Test Report

For:
Rivian Automotive, LLC

Brand:
-

Marketing Name:
Keyfob 2.0

Model Name:
Keyfob 2.0

Product Description:
Hand Held Automotive Vehicle Acess Keyfob

FCC ID: 2AW3A-2WWG24R1TKFB
2A3WA-2WWG24R1SKFB *
IC: 26958-2WWG24R1TKF
26958-2WWG24R1SKF *
* Cosmetic difference, see 12 Annex

Applied Rules and Standards:
FCC CFR 47 Subpart 15.247
RSS-247 Issue 3 (DTS) & RSS-Gen Issue 5

REPORT #: RIVIA_069_24001_FCC15247_RSS247_Rev1

DATE: 2024-10-15

A2LA Accredited

IC recognized #
3462B
CABID: US0187

***CETECOM* Inc.**
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1 Assessment

The following device was evaluated against the applicable criteria specified in

- FCC rule Part 15.247 of Title 47 of the Code of Federal Regulations
- RSS-247, Issue 3
- RSS-Gen, Issue 5

No deviations were ascertained.

Company	Description	Model #
Rivian Automotive, LLC	Hand Held Automotive Vehicle Acess Keyfob	Keyfob 2.0

Responsible for the Report:

Date	Section	Name	Signature
2024-10-15	Compliance	Guangcheng Huang (Senior EMC Test Engineer)	

The test results of this test report relate exclusively to the test item specified in Section3.
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
City/Zip Code	Milpitas, 95035 CA
Country	USA
Telephone:	+ 1 (408) 586 6200
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EMC Lab Manager:	Alvin Ilarina
Project Manager:	Akanksha Baskaran

2.2 Identification of the Client

Client's Name:	Rivian Automotive, LLC
Street Address:	14600 Myford Road
City/Zip Code	Irvine, CA 92606
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	same as client
Manufacturers Address:	same as client
City/Zip Code	same as client
Country	same as client

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	Keyfob 2.0
Marketing Name:	Keyfob 2.0
HW Version:	Rev.B.
SW Version:	-
FCC ID:	2AW3A-2WWG24R1TKFB 2A3WA-2WWG24R1SKFB *
IC:	26958-2WWG24R1TKF 26958-2WWG24R1SKF *
FWIN:	N/A
HVIN:	R1TKFB R1SKFB *
PMN:	Keyfob 2.0
Product Description:	Hand Held Automotive Vehicle Acess Keyfob
Power Supply / Rated operating Voltage Range:	Range: 2 - 3.3 V Normial: 3 V
Operating Temperature Range	Range: -30 °C to +45 °C Norminal: 20 °C
Sample Revision	pre-production
EUT Dimensions	85mmx44mmx16mm
Note: All information provided by the client. * Cosmetic difference, see 12 Annex.	

3.2 Radio Specifications

Embedded Radio Technologies	BLE, UWB
Frequency Range / number of channels:	BLE: CH1-39 (2402 - 2480 MHz) UWB: CH5 (6.5 GHz) (not supported), CH9 (8 GHz)
Tested radio technology	BLE BLE & UWB simultaneous transmission
Antenna Type / Gain	BLE: 1.12 dBi
Modes of Operation	BLE 1. Continueous transmission Note: Data rate: 1MBps; max. power level setting: -2 dBm UWB 1. Continueous transmission (for testing purpose only) 2. normal mode (as in used case) Note: Data rate: 6.8Mbps, 850Kbps, SP3; max. power level setting: 7F
Note: All information provided by the client.	

3.3 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	-	Rev.B.	-	For radiated testing
2	-	Rev.B.	-	For conducted testing

3.4 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
0	URAT cable	-	-	-

3.5 Mode of Operation

Mode #	Mode of Operation	Comments
1	BLE TX continuous	Continuously transmitting signal
2	BLE + UWB simultaneous transmission	Both TX continuously transmitting

3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter set on low, mid and high channels. 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 evaluate the compliance of the EUT against the relevant requirements specified in section 1 Assessment.

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	BLE	■	☐	☐	Complies
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	BLE	■	☐	☐	Complies
§15.247(b)(1) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	BLE	■	☐	☐	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	BLE	■	☐	☐	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	BLE	■	☐	☐	Complies
§15.247(d); §15.209 RSS-Gen 6.13	Radiated Spurious Emissions	Nominal	BLE+ UWB, BLE	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	BLE	☐	■	☐	NA

Note: NA= Not Applicable; NP= Not Performed.
*): see manufacturer's product manual.
Note 2. See section 3.5 Mode of Operation

6 Measurements

6.1 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=2.

