FCC / ISED Test Report

For:

Universal Audio, Inc.

Model Name:

GPM-WDR, GPM-RUBY, GPM-DRM

Product Description:

Guitar Effects Pedal

FCC ID: 2AXKQ2029
ISED ID: 26610-2029

Applied Rules and Standards:
KDB996369
47 CFR Part 15.247 (DTS)
RSS-247 Issue 2 (DTSs) & RSS-Gen Issue 5

REPORT #: EMC_UNIVE-013-21001_KDB996369_Rev1
DATE: 2022-1-31

A2LA Accredited

IC recognized #
3462B-1

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

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1 Assessment

The following device was evaluated against the applicable criteria specified in KDB996369, and FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations, and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
Universal Audio, Inc.	Guitar Effects Pedal	GPM-WDR, GPM-RUBY, GPM-DRM

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2022-1-31	Compliance	Kevin Wang (EMC Lab Manager)	kevin. wang@cetecom. com Digitally signed by: kevin. wang@cetecom.com DN: CN = kevin.wang@cetecom. com Date: 2022.02.01 12:02:48 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2022-1-31	Compliance	Kris Lazarov (EMC Engineer)	Kris Lazarov Digitally signed by Kris Lazarov Date: 2022.01.31 11:19:19 -08'00'

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:	Kevin Wang
Responsible Project Leader:	Palacios, Cathy

2.2 Identification of the Client

Client's Name:	Universal Audio, Inc.
Street Address:	4585 Scotts Valley Drive
City/Zip Code	Scotts Valley, CA 95066
Country	USA

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:	GPM-WDR, GPM-RUBY, GPM-DRM
HW Version :	10005438, 10005439, 10005440
SW Version :	1.1.0
FCC-ID :	2AXKQ2029
ISED-ID:	26610-2029
FWIN:	1.1.0
HVIN:	GPM-DRM, GPM-RUBY, GPM-WDR
PMN:	Dream '65 Reverb-Amp, Ruby '63 Top Boost Amplifier, Woodrow '55 Instrument Amplifier
Product Description:	Guitar Effects Pedal
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels
Modes of Operation:	Bluetooth LE in both advertising and connected mode of operation
Antenna Information as declared:	max gain 0 dBi
Power Supply/ Rated Operating Voltage Range:	Vmin: 8.55 VDC/ Vnom: 9 VDC / Vmax: 9.45 VDC
Operating Temperature Range	0 ºC to 40 ºC
Other Radios included in the device:	Non
Sample Revision	☐Prototype Unit; ☐Production Unit; ■Pre-Production

Note: All three models have the same Main PCBA. The Top Panel PCBA is different since WDR has a two-position spring loaded switch, but DRM and RUBY have a three-position spring loaded switch. All models have different firmware.

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	21432050100065	10005440	1.1.0	Woodrow

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	Power Supply	PSAC12R-090	Phihong	N/A

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1 + AE#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The internal antenna was connected.

3.5 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets at highest power on mid channel, and highest possible duty cycle. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in KDB996369.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	BTLE	■	☐	☐	Complies

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

6 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.

Measurement System		EMC 1	EMC 2
Conducted emissions (mains port)		1.12 dB	0.46 dB
Radiated emissions	(< 30 MHz)	3.66 dB	3.88 dB
	(30 MHz – 1GHz)	3.17 dB	3.34 dB
	(1 GHz – 3 GHz)	5.01 dB	4.45 dB
	(>3 GHz)	4.0 dB	4.79 dB

