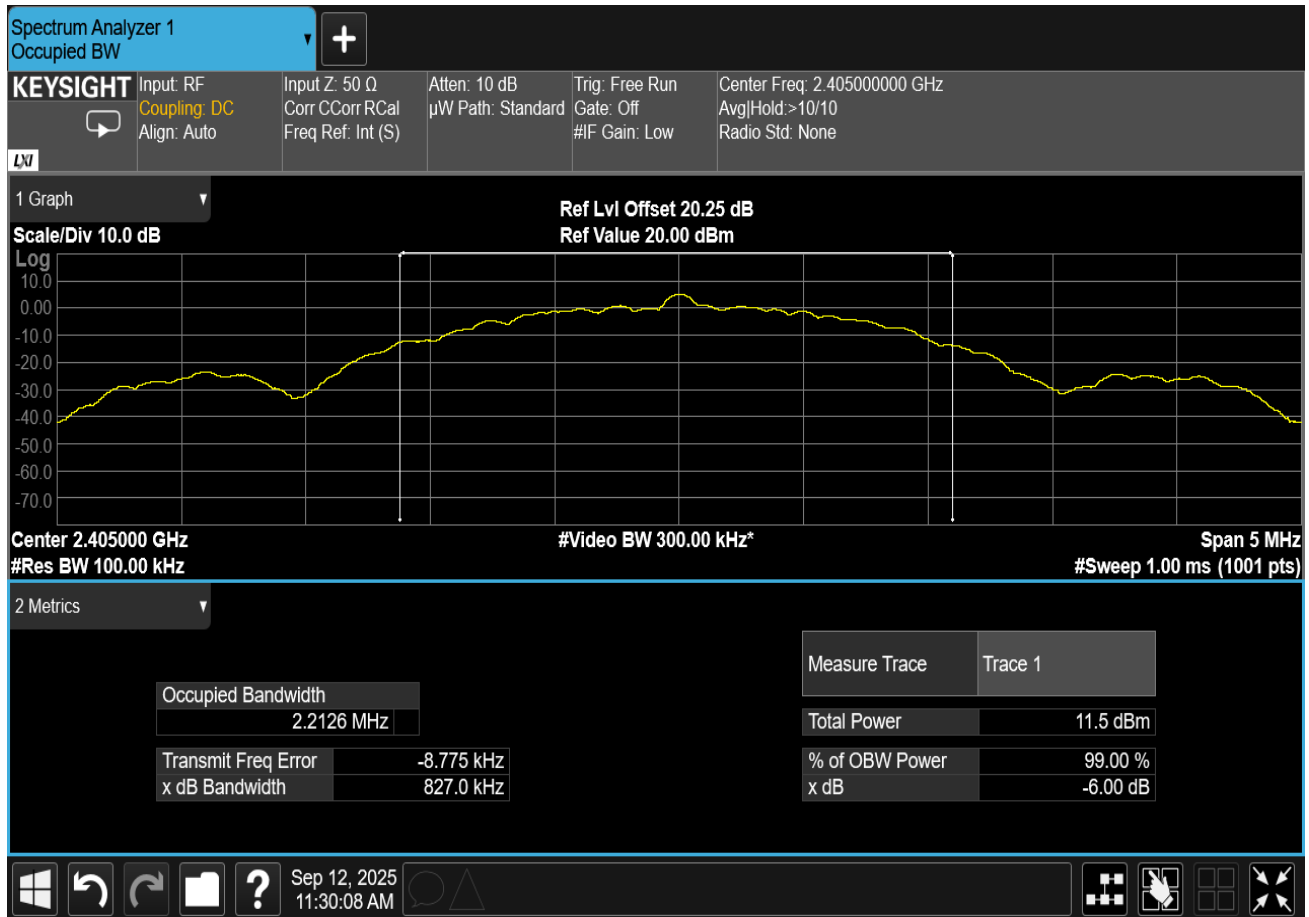
The EUT was configured to transmit a low channel, hopping disabled.

The EUT is compliant with the requirements of this test.

The final permissive change test data is provided below.



