



FCC / ISED Test Report

For:
Zipcar Inc.

Brand:
Zipcar

Marketing Name:
M400

Model #:
M400

Product Description:
Provide telemetry data to Zipcar backend.

FCC ID: 2AYUAM400
IC ID: 21268-M400

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

REPORT #: EMC_ZIPCA_009_20001_FCC_15.247_ISED_BTLE_DTS_Rev1

DATE: 4/27/2021



A2LA Accredited

IC recognized #
3462B

CETECOM Inc.

411 Dixon Landing Road ♦ Milpitas, CA 95035 ♦ U.S.A.

Phone: + 1 (408) 586 6200 ♦ Fax: + 1 (408) 586 6299 ♦ E-mail: info@etekom.com ♦ <http://www.cetekom.com>

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

TABLE OF CONTENTS

1	ASSESSMENT	3
2	ADMINISTRATIVE DATA	4
2.1	IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT	4
2.2	IDENTIFICATION OF THE CLIENT	4
2.3	IDENTIFICATION OF THE MANUFACTURER	4
3	EQUIPMENT UNDER TEST (EUT)	5
3.1	EUT SPECIFICATIONS	5
3.2	EUT SAMPLE DETAILS	6
3.3	ACCESSORY EQUIPMENT (AE) DETAILS	6
3.4	TEST SAMPLE CONFIGURATION	7
3.5	MODE OF OPERATION DETAILS	7
3.6	JUSTIFICATION FOR WORST CASE MODE OF OPERATION	7
4	SUBJECT OF INVESTIGATION	8
5	MEASUREMENT RESULTS SUMMARY	9
6	MEASUREMENT UNCERTAINTY	10
6.1	ENVIRONMENTAL CONDITIONS DURING TESTING:	10
6.2	DATES OF TESTING:	10
7	MEASUREMENT PROCEDURES	11
7.1	RADIATED MEASUREMENT	11
8	TEST RESULT DATA	14
8.1	RADIATED TRANSMITTER SPURIOUS EMISSIONS AND RESTRICTED BANDS	14
9	TEST SETUP PHOTOS	28
10	TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING	28
11	HISTORY	29

1 Assessment

The following device was evaluated against the applicable criteria specified in 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.

According to section 5 of this report, the overall result is Pass.

Company	Description	Model #
Zipcar Inc.	Provide telemetry data to Zipcar backend.	M400

Responsible for Testing Laboratory:

4/27/2021	Compliance	Wang, Kevin (EMC Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

4/27/2021	Compliance	Ghanma, Issa (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

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:	Wang, Kevin
Responsible Project Leader:	Saman, Rami

2.2 Identification of the Client

Applicant's Name:	Zipcar Inc.
Street Address:	35 Thomson Place
City/Zip Code	Boston, MA 02210
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:	M400
Marketing name:	M400
FCC-ID :	2AYUAM400
IC-ID:	21268-M400
HW Version :	E4
SW Version :	670
HVIN:	M400
PMN:	M400
Product Description:	Provide telemetry data to Zipcar backend.
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
Radio information:	❖ Bluetooth LE version 4.2: • Module name : ST Microelectronics • Model number : BlueNRG-M0 • FCC ID : S9NBNRGM0AL • IC ID : 8976C-BNRGM0AL • Data rate : 1 Mbps • Modulation : GFSK
Measured declared Conducted Output Power:	+5.31 dBm
Power Supply/ Rated Operating Voltage Range:	Low 9 V, High 14 V DC
Operating Temperature Range:	Low -40° C, High +85° C

Antenna Information as declared:	❖ Dedicated on PCB: Maximum total gain: +0.5 dBi max peak
Other Radios included in the device:	❖ Cellular LTE – Telit LE910 - FCC ID : RI7LE910CXNF - IC ID : 5131A-LE910CXNF ❖ GPS – Ublox MAX-8Q ❖ 125 KHz AWID SR2400 Card reader - FCC ID : OGSSR2400 - IC ID : 6449A-SR2400A
Sample Revision:	☐ Prototype Unit; ☐ Production Unit; ☒ Pre-Production
Product dimensions [mm]:	12.7 x 15.24 x 2.54

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	012121007006	E4	670	Radiated measurement

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Brand/Manufacturer	Serial Number
1	Card reader	SR2400	AWID	Y1226-02-0410
2	Combined GPS/LTE external antenna	MA220.LB.079	Taoglas	1
3	Key Management Device	Traka	Traka	1
4	Installation Cable	17.HONDA.BK	Zipcar customer-made	1

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for the test set up	Comments
1	EUT#1 + AE#1 + AE#2 + AE#3 + AE#4	The external antenna was connected.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	BT-LE + WCDMA V + 125 KHz Card reader	❖ TeraTerm terminal used to communicate with the device, and sending commands provided by client, that will not be available to end-user, to configure the Wi-Fi radio: ▪ Maximum power level ▪ Transmit mode : Continuous TX ▪ Duty cycle : 100% ▪ Hopping : No ▪ Hopping Type : Single Frequency ▪ Channel : Low , Mid, High, Channel # 39 ▪ Data rate : 1 Mb/s ❖ TeraTerm terminal used to send AT commands to connect to the base station (R&S CMW500) ❖ Card reader AWID SR-2400 is always on with a duty cycle of 2 seconds OFF and 360ms ON. The maximum power output of this reader is 96 dB at 12 V.

3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle and output power, transmitting simultaneously with the highest power band of cellular radio (WCDMA V) and 125 KHz card reader.

For radiated measurements;

- All data in this report show the worst case of Wi-Fi radio in simultaneous transmission mode with BLE CH39, transmitting at the highest output power band representing worst case transmission mode.
- All data in this report show 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 FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

This test report is to support a request for new equipment authorization under:

- FCC ID: 2AYUAM400
- IC ID: 21268-M400

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – “GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES” - April 2, 2019, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(a)(1) RSS-247 5.2(a)	Emission Bandwidth	Nominal	-	☐	☐	☒	Note 1 Note 2
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	-	☐	☐	☒	Note 1 Note 2
§15.247(b)(1) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	-	☐	☐	☒	Note 1 Note 2
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	-	☐	☐	☒	Note 1 Note 2
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	-	☐	☐	☒	Note 1 Note 2
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	O.p 1	☒	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	-	☐	☒	☐	Note 1 Note 3

Note1: NA= Not Applicable; NP= Not Performed.

Note2: Leveraged from ST Microelectronics BlueNRG-M0 certification report # AR19-0034267-01 under FCC: S9NBNRGM0AL; IC ID: 8976C-BNRGM0AL

Note 3: The EUT is powered by a vehicular 12 V DC; hence this test does not apply.

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 $k=1$.

Radiated measurement

9 kHz to 30 MHz	± 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)

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: <http://physics.nist.gov/cuu/Uncertainty/typeb.html>. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

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:

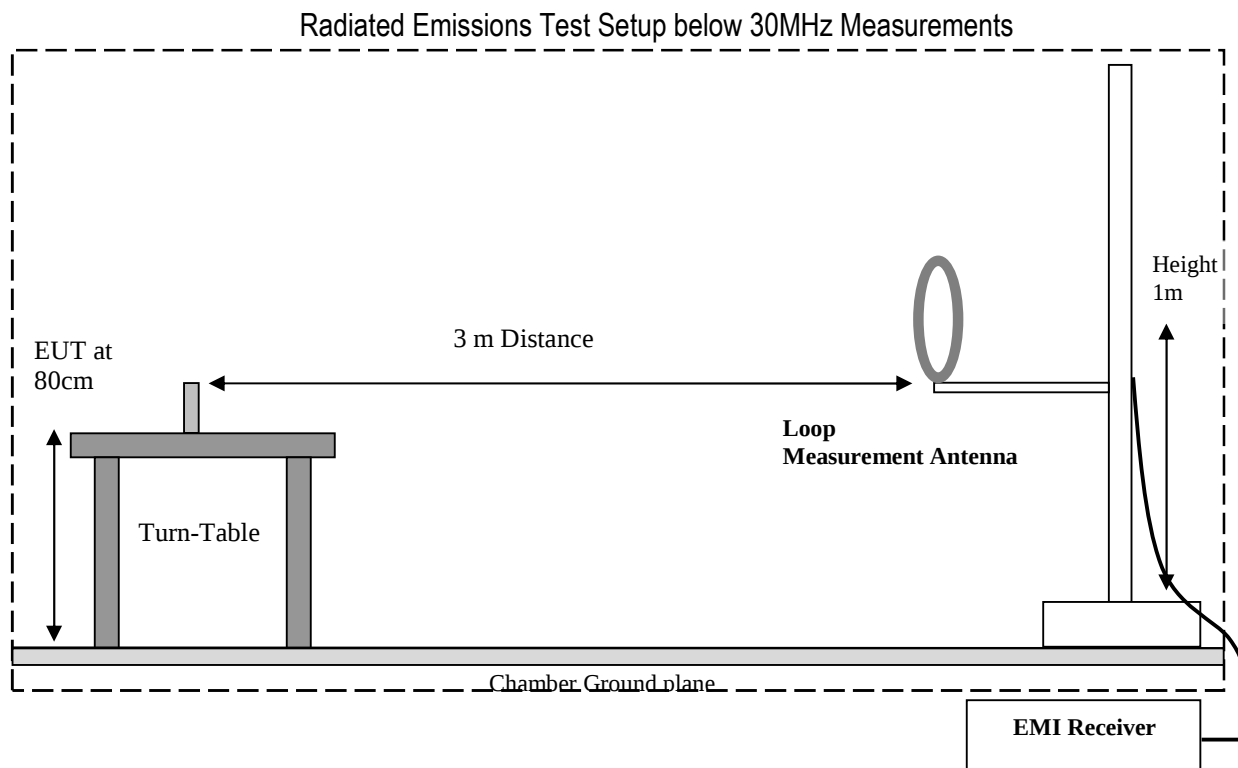
2/12/2021 – 2/16/2021

7 Measurement Procedures

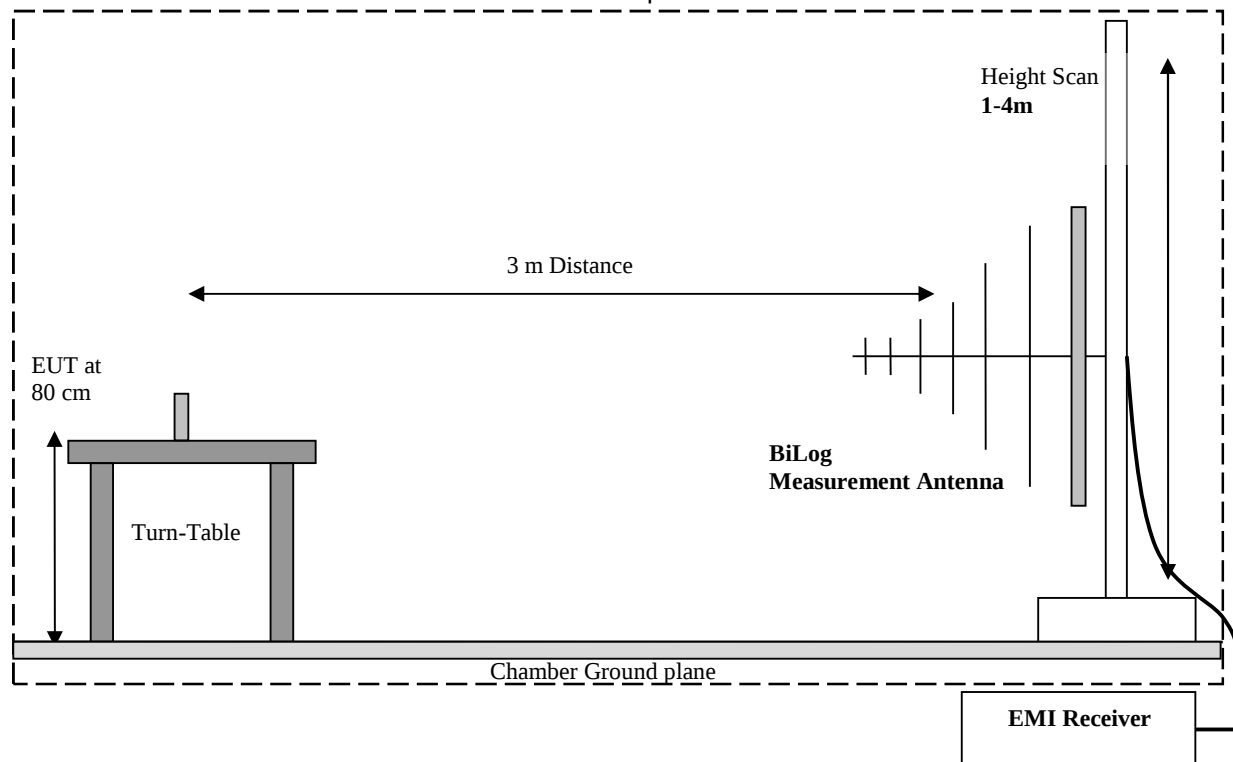
7.1 Radiated Measurement

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

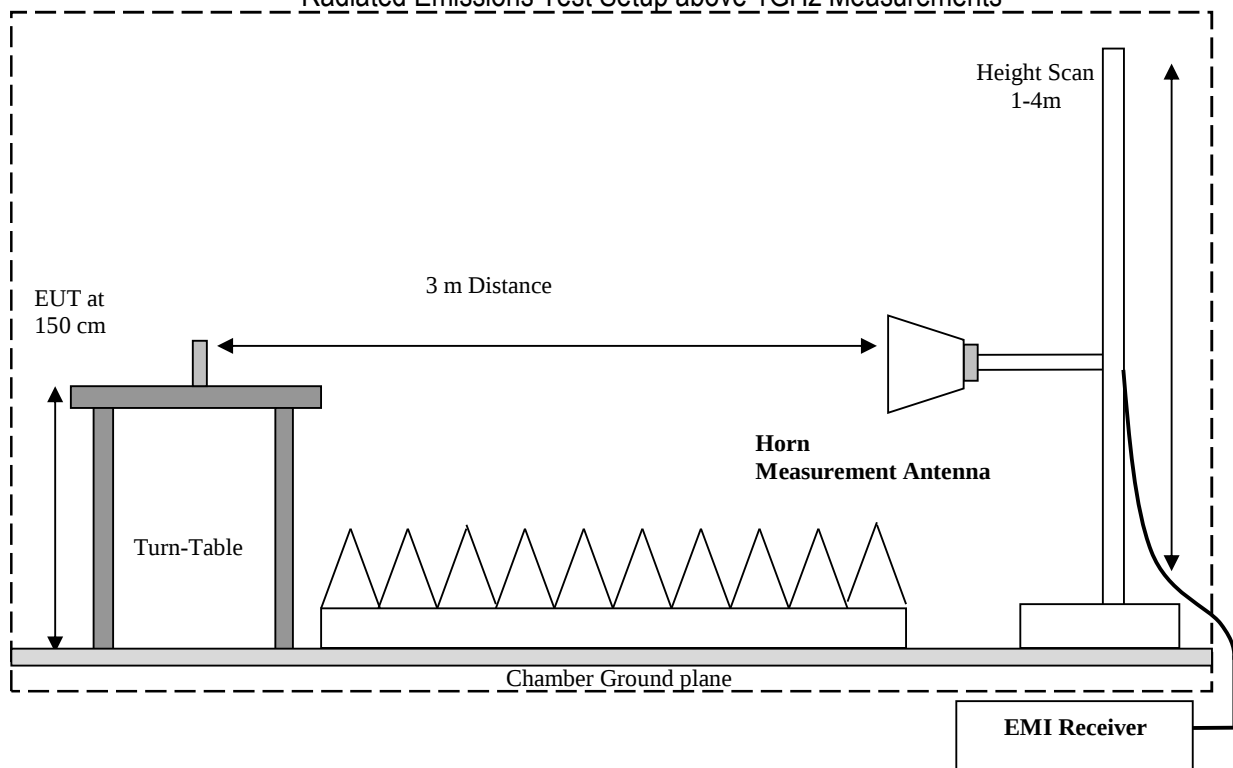
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360° continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above 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 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 dB μ V
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:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