6.1 Environmental Conditions during Testing:

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

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

6.2 Dates of Testing:

11/22/2021

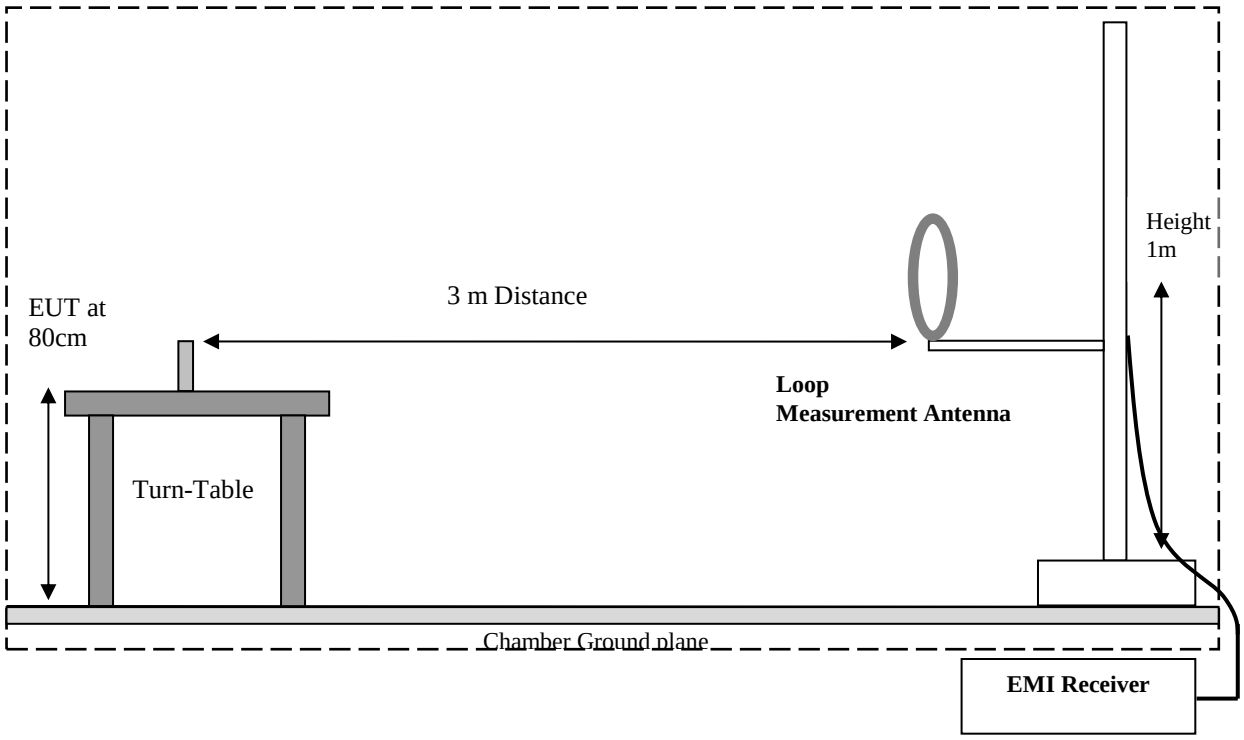
7 Measurement Procedures

7.1 Radiated Measurement

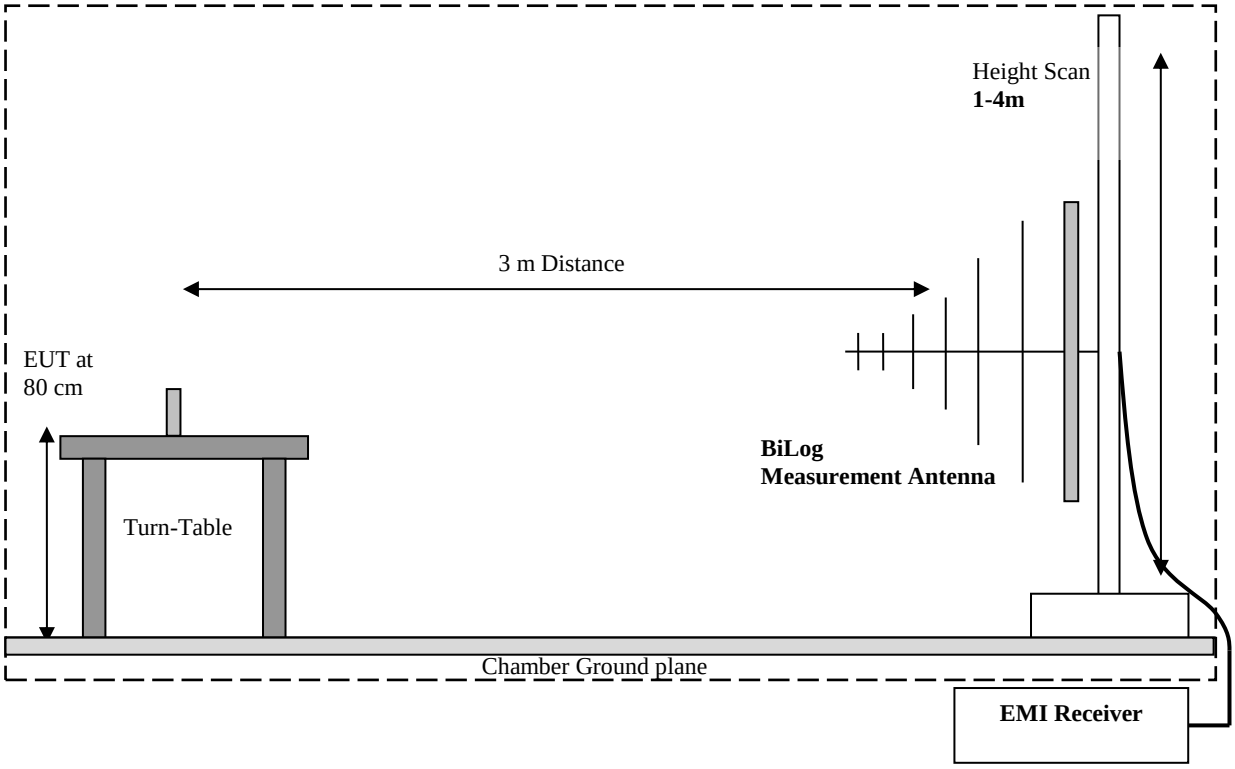
The radiated measurement is performed according to ANSI C63.10 (2013)