Figure 1: Permissive Change, Occupied Bandwidth, Low Channel



-6dB OBW = 827.0 kHz

99% OBW = 2.2126 MHz



4.2 Peak Transmit Power

For a DTS operating in the 2.4GHz band, FCC Rule Part 15.247(b)(3) requires that the maximum peak conducted output power shall not exceed 30 dBm (1W). Additionally, the EIRP shall not exceed 36 dBm. For this permissive change, the transmitter power of the EUT shall closely resemble the original filing test data.

The transmit output power data from the original filing is as follows:

OET Data:

Emissions Designator	Channel Frequency	Conducted Power (dBm)	EIRP (dBm)
834KG1D	2405 MHz	5.46	7.76

4.2.1 Measurement Method

This test was performed in accordance with Clause 11.9.1.1, of ANSI C63.10-2020.

This test was performed as a conducted at the antenna port measurement.

4.2.2 Test Data

The EUT was configured to transmit a modulated signal, with channel hopping disabled.

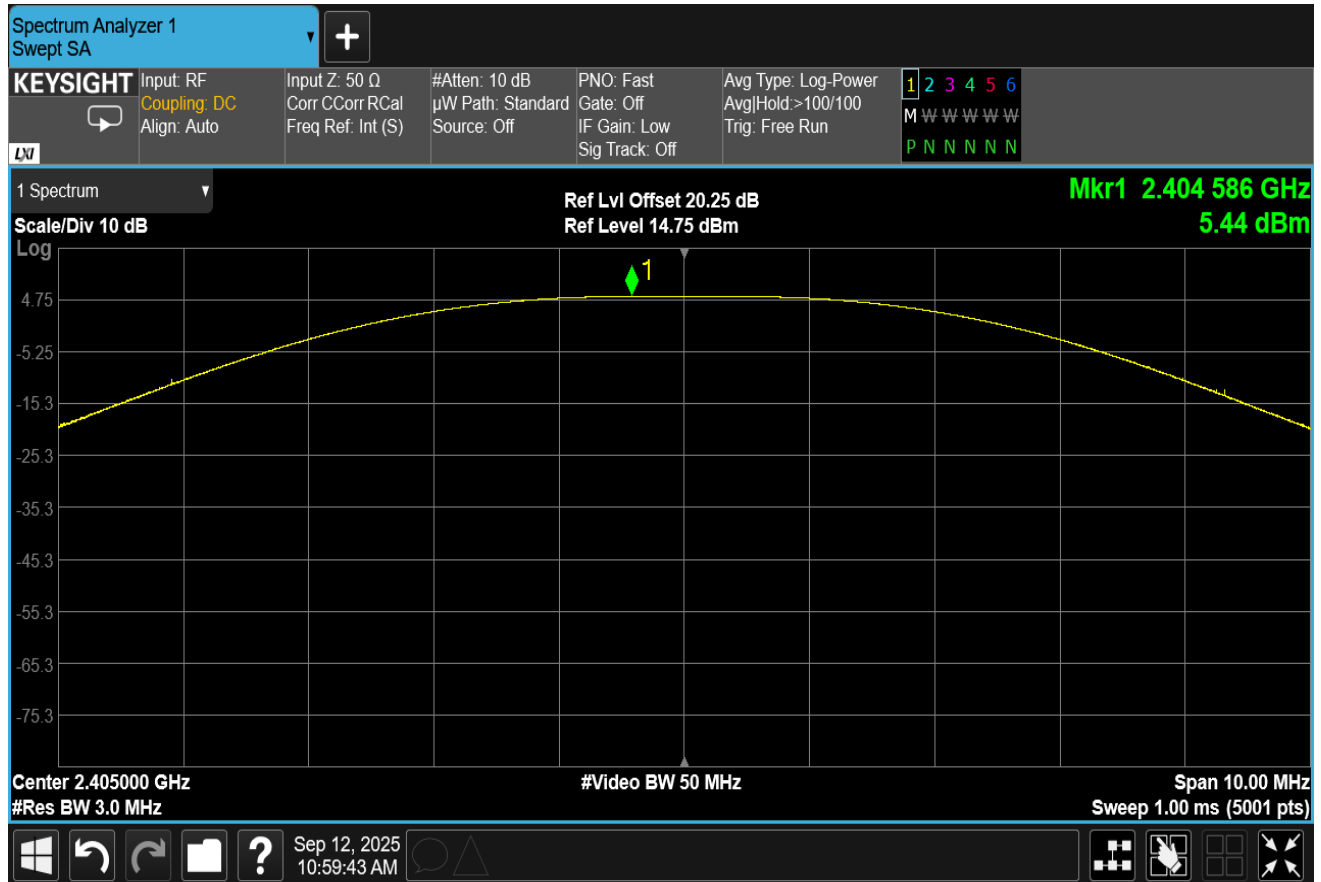
The EUT is compliant with the requirements of this test.