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

8 Test Result Data

8.1 Radiated Transmitter Spurious Emissions and Restricted Bands

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 at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = $40 \log (D/d) = 40 \log (300\text{m} / 3\text{m}) = 80\text{dB}$

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 ($\mu\text{V/m}$)	Measurement Distance (m)	Field strength @ 3m (dB $\mu\text{V/m}$)
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 dB $\mu\text{V/m}$
88–216	150	3	43.5 dB $\mu\text{V/m}$
216–960	200	3	46 dB $\mu\text{V/m}$
Above 960	500	3	54 dB $\mu\text{V/m}$

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
10.495-0.505	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 dB $\mu\text{V/m}$
 *AVG. LIMIT= 54 dB $\mu\text{V/m}$

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23.8°C	1	Op. 1	12V DC

8.1.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Lowest margin emission [dB μ V/m]	Result
1 – 3	Low	30 MHz – 18 GHz	See section 8.1.2	37.56	Pass
4 – 8	Mid	9 kHz – 40 GHz	See section 8.1.2	36.61	Pass
9 – 11	High	30 MHz – 18 GHz	See section 8.1.2	52.78	Pass

8.1.5 Measurement Plots:

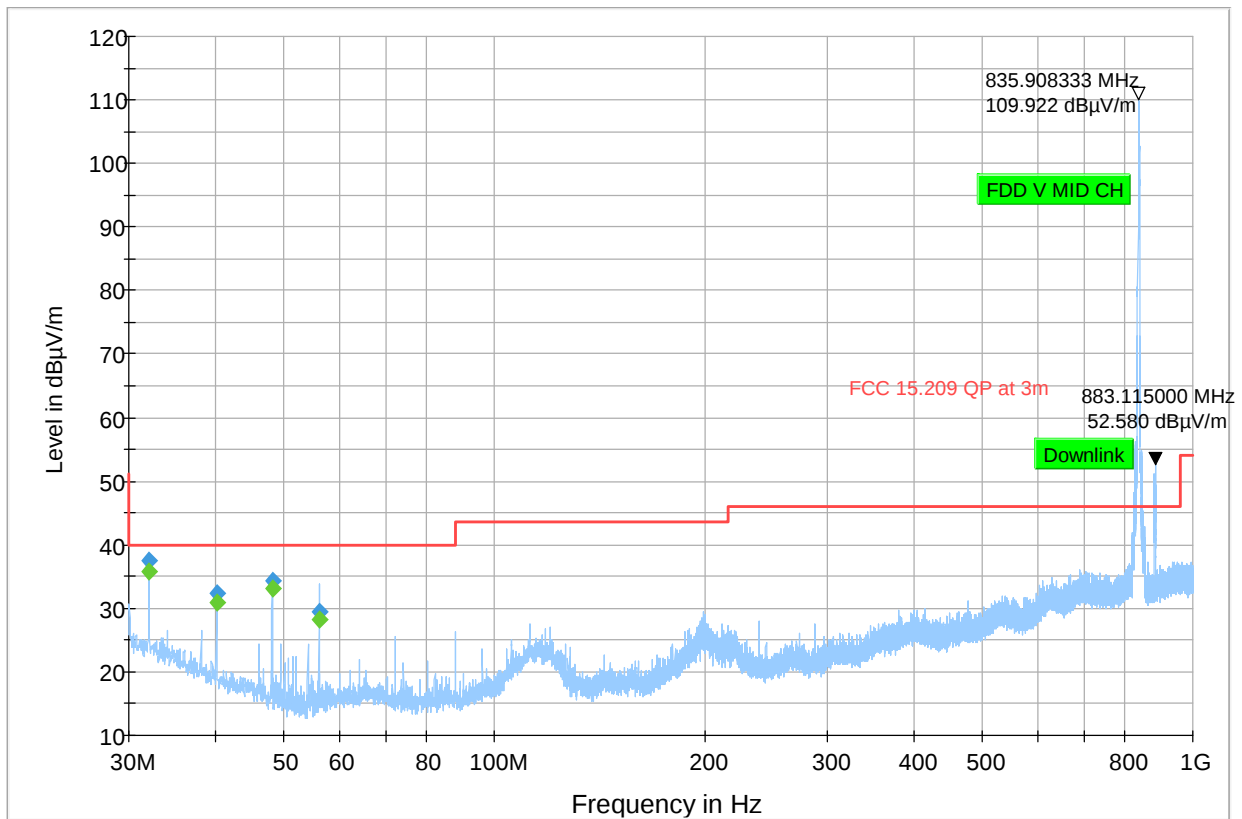
Plot # 1 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2402 MHz

Mode: BT LE

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.102	37.56	---	40.00	2.44	500.0	120.000	140.0	V	131.0	19.7
32.102	---	35.85	40.00	4.15	500.0	120.000	140.0	V	131.0	19.7
40.088	32.47	---	40.00	7.53	500.0	120.000	140.0	V	161.0	14.7
40.088	---	30.93	40.00	9.07	500.0	120.000	140.0	V	161.0	14.7
48.107	---	33.10	40.00	6.90	500.0	120.000	162.0	V	81.0	10.8
48.107	34.25	---	40.00	5.75	500.0	120.000	162.0	V	81.0	10.8
56.158	---	28.24	40.00	11.76	500.0	120.000	151.0	V	170.0	9.8
56.158	29.54	---	40.00	10.46	500.0	120.000	151.0	V	170.0	9.8

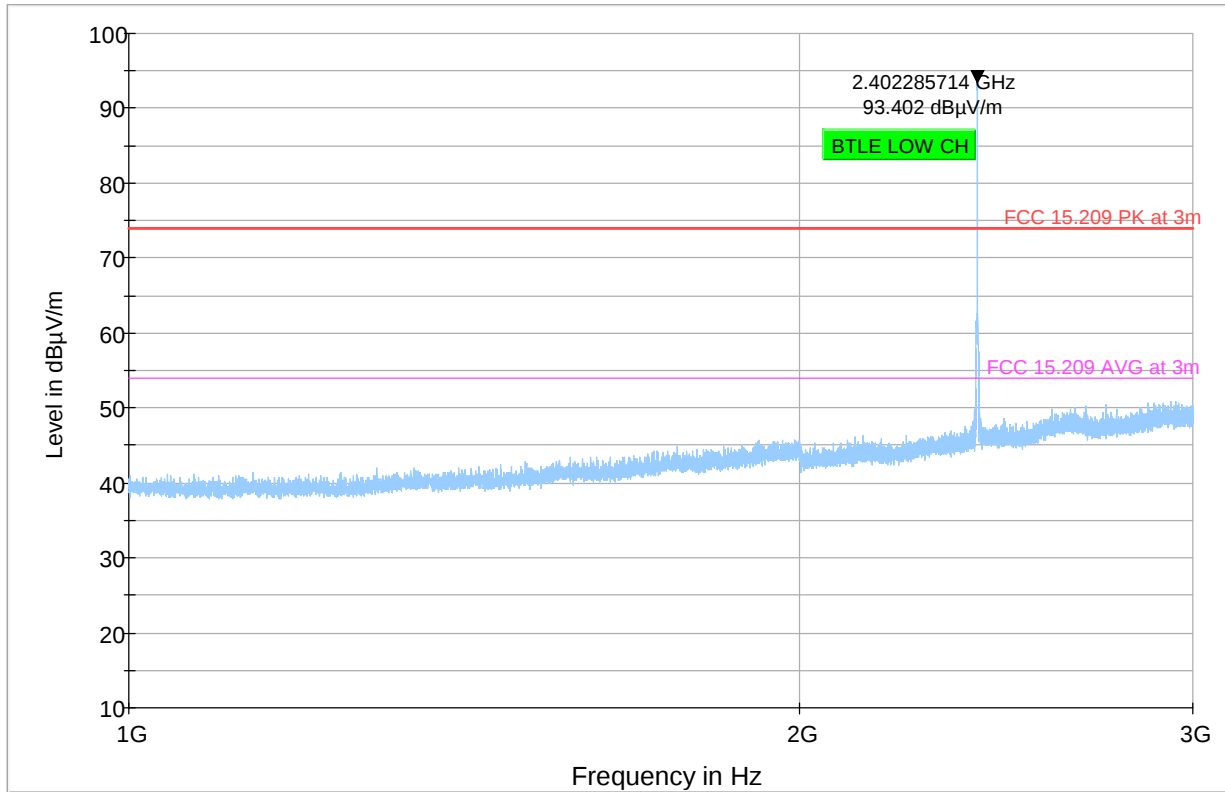


◆ Preview Result 2-QPK
◆ Final_Result PK+
 ◆ Preview Result 1-PK+
◆ Final_Result QPK
 — FCC 15.209 QP at 3m