- 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.

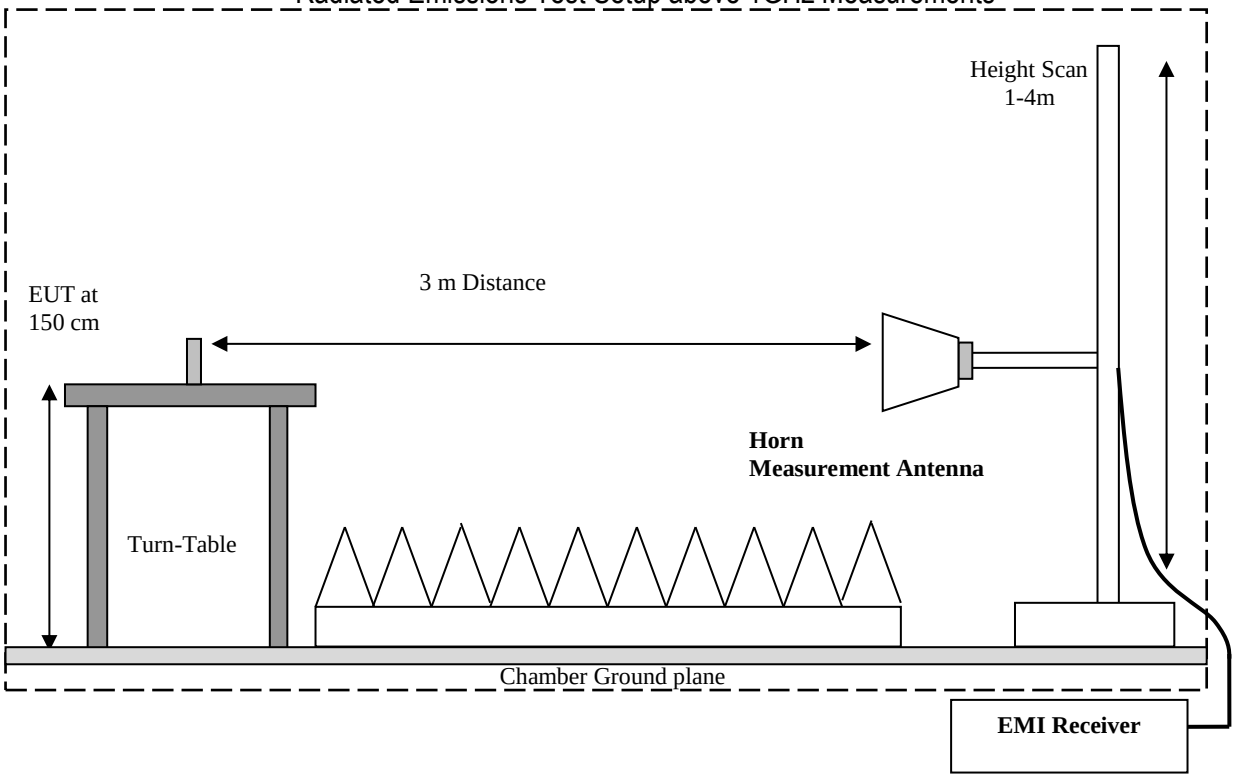
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

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

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. 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

8 Test Result Data

8.1 Radiated Transmitter Spurious Emissions

8.1.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing frequencies below 30 MHz at distance other than the specified in the standard, the limit conversion is calculated by using the FCC materials for the ANSI 63 committee issued on January, 27 1991.