Radiated measurement

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

Conducted measurement

RF conducted measurement ±0.5 dB

6.2 Environmental Conditions During Testing:

The following environmental conditions were maintained during testing:

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

6.3 Dates of Testing:

2024-09-03 to 2024-09-20

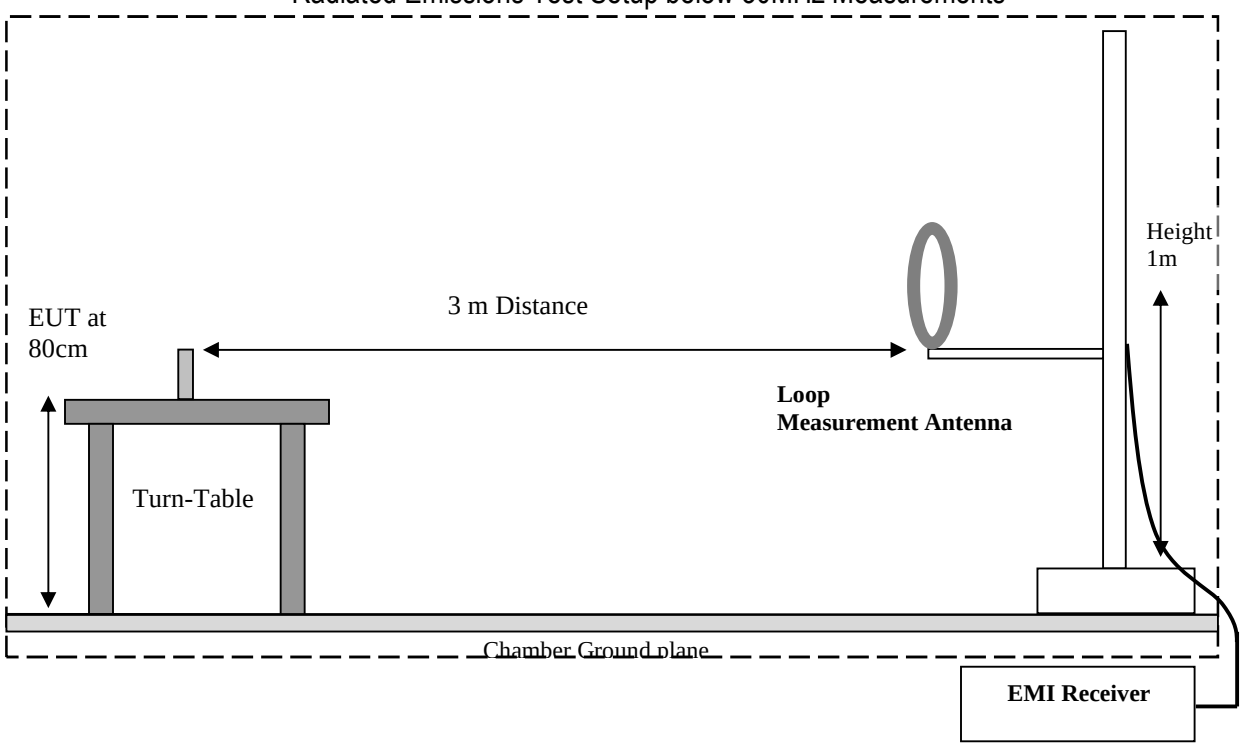
7 Measurement Procedures

7.1 Radiated Measurement

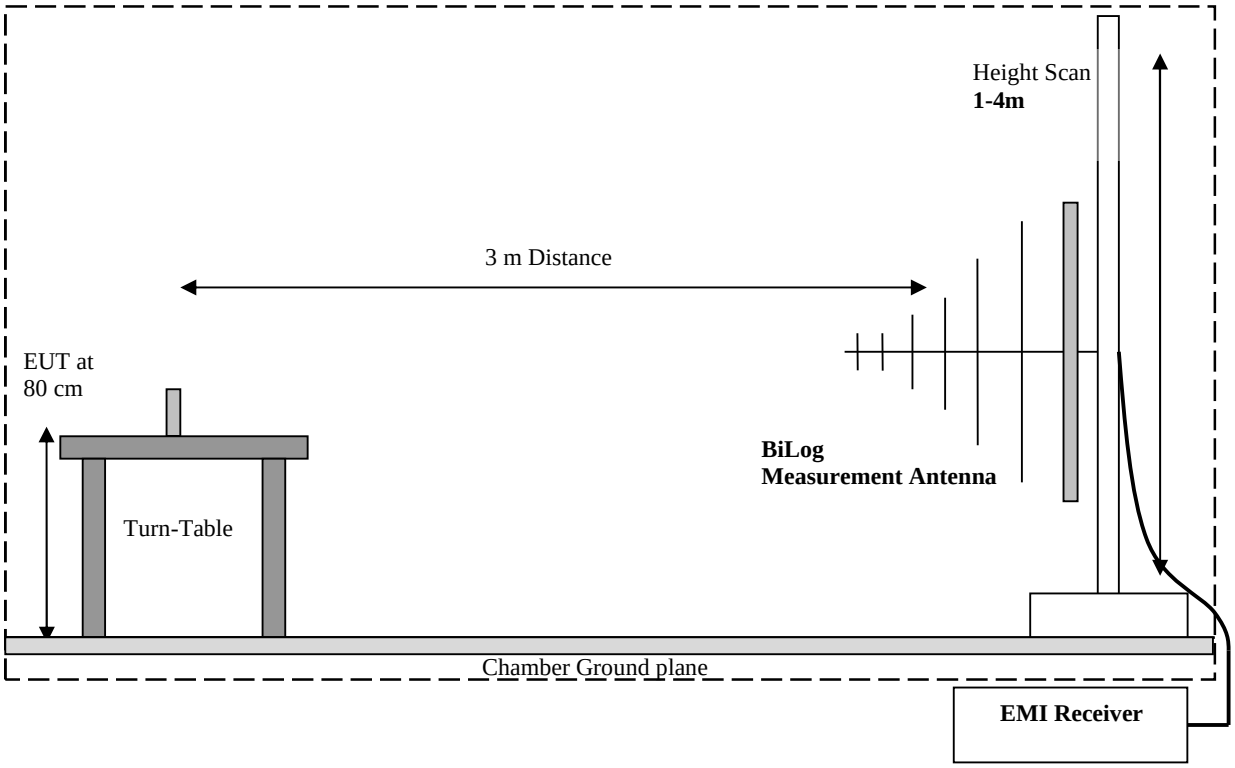
The radiated measurement is performed according to: ANSI C63.10 (2013)

- 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.

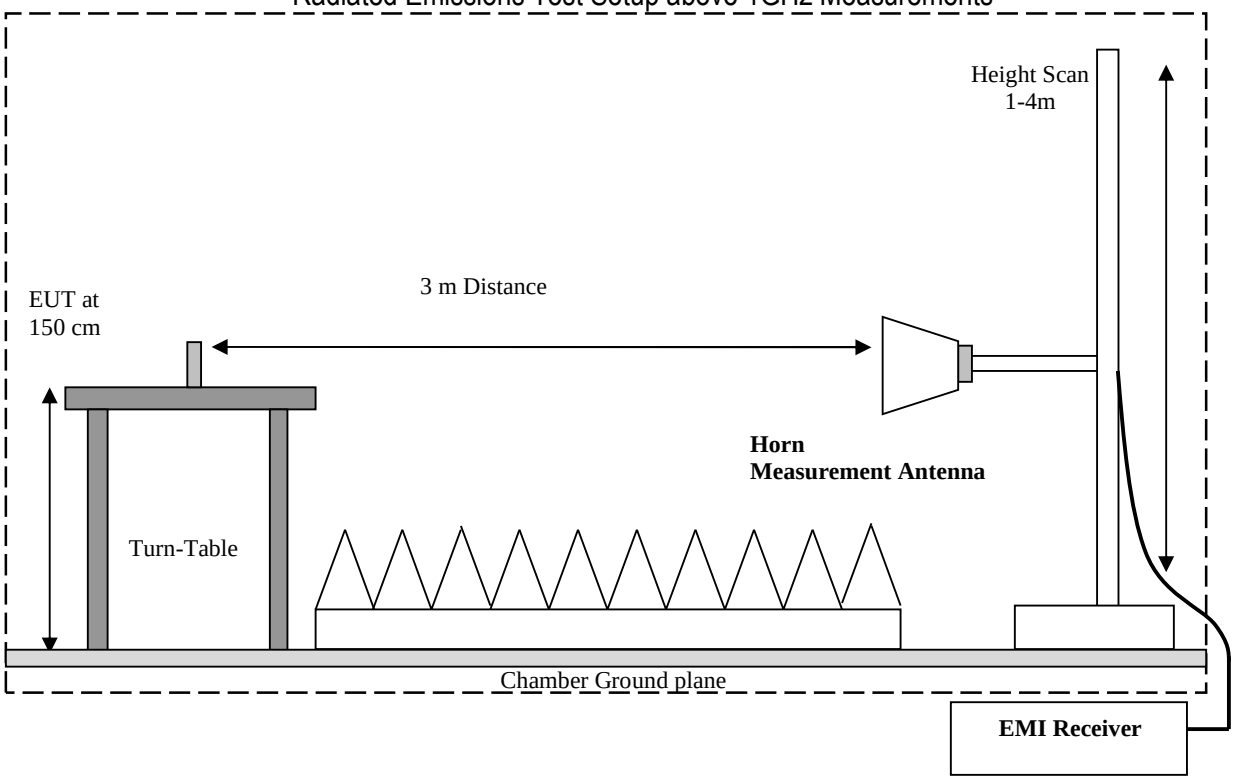
Radiated Emissions Test Setup below 30MHz Measurements