Plot # 2 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2402 MHz

Mode: BT LE



Preview Result 2-QPK	Preview Result 1-PK+	* Critical_Freqs QPK
* Critical_Freqs PK+	— FCC 15.209 PK at 3m	— FCC 15.209 AVG at 3m
◆ Final_Result PK+	◆ Final_Result CAV	

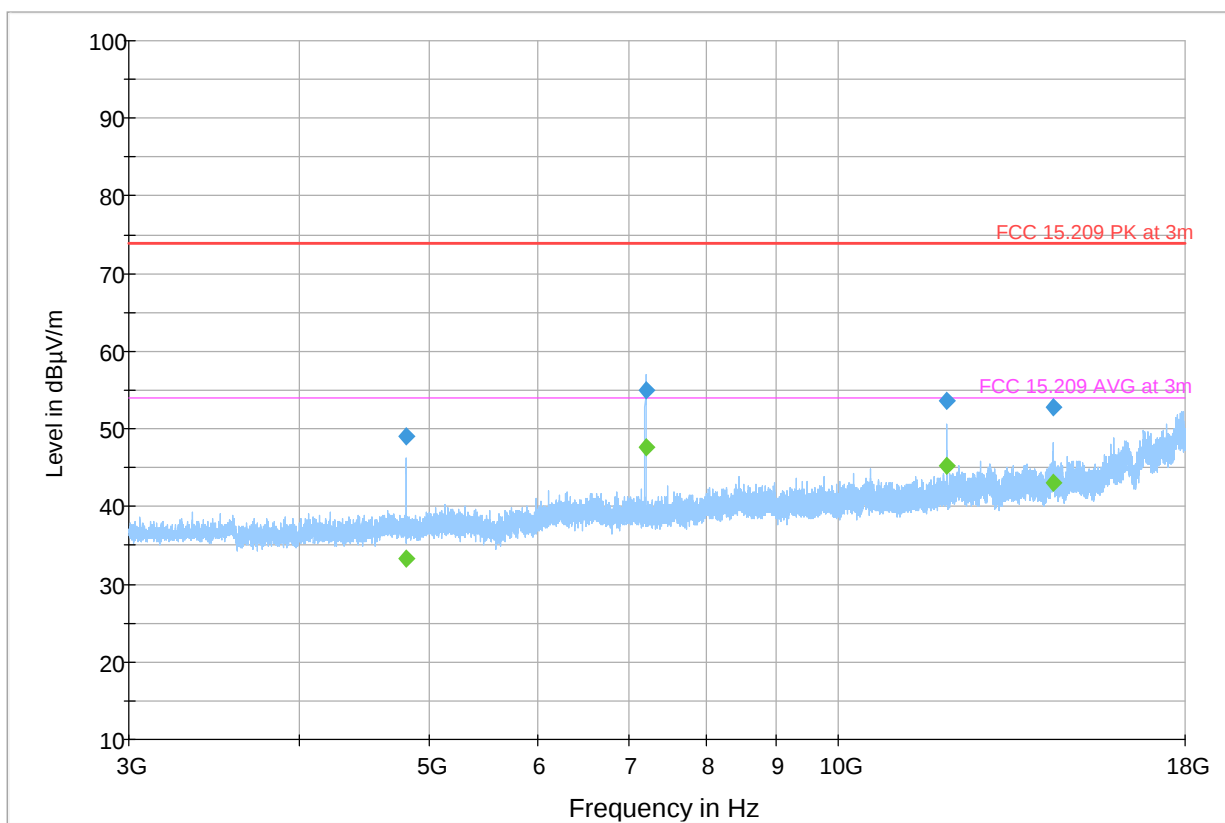
Plot # 3 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2402 MHz

Mode: BT LE

Final Result

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)
4803.500	---	33.28	53.98	20.70	500.0	1000.000	140.0	H	311.0	-4.8
4803.500	48.98	---	73.98	25.00	500.0	1000.000	140.0	H	311.0	-4.8
7207.000	54.91	---	73.98	19.07	500.0	1000.000	244.0	V	348.0	-0.6
7207.000	---	47.61	53.98	6.37	500.0	1000.000	244.0	V	348.0	-0.6
12011.500	53.54	---	73.98	20.44	500.0	1000.000	252.0	V	142.0	3.1
12011.500	---	45.17	53.98	8.81	500.0	1000.000	252.0	V	142.0	3.1
14414.000	---	43.06	53.98	10.92	500.0	1000.000	253.0	V	344.0	6.1
14414.000	52.91	---	73.98	21.07	500.0	1000.000	253.0	V	344.0	6.1



Preview Result 2-QPK Preview Result 1-PK+ FCC 15.209 PK at 3m
FCC 15.209 AVG at 3m Final Result PK+ Final Result CAV

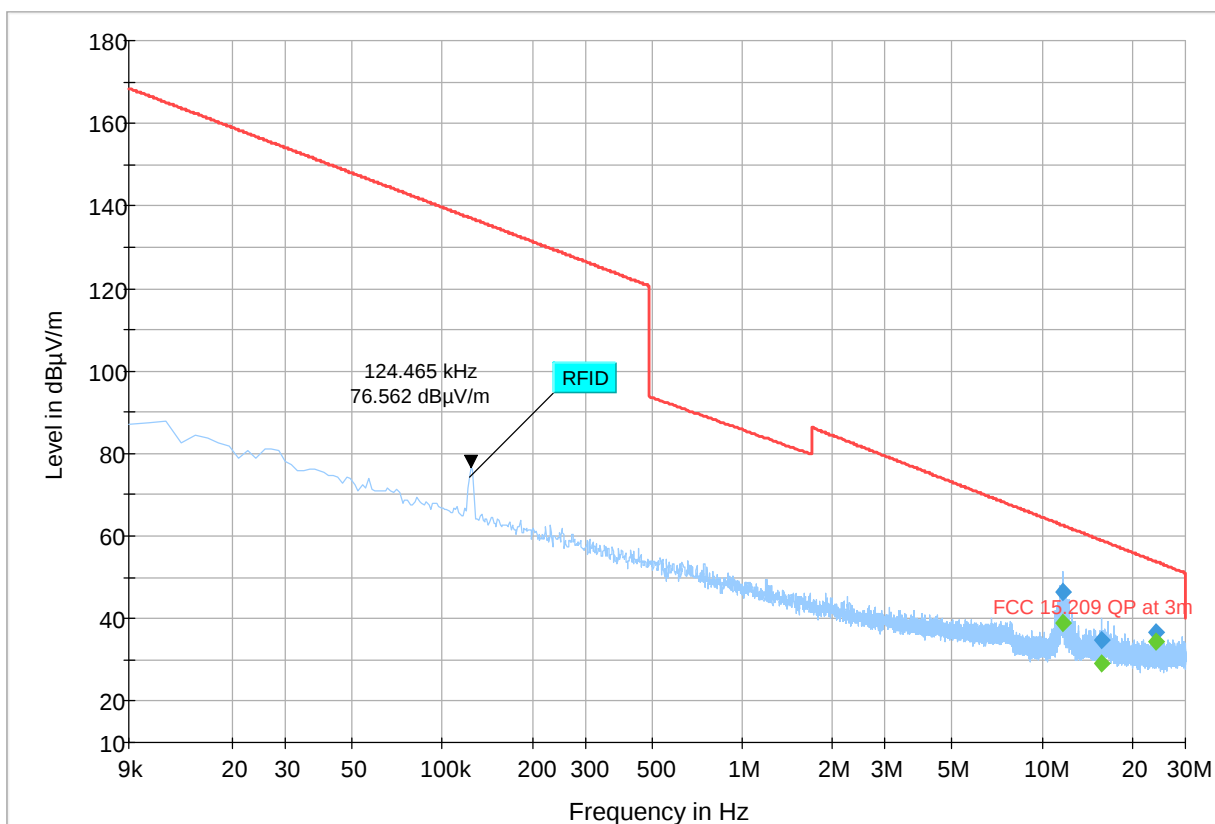
Plot # 4 Radiated Emissions: 9 KHz – 30 MHz