8.1.2 Limits:

FCC §15.247

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	GFSK continuous fixed channel	9 VDC

8.1.4 Measurement result:

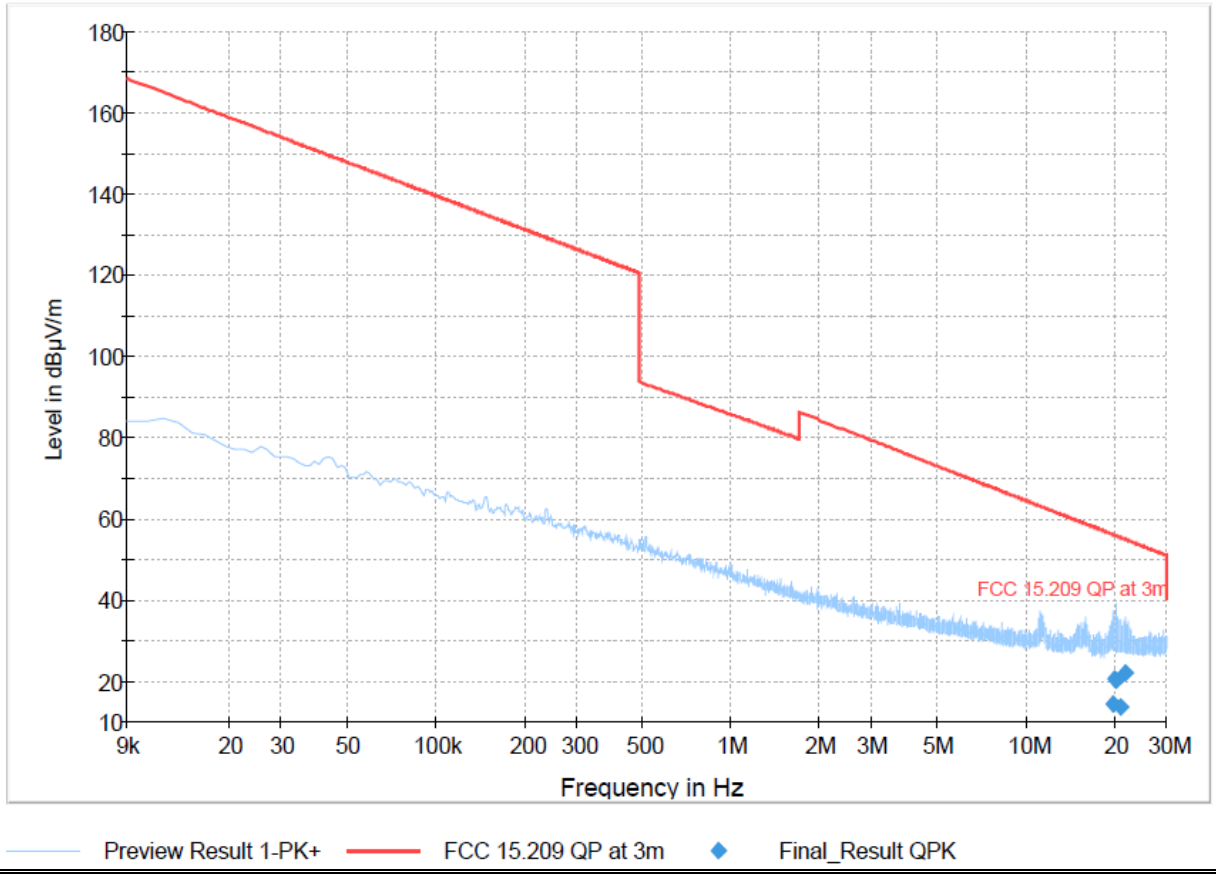
Plot #	Channel #	Scan Frequency	Limit	Result
1-5	Mid	9 kHz – 26 GHz	See section 8.5.2	Pass