When comparing the conducted power, the final result is acceptable

The final permissive change test data is provided below.



Figure 2: Permissive Change, Conducted Output Power, Low Channel



OET power = 5.46 dBm

CIIPC power = 5.44 dBm



4.3 Radiated Emissions

4.3.1 Requirements

Compliance Standard: FCC Part(s) 15.209, 15.247, 15.205

Radiated Emissions, Compliance Limits	
Frequency Range	15.209 (3-meters)
30 to 88 MHz	100 μ V/m
88 to 216 MHz	150 μ V/m
216 to 960 MHz	200 μ V/m
> 960 MHz	500 μ V/m

4.3.2 Test Procedure

The requirements of FCC Part 15 call for the EUT to be placed on a 1 X 1.5 meters non-conductive motorized turntable for radiated testing on an open air test site. The height of the table is 80cm for testing below 1GHz. The height of the table is 150cm for testing above 1GHz. Please note the test distances: from 30MHz to 18GHz, 3-meters. From 18GHz to 26.5GHz, 2-meters.

An initial pre-scan of the EUT was performed to identify any emissions that exceed, or come within 6dB of, the applicable limit. This pre-scan was performed with the employment of a spectrum analyzer peak detector function. The highest amplitude (worst-case) emissions noted during the pre-scan were selected for final compliance measurements.

The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Broadband log periodic and double-ridged horn antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The output of the antenna was connected to the input of the spectrum analyzer and the emissions in the frequency range of 30MHz to 26.5GHz were measured. When applicable, any peripherals were placed on the table in accordance with ANSI C63.4 and cables are varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The detector function was set to quasi-peak for measurements below 1 GHz. The measurement bandwidth of the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. For measurements above 1 GHz, the average levels are recorded, using a measurement bandwidth of 1 MHz, with a video bandwidth setting of 20 Hz, in the case of video averaging. Otherwise, an EMI AVG detector was employed.



4.3.3 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antenna(s) and other measurement equipment. These factors include the antenna factor ((AF)(in dB/m)), cable loss factors ((CF)(in dB)), and the pre-amplifier gain [if applicable] ((G)(in dB)). These correction values are algebraically added to the raw Spectrum Analyzer Voltage (in dBμV) to obtain the corrected radiated electric field, which shall be the final corrected logarithm amplitude ((Corr. Meas.)(in dBμV/m)). This logarithm amplitude is then compared to the FCC limit, which has been converted to a unit of log in dBμV/m.

Example:

Spectrum Analyzer Voltage:	VdBμV (SA)
Antenna Correction Factor:	AFdB/m
Cable Correction Factor:	CFdB
Pre-Amplifier Gain (if applicable):	GdB
Electric Field:	$EdB\mu V/m = V\ dB\mu V\ (SA) + AFdB/m + CFdB - GdB$
To convert from linear units of measure:	$dBuV/m = 20\text{LOG}(uV/m)$
To convert limits, based on D_{Measure} :	$3m\ \text{Limit} = 10m\ \text{Limit} + 20\text{LOG}(10/3)$

4.3.4 Test Data

The EUT complies with the Radiated Emission requirements.

A complete investigation of the radiated fundamental field strength was performed. The EUT was evaluated in three orthogonal axes (x, y, z). The EUT position the produced the highest radiated power was maintained during all testing.

The EUT was investigated and scanned for radiated emissions in the range of 30MHz to 26.5GHz, which covers the tenth harmonic of the fundamental.

There were no emissions detected from the EUT above 8 GHz.

Only the worst-case emissions levels are provided.