Tx Frequency: 2440 MHz

Mode: BT LE

Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
11.670	---	39.12	62.66	23.54	500.0	9.000	152.0	V	299.0	17.4
11.670	46.63	---	62.66	16.03	500.0	9.000	152.0	V	299.0	17.4
15.694	34.96	---	59.02	24.06	500.0	9.000	196.0	V	14.0	17.1
15.694	---	29.23	59.02	29.79	500.0	9.000	196.0	V	14.0	17.1
24.068	36.89	---	53.75	16.86	500.0	9.000	152.0	H	139.0	16.4
24.068	---	34.31	53.75	19.44	500.0	9.000	152.0	H	139.0	16.4



Preview Result 2-QPK
Final_Result PK+

Preview Result 1-PK+
Final_Result QPK

FCC 15.209 QP at 3m

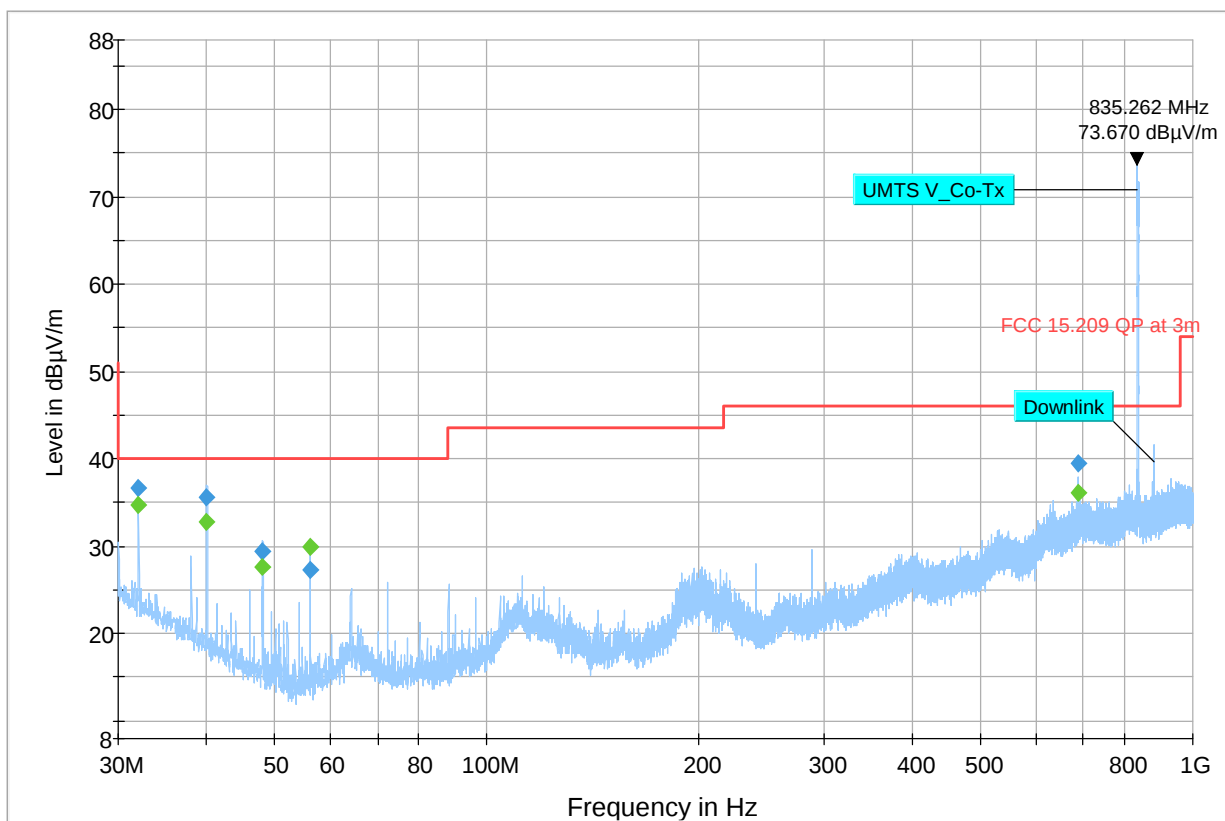
Plot # 5 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2440 MHz

Mode: BT LE

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.069	36.61	---	40.00	3.39	500.0	120.000	140.0	V	211.0	19.7
32.069	---	34.77	40.00	5.23	500.0	120.000	140.0	V	211.0	19.7
40.088	35.64	---	40.00	4.36	500.0	120.000	140.0	V	131.0	14.7
40.088	---	32.85	40.00	7.15	500.0	120.000	140.0	V	131.0	14.7
48.107	29.35	---	40.00	10.65	500.0	120.000	174.0	V	107.0	10.8
48.107	---	27.63	40.00	12.37	500.0	120.000	174.0	V	107.0	10.8
56.158	27.25	---	40.00	12.75	500.0	120.000	152.0	V	157.0	9.8
56.158	---	29.92	40.00	10.08	500.0	120.000	152.0	V	157.0	9.8
687.531	---	36.05	40.00	3.95	500.0	120.000	243.0	V	349.0	29.0
687.531	39.44	---	46.02	6.58	500.0	120.000	243.0	V	349.0	29.0



◆ Preview Result 2-QPK Final_Result PK+
 ◆ Preview Result 1-PK+ Final_Result QPK
 — FCC 15.209 QP at 3m