8.1.5 Measurement Plots:

Plot # 1 Radiated Emissions: 9 KHz – 30 MHz

Modulation: BT LE | **Channel: Mid** | **100% Duty Cycle**

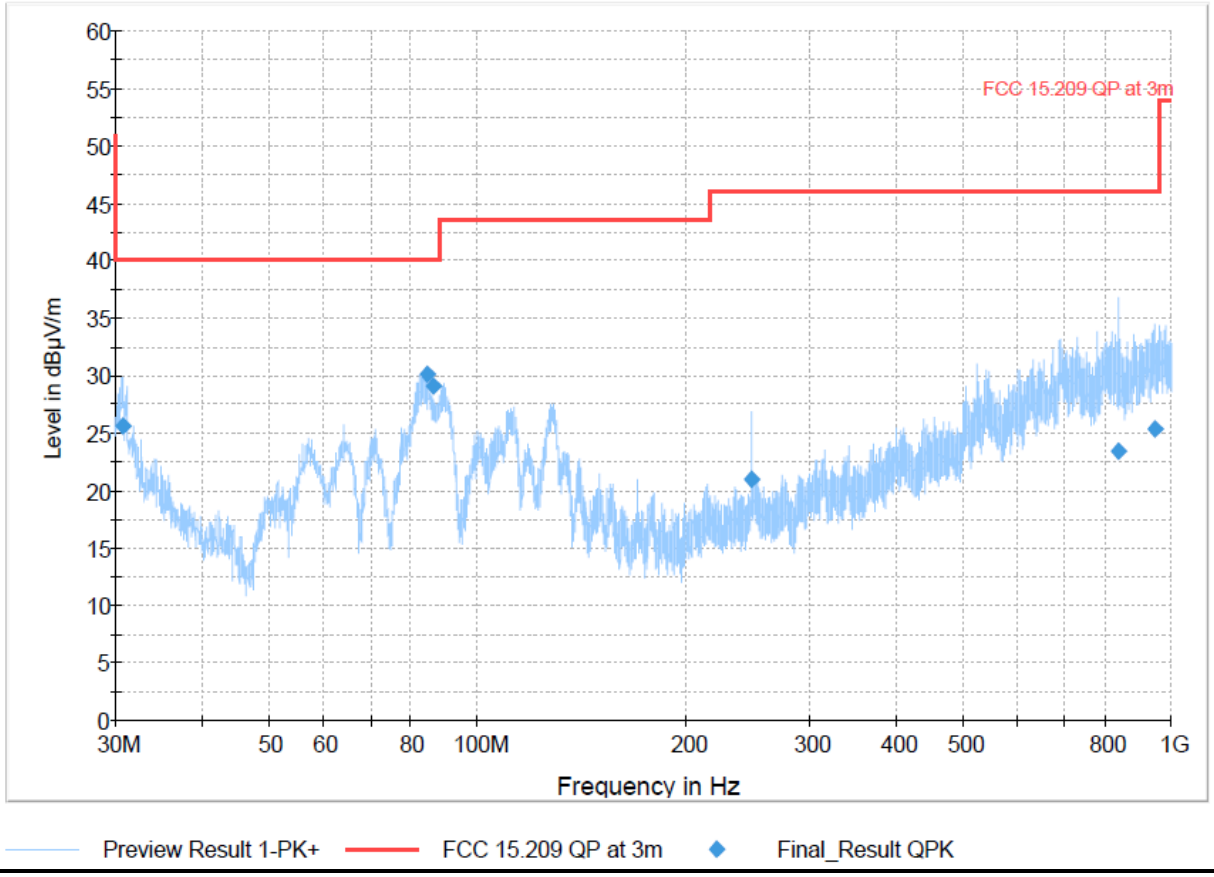
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19.890	14.53	56.10	41.57	500.0	0.200	149.0	H	70.0	16.5
20.134	20.44	55.95	35.51	500.0	0.200	150.0	V	210.0	16.4
20.376	20.32	55.80	35.48	500.0	0.200	201.0	V	40.0	16.4
21.103	13.79	55.37	41.58	500.0	0.200	162.0	V	107.0	16.4
21.832	21.86	54.95	33.10	500.0	0.200	150.0	V	106.0	16.3
22.316	5.24	54.68	49.44	500.0	0.200	270.0	V	183.0	16.2