Table 8: Radiated Emissions Test Data, 30MHz to 26GHz

Frequency (MHz)	Detector	Corr. Meas (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Turn Table (deg)	Antenna (cm)
303.987	Peak	25.368	--	--	120	Vert, 100
	QP	23.195	46	-22.805	120	Vert, 100
562.973	Peak	25.123	--	--	120	Vert, 100
	QP	17.744	46	-28.256	120	Vert, 100
988.181	Peak	30.12	--	--	120	Horiz, 100
	QP	24.023	54	-29.977	120\	Horiz, 100

Frequency (GHz)	Detector	Corr. Meas (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Turn Table (deg)	Antenna (cm)
2.390	Peak	41.403	74	-32.597	0	Horiz, 250
	Avg	28.771	54	-25.229	0	Horiz, 250
2.405	Peak	99.937	--	--	0	Horiz, 250
	Avg	--	--	--	--	--
5.172	Peak	53.906	74	-20.094	0	Horiz, 250
	Avg	36.484	54	-17.516	0	Horiz, 250
7.214	Peak	58.315	74	-15.685	15	Vert, 160
	Avg	46.573	54	-7.427	15	Vert, 160
*10.798	Peak	63.136	74	-10.864	15	Vert, 160
	Avg	50.148	54	-3.852	15	Vert, 160
*11.998	Peak	62.848	74	-11.152	15	Vert, 160
	Avg	48.499	54	-5.501	15	Vert, 160

*Ambient

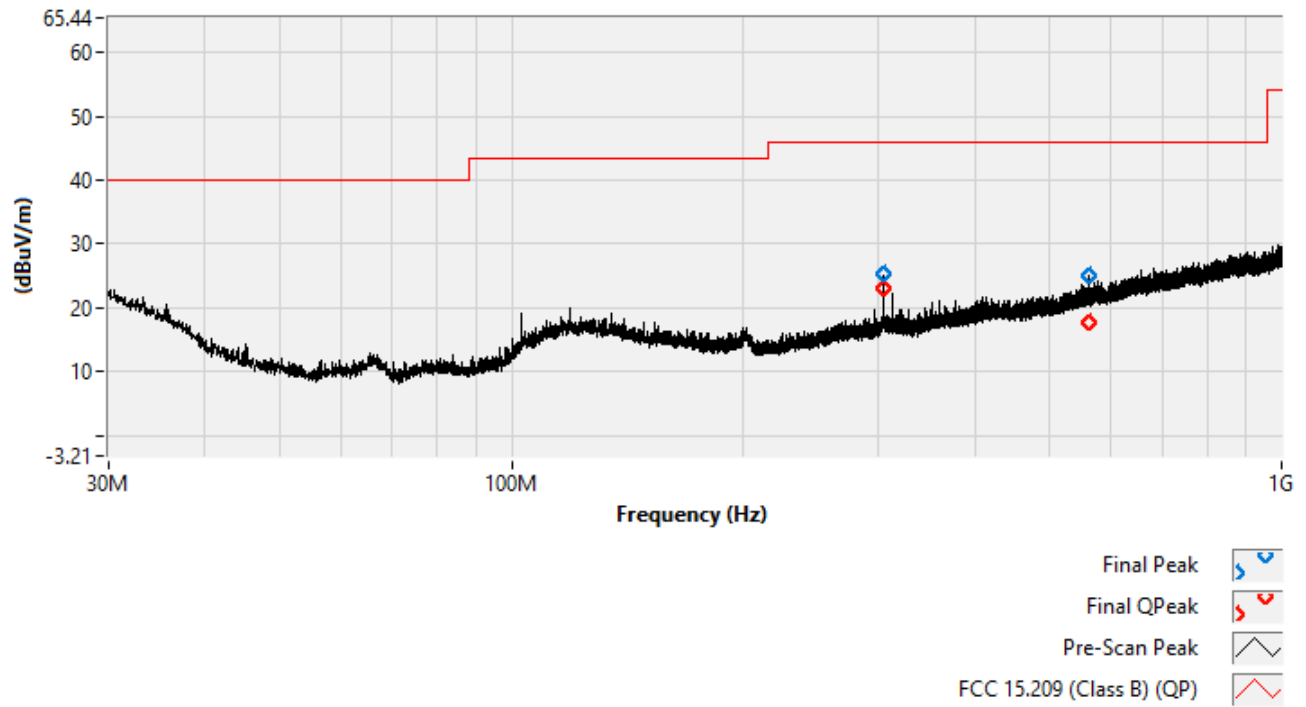


Frequency (GHz)	Detector	Corr. Meas (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Turn Table (deg)	Antenna (cm)
*13.169	Peak	56.716	74	-17.284	15	Vert, 160
	Avg	43.179	54	-10.821	15	Vert, 160
*16.089	Peak	58.995	74	-15.005	15	Vert, 160
	Avg	45.329	54	-8.671	15	Vert, 160
*17.751	Peak	63.138	74	-10.862	15	Vert, 160
	Avg	49.721	54	-4.279	15	Vert, 160