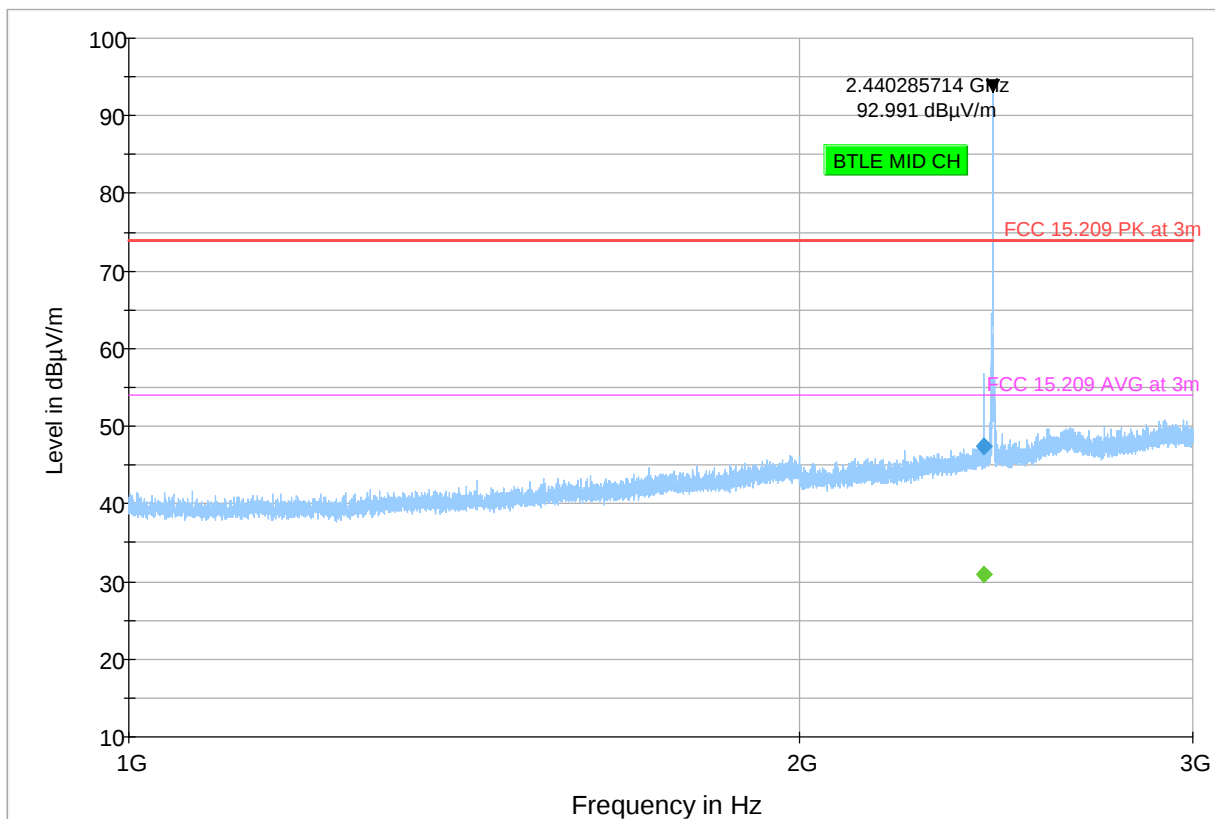
Plot # 6 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2440 MHz

Mode: BT LE

Final_Result

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)
2416.000	---	30.92	53.98	23.06	500.0	1000.000	174.0	H	54.0	9.3
2416.000	47.50	---	73.98	26.47	500.0	1000.000	174.0	H	54.0	9.3



— Preview Result 2-QPK
 — Preview Result 1-PK+
 — FCC 15.209 PK at 3m
— FCC 15.209 AVG at 3m
 ◆ Final_Result PK+
 ◆ Final_Result CAV

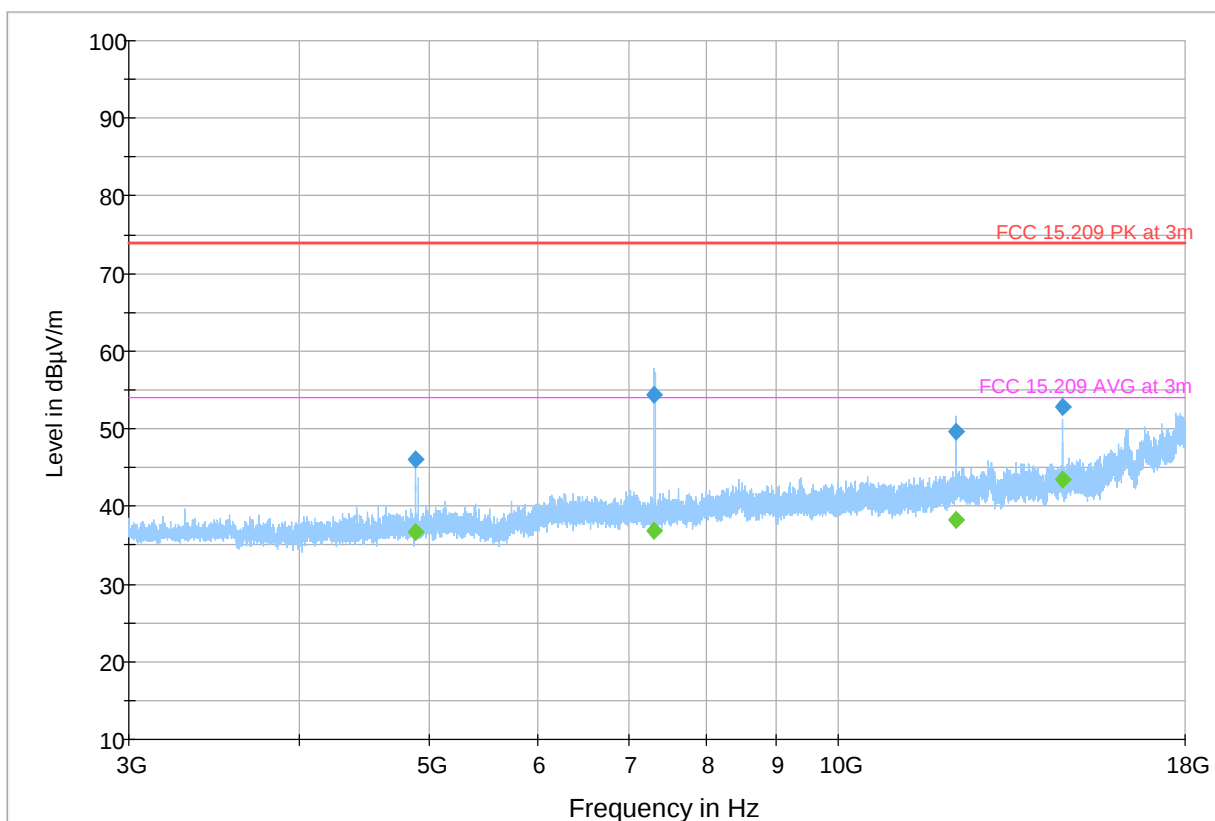
Plot # 7 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2440 MHz

Mode: BT LE

Final_Result

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)
4880.500	---	36.67	53.98	17.31	500.0	1000.000	140.0	H	36.0	-5.0
4880.500	46.10	---	73.98	27.88	500.0	1000.000	140.0	H	36.0	-5.0
7319.500	---	36.87	53.98	17.11	500.0	1000.000	262.0	H	354.0	-0.5
7319.500	54.42	---	73.98	19.56	500.0	1000.000	262.0	H	354.0	-0.5
12202.000	---	38.37	53.98	15.61	500.0	1000.000	196.0	V	144.0	3.6
12202.000	49.66	---	73.98	24.32	500.0	1000.000	196.0	V	144.0	3.6
14642.000	---	43.53	53.98	10.45	500.0	1000.000	175.0	V	162.0	5.6
14642.000	52.71	---	73.98	21.27	500.0	1000.000	175.0	V	162.0	5.6



— Preview Result 2-QPK
 — Preview Result 1-PK+
 — FCC 15.209 PK at 3m
— FCC 15.209 AVG at 3m
◆ Final_Result PK+
◆ Final_Result CAV