Plot #2 Radiated Emissions: 30 MHz – 1GHz

Modulation: BT LE | **Channel: Mid** | **100% Duty Cycle**

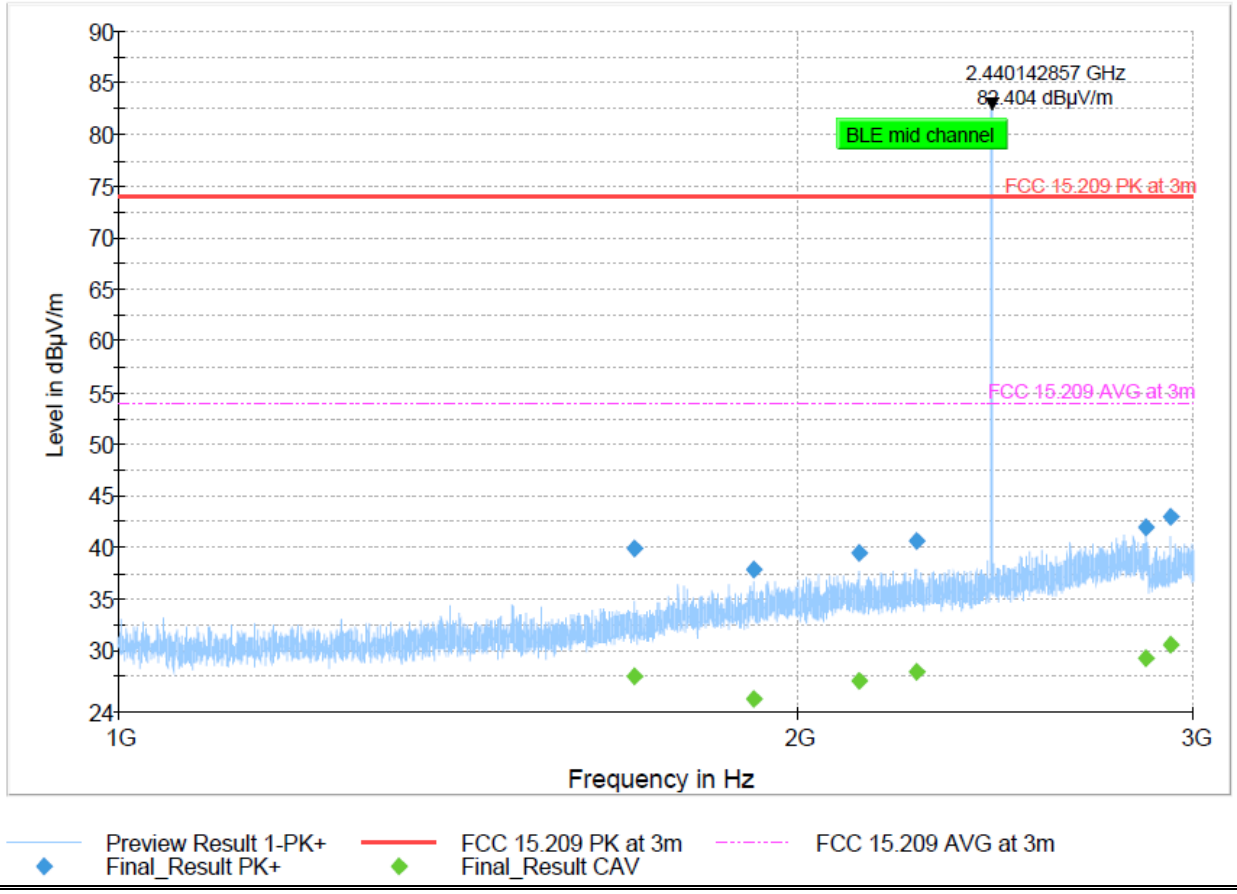
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.778	25.63	40.00	14.37	500.0	120.000	175.0	V	218.0	20.5
84.440	30.15	40.00	9.85	500.0	120.000	150.0	V	311.0	11.9
86.310	29.15	40.00	10.85	500.0	120.000	149.0	V	322.0	12.0
247.473	20.97	46.02	25.06	500.0	120.000	315.0	V	3.0	16.9
839.305	23.48	46.02	22.54	500.0	120.000	234.0	V	241.0	29.2
945.108	25.32	46.02	20.70	500.0	120.000	188.0	H	271.0	30.8