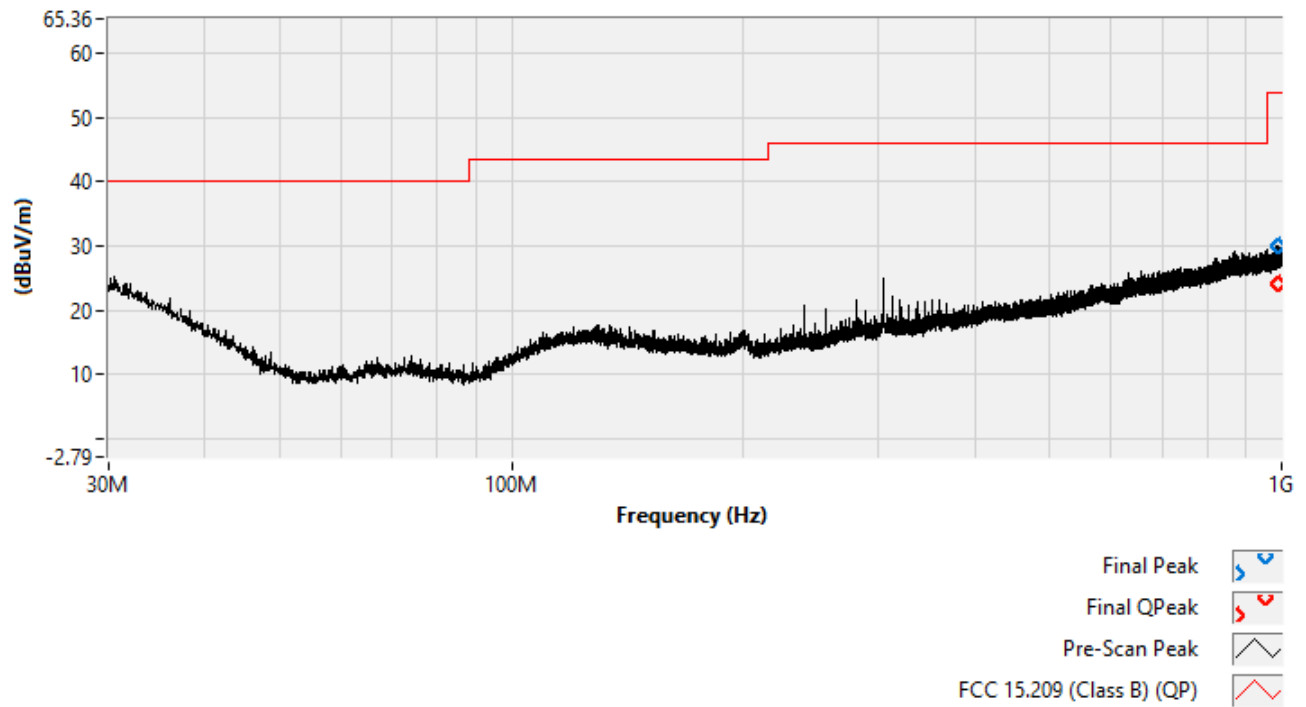
*Ambient



Pre-scan and Final Data (Vertical)