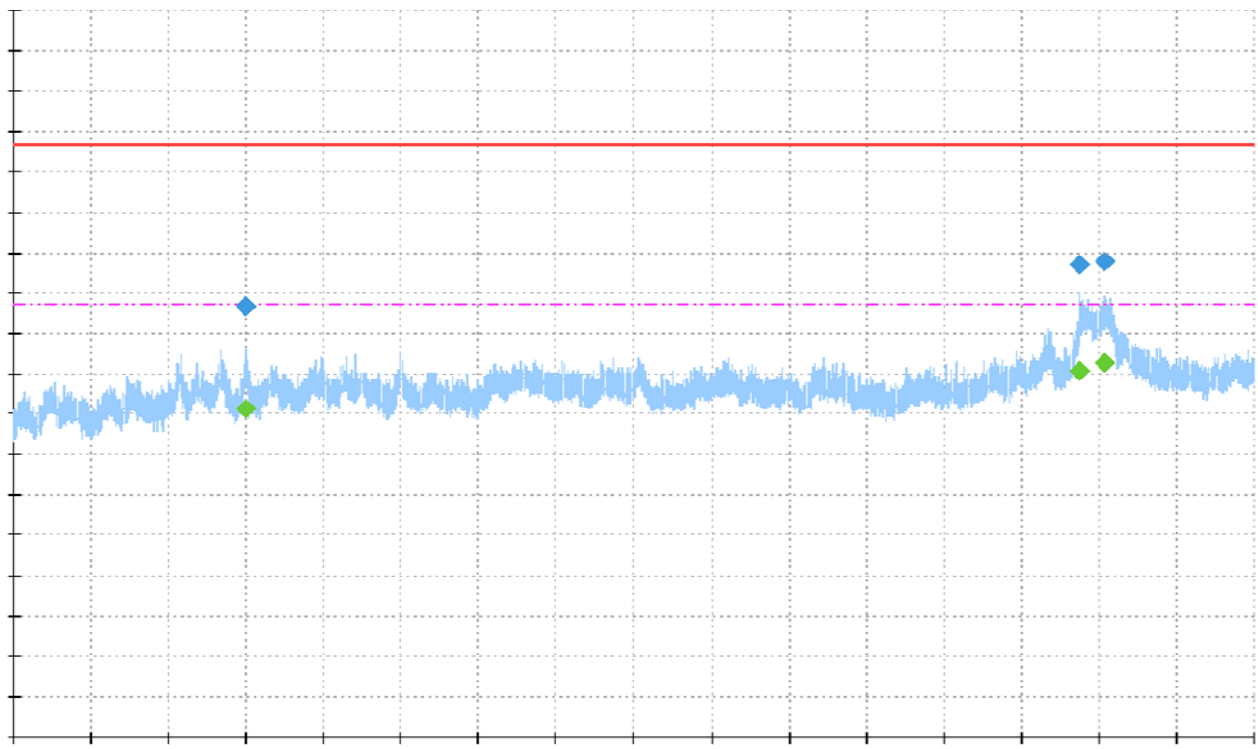
Plot # 8 Radiated Emissions: 18 – 26 GHz

Tx Frequency: 2440 MHz

Mode: BT LE

Final_Result

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)
19497.081	---	50.56	63.50	12.94	500.0	1000.000	120.0	V	136.0	23.1
19497.081	63.33	---	83.50	20.17	500.0	1000.000	120.0	V	136.0	23.1
24878.264	68.49	---	83.50	15.01	500.0	1000.000	315.0	H	9.0	30.1
24878.264	---	55.38	63.50	8.12	500.0	1000.000	315.0	H	9.0	30.1
25034.762	68.99	---	83.50	14.51	500.0	1000.000	145.0	H	187.0	30.5
25034.762	---	56.33	63.50	7.17	500.0	1000.000	145.0	H	187.0	30.5



Preview Result 2-QPK Preview Result 1-PK+ FCC 15.209 PK at 1m
FCC 15.209 AVG at 1m Final_Result PK+ Final_Result CAV

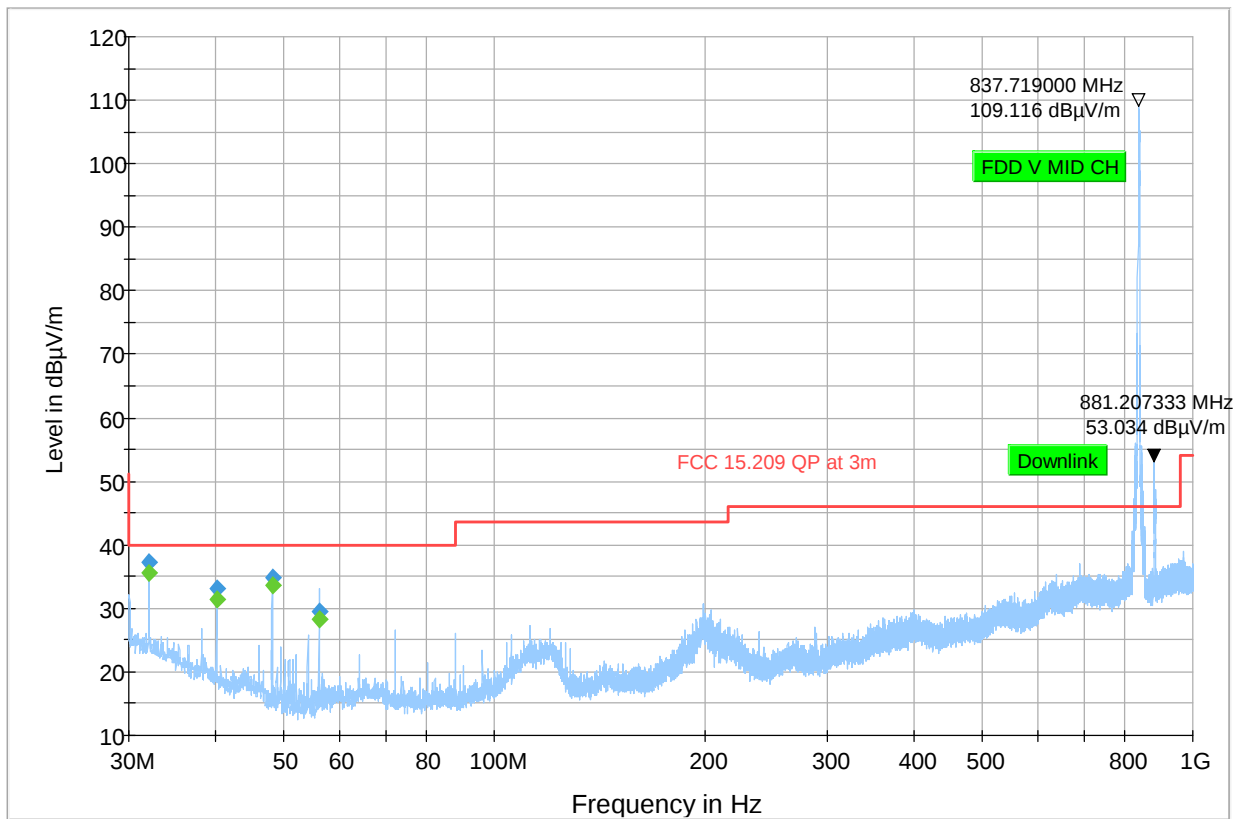
Plot # 9 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2480 MHz

Mode: BT LE

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.069	37.20	---	40.00	2.80	500.0	120.000	140.0	V	172.0	19.7
32.069	---	35.63	40.00	4.37	500.0	120.000	140.0	V	172.0	19.7
40.088	---	31.42	40.00	8.58	500.0	120.000	140.0	V	159.0	14.7
40.088	33.04	---	40.00	6.96	500.0	120.000	140.0	V	159.0	14.7
48.107	34.84	---	40.00	5.16	500.0	120.000	140.0	V	86.0	10.8
48.107	---	33.50	40.00	6.50	500.0	120.000	140.0	V	86.0	10.8
56.158	---	28.16	40.00	11.84	500.0	120.000	220.0	V	173.0	9.8
56.158	29.37	---	40.00	10.63	500.0	120.000	220.0	V	173.0	9.8