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, considering 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:

$$E = P + \mathrm{AF} - \mathrm{Cable\ loss}$$

E Field strength in dBµV/m
P Test receiver raw value in dBµV
AF antenna factor in dB/m, including gain from attached amplifier in dB

Example:

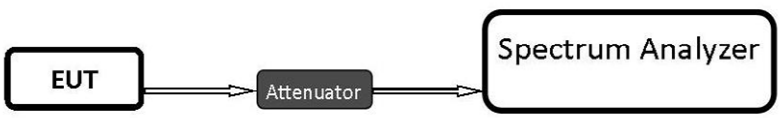
Frequency (MHz)	Measured raw value (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB/m)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

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.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

8 Test Result

8.1 Maximum Peak Conducted Output Power

8.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.11.9

Spectrum Analyzer settings:

- RBW ≥ DTS bandwidth
- VBW ≥ 3 x RBW
- Span ≥ 3 x RBW
- Sweep = Auto couple
- Detector function = Peak
- Trace = Max hold
- Use peak marker function to determine the peak amplitude level

8.1.2 Limits:

Maximum Peak Output Power:

- FCC §15.247 (b)(1): 1 W
- IC RSS-247: 1 W

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22 °C	1	BLE continuous fixed channel	nominal	1.12 dBi

8.1.4 Measurement result:

Plot #	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
1	2402	7.5	8.9	30 (Pk) / 36 (EIRP)	Pass
2	2441	8.9	10.3	30 (Pk) / 36 (EIRP)	Pass
3	2480	9.4	10.8	30 (Pk) / 36 (EIRP)	Pass

8.2 Power Spectral Density

8.2.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 x DTS bandwidth
- Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz
- Set the VBW ≥ 3 x RBW
- Detector = Peak
- Sweep time = Auto couple
- Trace mode = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level within the RBW
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

8.2.2 Limits:

FCC§15.247(e) & RSS-247 5.2(b)

- For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.2.3 Test conditions and setup:

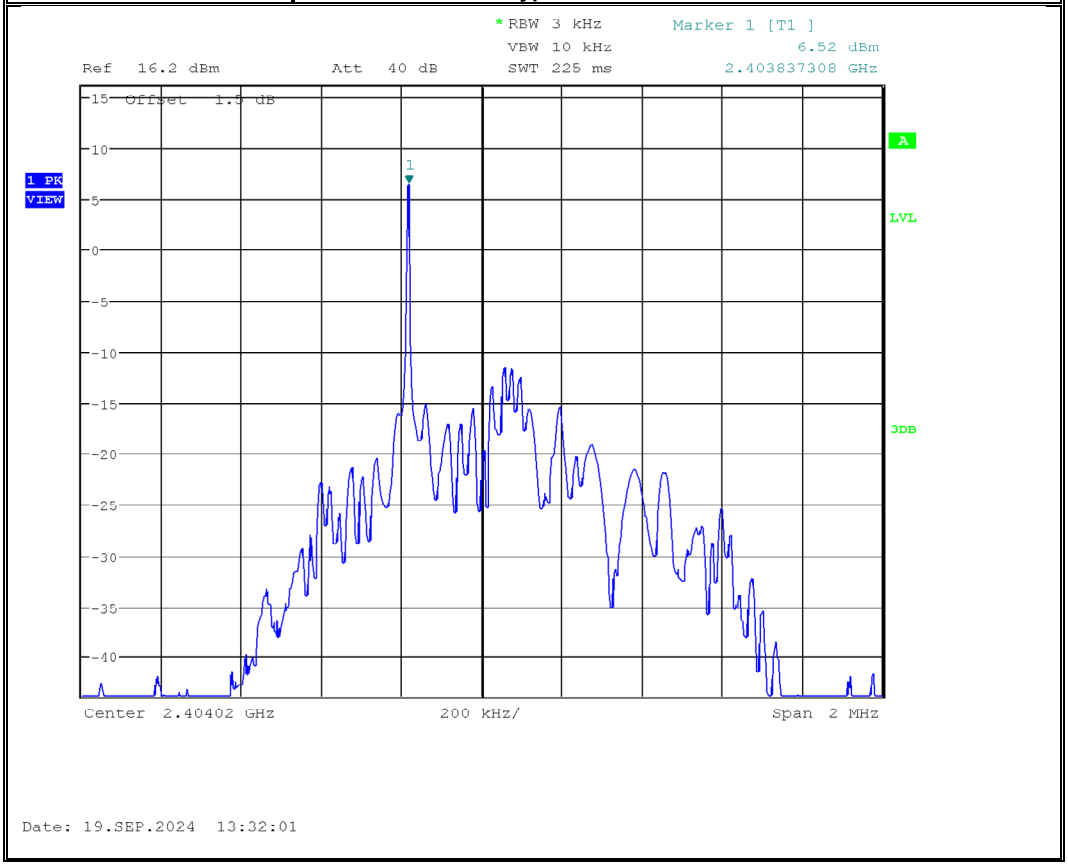
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22 °C	1	BLE continuous fixed channel	Nominal	1.12 dBi

8.2.4 Measurement result:

Plot #	Frequency (MHz)	Maximum Power Spectral Density (dBm/3 kHz)	Limit (dBm / 3 kHz)	Result
1	2402	6.52	8	Pass
2	2441	7.99	8	Pass
3	2480	7.90	8	Pass

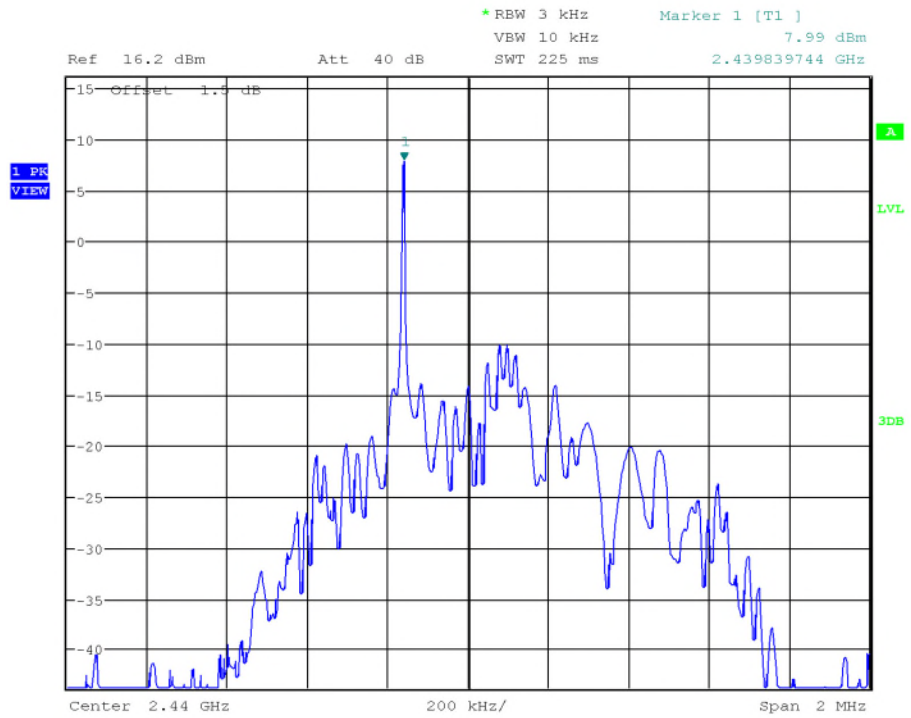
8.2.5 Measurement Plots:

Plot #1	
Low channel	Modulation/Packet Type: BTLE



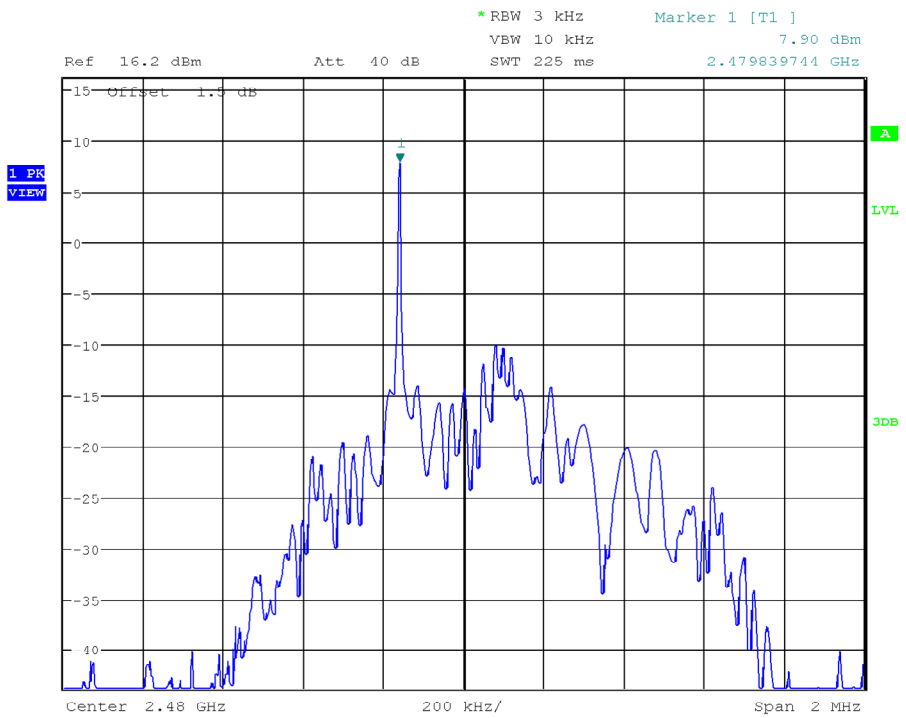
Plot #2

Mid channel	Modulation/Packet Type: BTLE



Plot #3

High channel	Modulation/Packet Type: BTLE



8.3 Band Edge Compliance

8.3.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings for band edge:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

8.3.2 Limits non restricted band:

FCC§15.247 (d)

- 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)).

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- 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 30dB instead of 20dB.

Spectrum Analyzer settings for restricted band:

- Peak measurements are made using a peak detector and RBW=1 MHz

8.3.3 Limits restricted band §15.247/15.209/15.205 and RSS-Gen 8.9/8.10

- *PEAK LIMIT= 74 dBµV/m @3m =-21.23 dBm
- *AVG. LIMIT= 54 dBµV/m @3m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

(a) 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			

8.3.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22 °C	1	BLE continuous fixed channel	Nominal	1.12 dBi