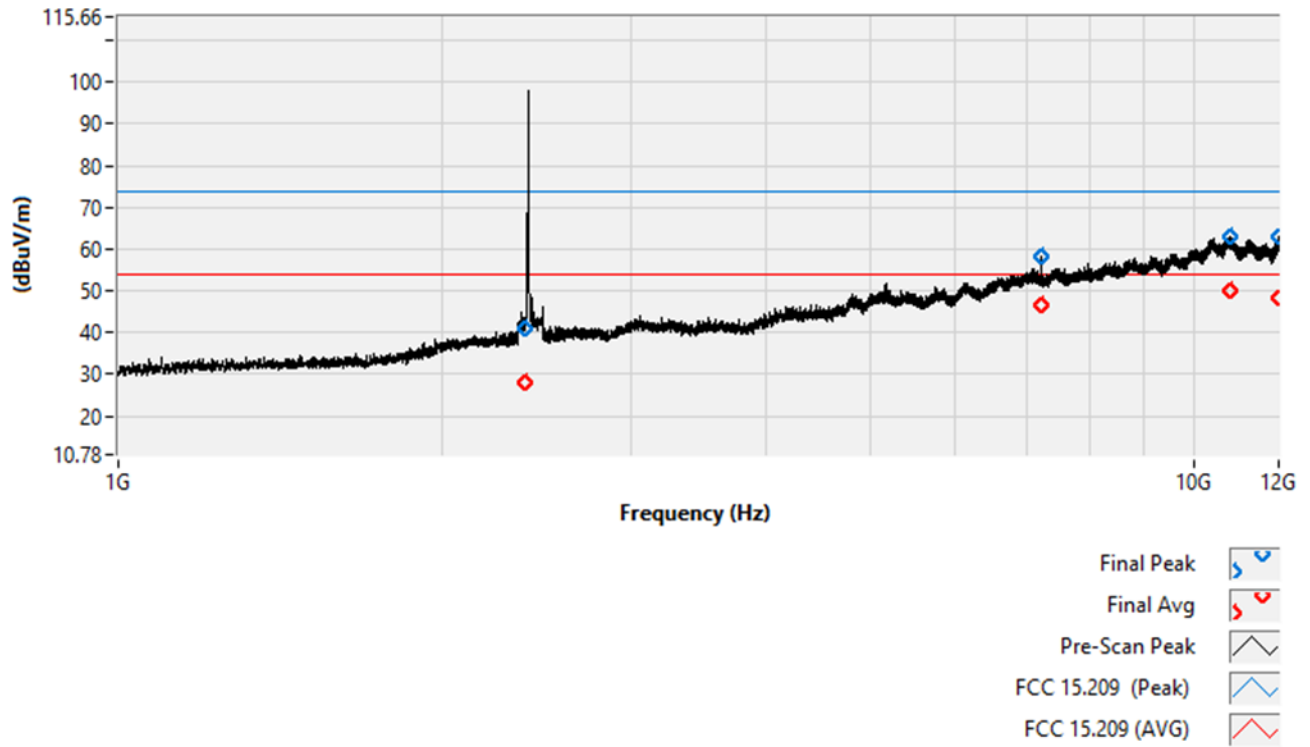


Pre-scan and Final Data (Horizontal)