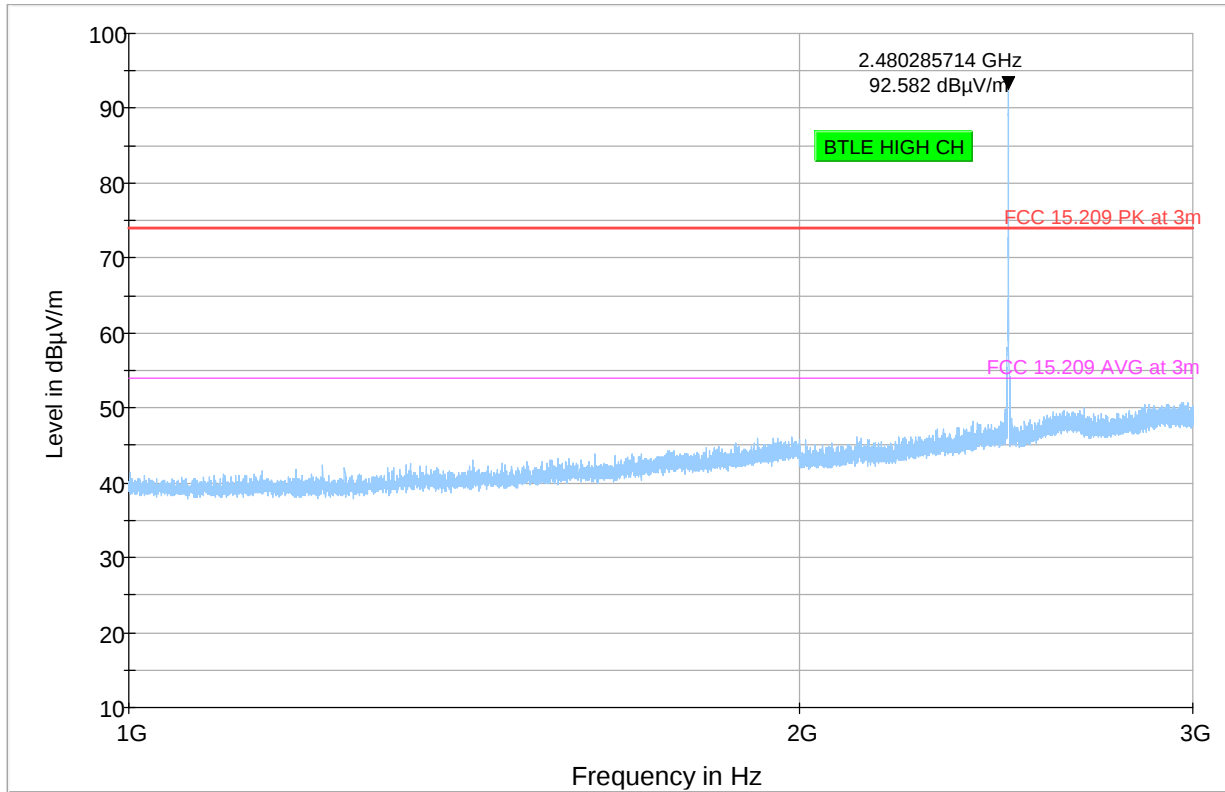


Preview Result 2-QPK Final_Result PK+ Preview Result 1-PK+ Final_Result QPK FCC 15.209 QP at 3m

Plot # 10 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2480 MHz

Mode: BT LE



Preview Result 2-QPK
* Critical_Freqs PK+
◆ Final_Result PK+

Preview Result 1-PK+
FCC 15.209 PK at 3m
◆ Final_Result CAV

* Critical_Freqs QPK
FCC 15.209 AVG at 3m

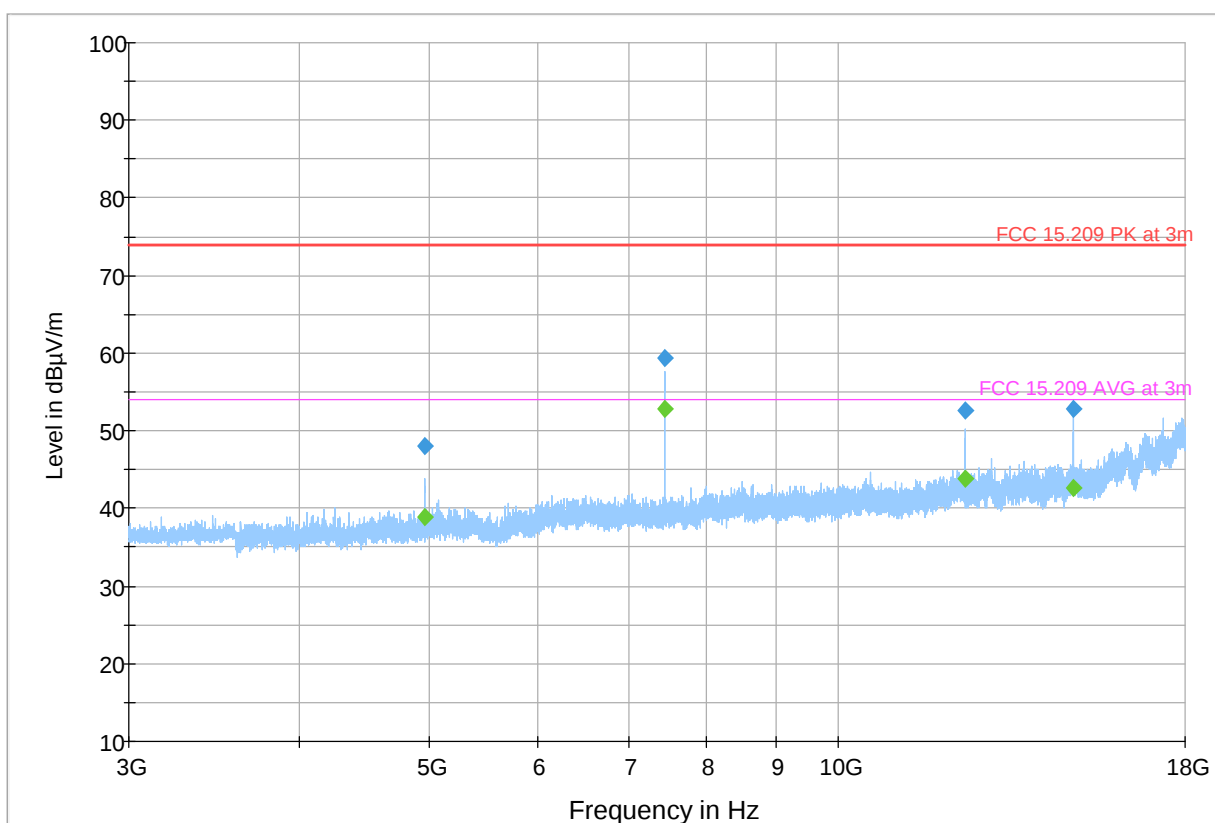
Plot # 11 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2480 MHz

Mode: BT LE

Final_Result

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)
4960.500	---	38.80	53.98	15.18	500.0	1000.000	140.0	H	324.0	-4.5
4960.500	48.03	---	73.98	25.95	500.0	1000.000	140.0	H	324.0	-4.5
7441.000	59.47	---	73.98	14.51	500.0	1000.000	140.0	V	282.0	-0.2
7441.000	---	52.78	53.98	1.20	500.0	1000.000	140.0	V	282.0	-0.2
12401.500	---	43.90	53.98	10.08	500.0	1000.000	140.0	V	145.0	4.0
12401.500	52.69	---	73.98	21.29	500.0	1000.000	140.0	V	145.0	4.0
14882.000	52.77	---	73.98	21.21	500.0	1000.000	152.0	V	105.0	6.3
14882.000	---	42.62	53.98	11.36	500.0	1000.000	152.0	V	105.0	6.3



Preview Result 2-QPK Preview Result 1-PK+ FCC 15.209 PK at 3m
FCC 15.209 AVG at 3m Final_Result PK+ Final_Result CAV

9 Test setup photos

Setup photos are included in supporting file name: "EMC_ZIPCA_009_20001_FCC_ISED_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
Biconilog Antenna	ETS Lindgren	3142E	00166067	3 years	3/20/2020
Horn Antenna	ETS Lindgren	3115	00035114	3 years	10/10/2020
Horn Antenna	ETS Lindgren	3117-PA	00215984	3 years	1/31/2021
HORN ANTENNA	ETS LINDGREN	3116C	00070497	3 YEARS	11/23/2020
EMI Receiver	R&S	ESU40	100251	3 years	7/16/2019
Digital Thermometer/Chilled Mirror Hygrometer	Control Company	36934-164	191872028	3 years	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.

11 History

Date	Report Name	Changes to report	Report prepared by
4/6/2021	EMC_ZIPCA_009_20001_FCC_15.247_ISED_BTLE_DTS	Initial Version	Issa Ghanma
4/27/2021	EMC_ZIPCA_009_20001_FCC_15.247_ISED_BTLE_DTS_Rev1	❖ Add 125 KHz card reader to: • Section 3.1 Other Radios included in the device. • Section 3.5 Mode of Operation details • Section 3.6 Justification for worst case mode of operation. • Section 8.1.5 Measurement plots, marker and label to 125 KHz	Issa Ghanma

<<< The End >>>