Plot #3 Radiated Emissions: 1-3 GHz

Modulation: BT LE | **Channel: Mid** | **100% Duty Cycle**

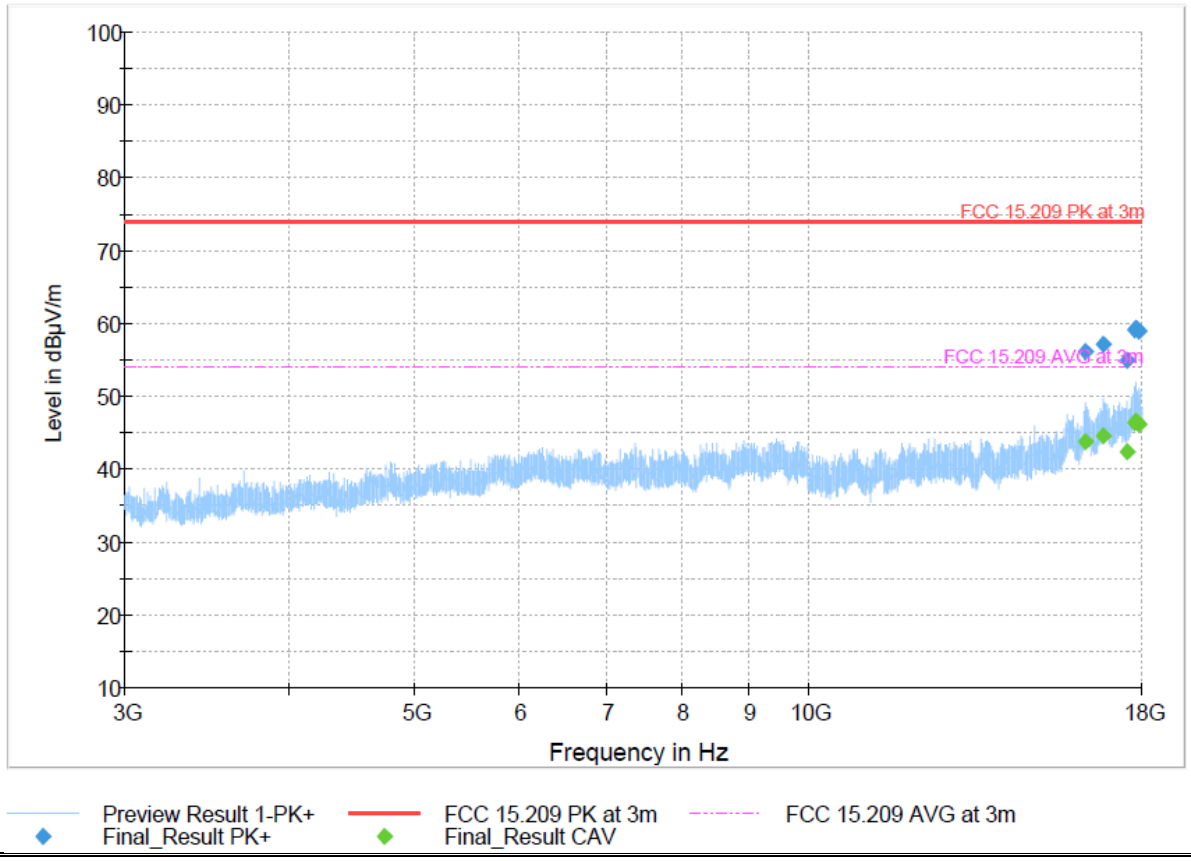
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1693.686	---	27.51	53.98	26.47	500.0	1000.000	274.0	H	281.0	6.1
1693.686	39.91	---	73.98	34.07	500.0	1000.000	274.0	H	281.0	6.1
1912.514	37.87	---	73.98	36.10	500.0	1000.000	149.0	V	-2.0	7.0
1912.514	---	25.30	53.98	28.68	500.0	1000.000	149.0	V	-2.0	7.0
2131.357	39.41	---	73.98	34.57	500.0	1000.000	252.0	H	61.0	8.6
2131.357	---	27.01	53.98	26.97	500.0	1000.000	252.0	H	61.0	8.6
2258.257	40.67	---	73.98	33.30	500.0	1000.000	188.0	H	158.0	8.9
2258.257	---	27.90	53.98	26.08	500.0	1000.000	188.0	H	158.0	8.9
2854.214	---	29.26	53.98	24.72	500.0	1000.000	150.0	H	327.0	10.7
2854.214	41.94	---	73.98	32.04	500.0	1000.000	150.0	H	327.0	10.7
2928.071	43.04	---	73.98	30.94	500.0	1000.000	234.0	H	214.0	11.1
2928.071	---	30.58	53.98	23.40	500.0	1000.000	234.0	H	214.0	11.1