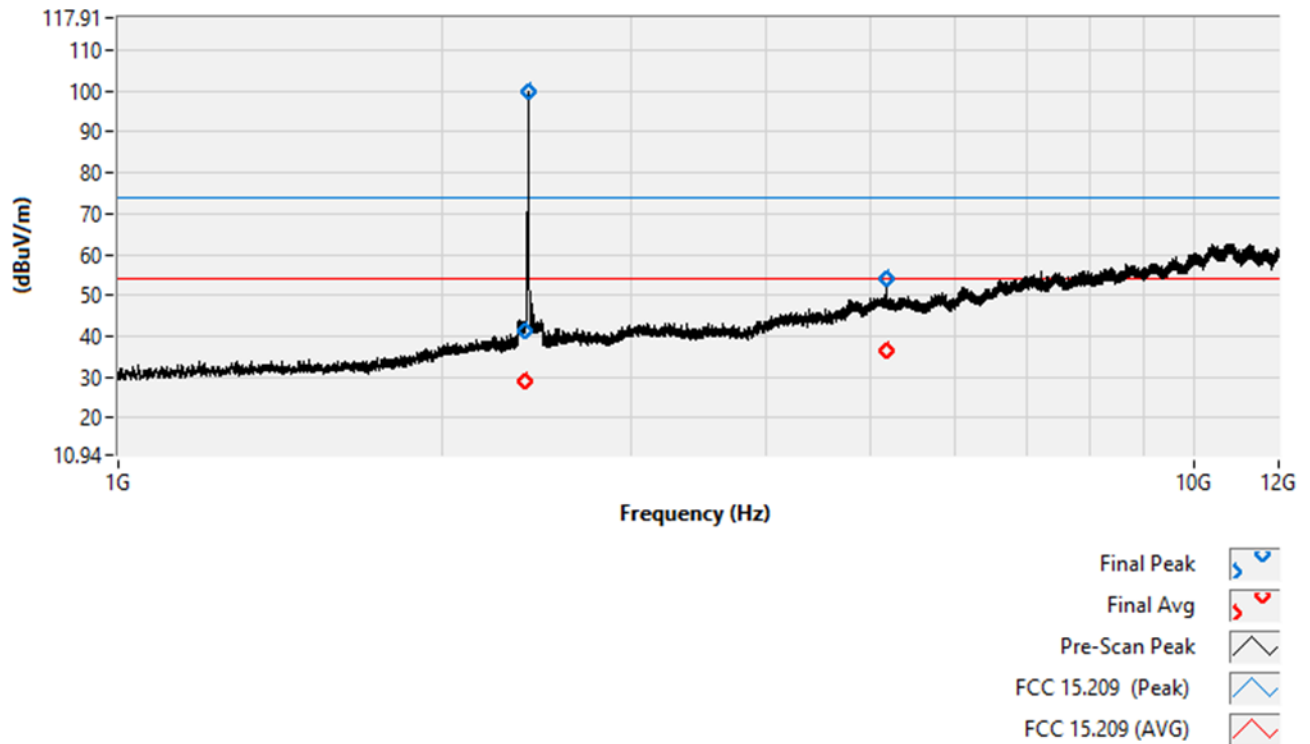




Pre-scan and Final Data (Vertical)

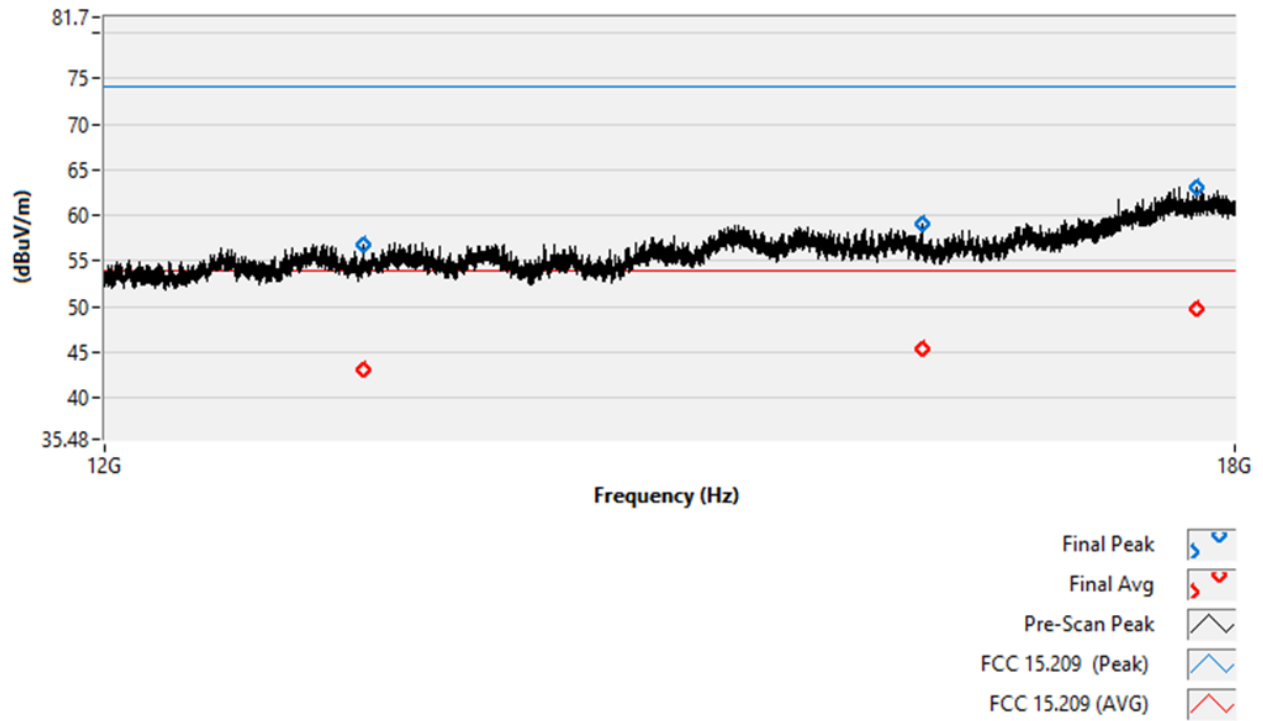


Pre-scan and Final Data (Horizontal)