Plot #4 Radiated Emissions: 3-18 GHz

Modulation: BT LE | **Channel: Mid** | **100% Duty Cycle**

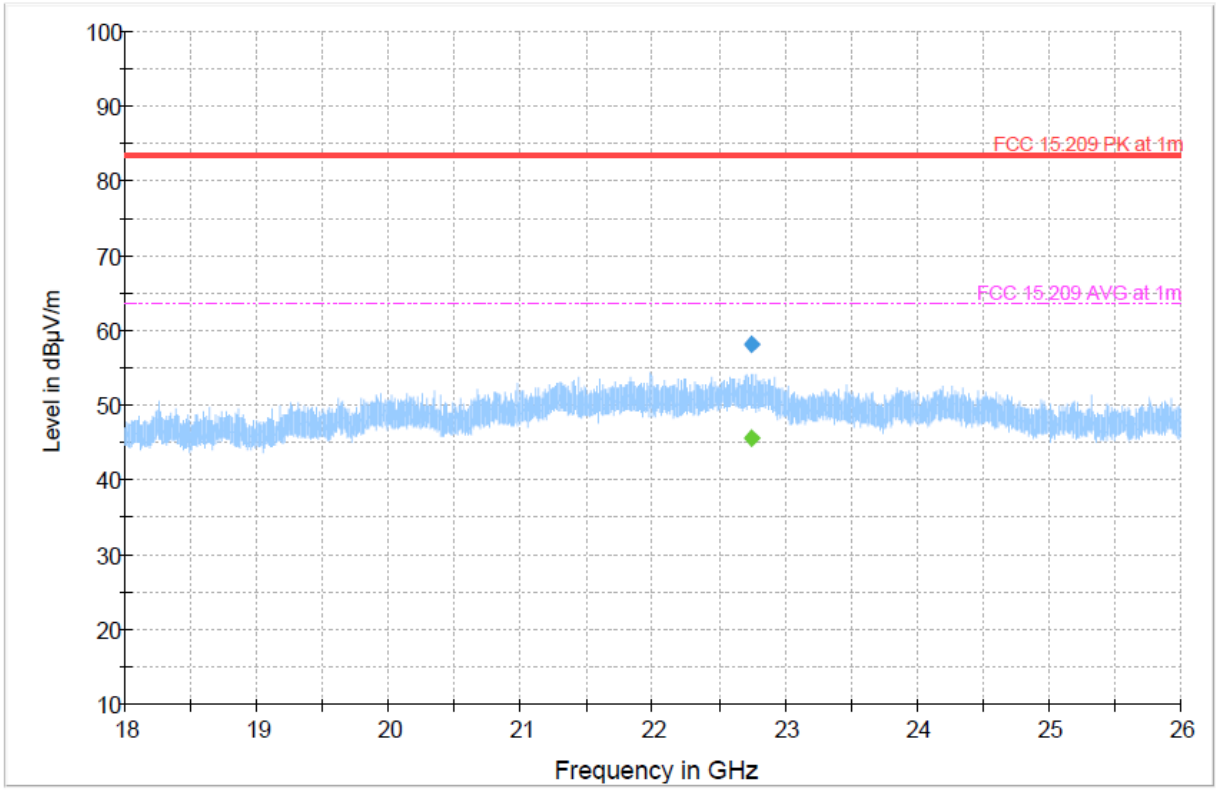
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
16309.980	---	43.76	53.98	10.22	500.0	1000.000	221.0	H	4.0	12.3
16309.980	56.23	---	73.98	17.75	500.0	1000.000	221.0	H	4.0	12.3
16833.216	57.14	---	73.98	16.84	500.0	1000.000	315.0	H	282.0	13.6
16833.216	---	44.66	53.98	9.32	500.0	1000.000	315.0	H	282.0	13.6
17541.245	---	42.39	53.98	11.59	500.0	1000.000	265.0	H	128.0	13.2
17541.245	55.09	---	73.98	18.89	500.0	1000.000	265.0	H	128.0	13.2
17787.249	---	46.48	53.98	7.50	500.0	1000.000	266.0	V	139.0	16.5
17787.249	59.26	---	73.98	14.72	500.0	1000.000	266.0	V	139.0	16.5
17823.616	---	46.56	53.98	7.42	500.0	1000.000	233.0	H	63.0	16.8
17823.616	59.48	---	73.98	14.50	500.0	1000.000	233.0	H	63.0	16.8
17911.216	58.90	---	73.98	15.08	500.0	1000.000	221.0	V	115.0	16.8
17911.216	---	46.33	53.98	7.65	500.0	1000.000	221.0	V	115.0	16.8



Plot #5 Radiated Emissions: 18-26 GHz

Modulation: BT LE | **Channel: Mid** | **100% Duty Cycle**

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22751.250	---	45.63	63.50	17.87	500.0	1000.000	267.0	H	14.0	20.1
22751.250	58.20	---	83.50	25.30	500.0	1000.000	267.0	H	14.0	20.1



9 Test setup photos

Setup photos are included in supporting file name: "EMC_UNIVE-013-21001_KDB996369_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Name/Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	3 Years	7/16/2019
Loop antenna	ETS Lindgren	6512	49383	3 Years	7/27/2020
Biconlog Antenna	EMCO	3142E	166067	3 years	3/12/2020
Horn Antenna	EMCO	3115	35111	3 years	4/17/2019
Horn Antenna	ETS Lindgren	Horn 3117-PA	215984	3 years	1/26/2018
Compact Digital Barometer	Control Company	D4540001	130070752	3 Years	4/13/2020

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.

11 History

Date	Template Revision	Changes to report	Prepared by	Approved by
2022-1-12	EMC_UNIVE-013-21001_KDB996369	Initial Version	Kris Lazarov	
2022-1-31	EMC_UNIVE-013-21001_KDB996369_Rev1	Page 5 – Updated Note	Kris Lazarov	

<<< The End >>>