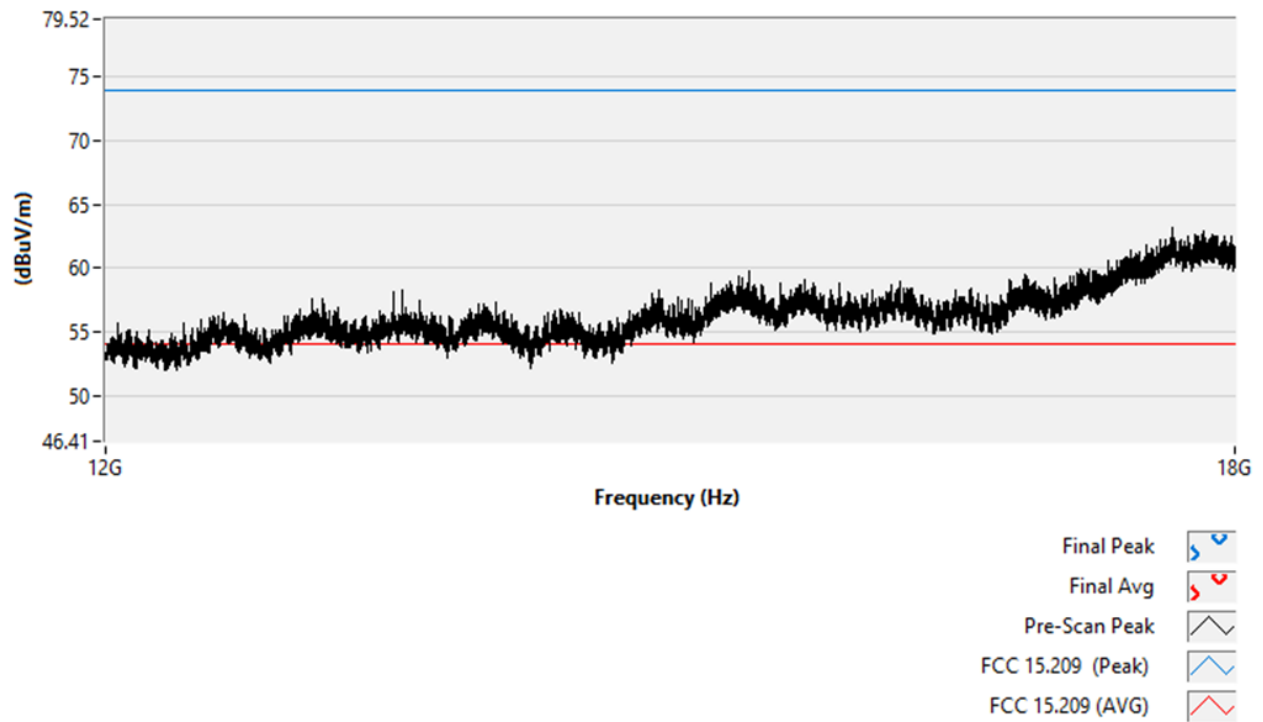




Pre-scan and Final Data (Vertical)



Pre-scan and Final Data (Horizontal)





4.4 AC Powerline Conducted Emissions

4.4.1 Requirement

Compliance Standard: FCC Part 15.207.

FCC Compliance Limits				
Frequency Range	Class A Device		Class B Device	
	Quasi-peak	Average	Quasi-peak	Average
0.15 – 0.5 MHz	79 dB μ V	66 dB μ V	66 to 56 dB μ V	56 to 46 dB μ V
0.5 – 5 MHz	79 dB μ V	66 dB μ V	56 dB μ V	46 dB μ V
0.5 – 30 MHz	73 dB μ V	60 dB μ V	60 dB μ V	50 dB μ V

4.4.2 Test Summary

The EUT was not evaluated for AC powerline emissions.

The EUT is battery powered only and the battery is not rechargeable.