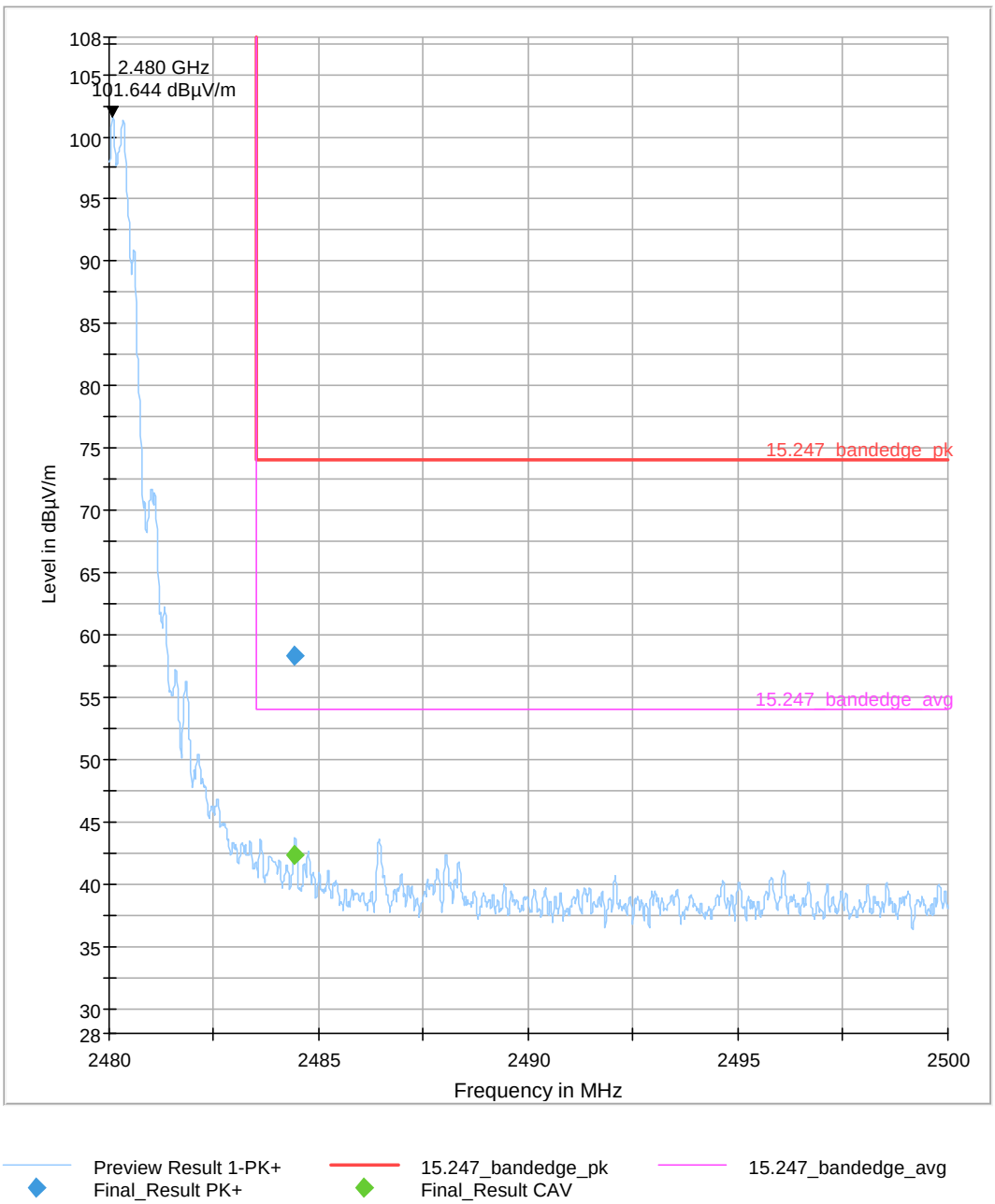
8.3.5 Measurement result:

Plot #	Operation Mode	Scan Frequency	Spurious emission level with lowest margin	Limit	Result
1	BLE channel 39	2480 – 2500 MHz	42.32 dBµV/m	See section 8.3.2	Pass

8.3.6 Measurement Plots:

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)
2484.439	---	42.32	54.00	11.68	500.0	1000.0	260.0	V	34.0	34.3
2484.439	58.27	---	74.00	15.73	500.0	1000.0	260.0	V	34.0	34.3



8.4 Emission Bandwidth 6dB and 99% Occupied Bandwidth

8.4.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

6dB (DTS) Bandwidth:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

99% Occupied Bandwidth:

- Set frequency = nominal EUT channel center frequency
- Set Span = 1.5 x to 5.0 x OBW
- Set RBW = 1% to 5% of OBW
- Set the video bandwidth (VBW) ≈ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

8.4.2 Limits:

FCC §15.247(a)(2) and RSS-247 5.2(a)

- Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.4.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	1	BLE continuous fixed channel	Nominal

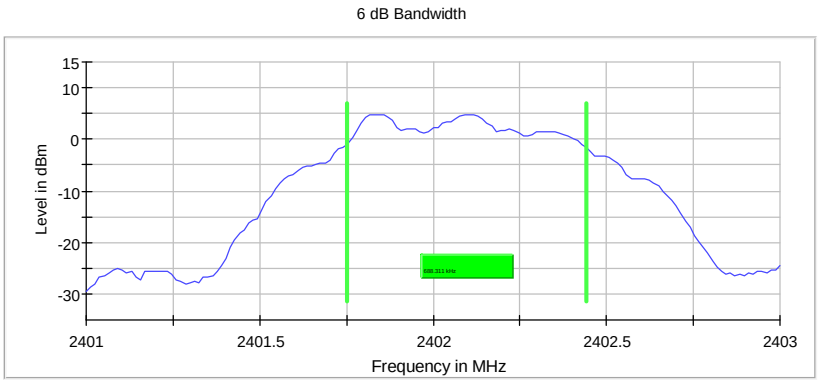
8.4.4 Measurement result:

Plot #	Frequency (MHz)	6dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	2402	0.688	> 0.5	Pass
2	2441	0.688	> 0.5	Pass
3	2480	0.688	> 0.5	Pass

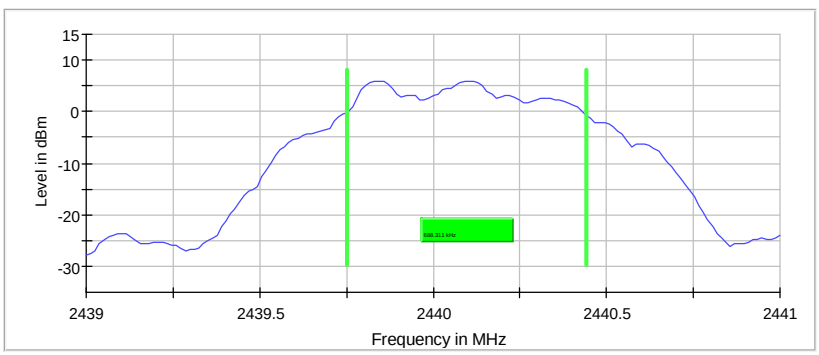
Plot #	Frequency (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
4	2402	1.000	For information only	-
5	2441	1.005	For information only	-
6	2480	0.995	For information only	-

8.4.5 Measurement Plots:

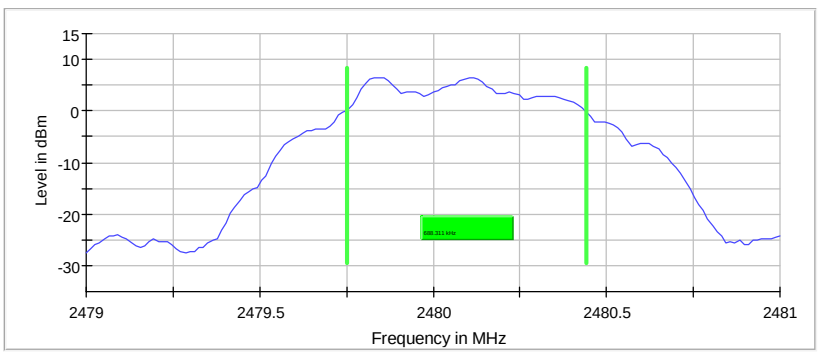
Plot #1	
2402 MHz	Mode: BTLE



Plot #2	
2440 MHz	Mode: BTLE

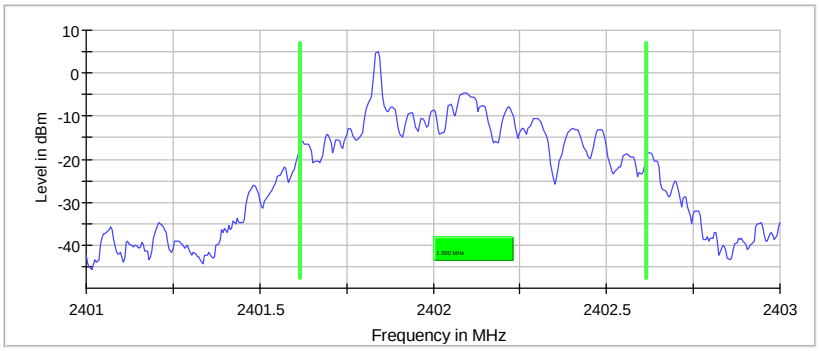


Plot #3	
2480 MHz	Mode: BTLE



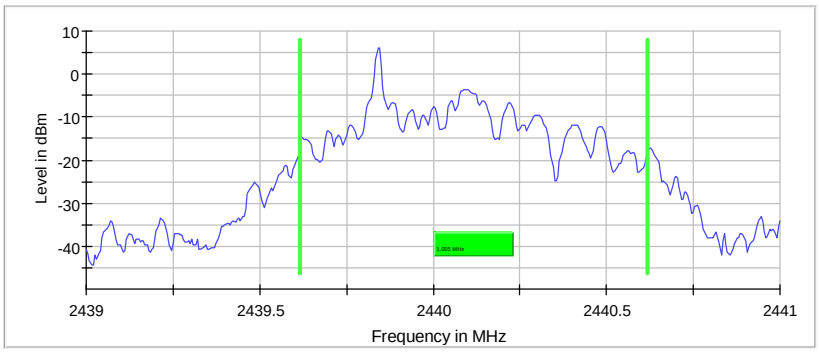
Plot #4

2402 MHz	Mode: BTLE



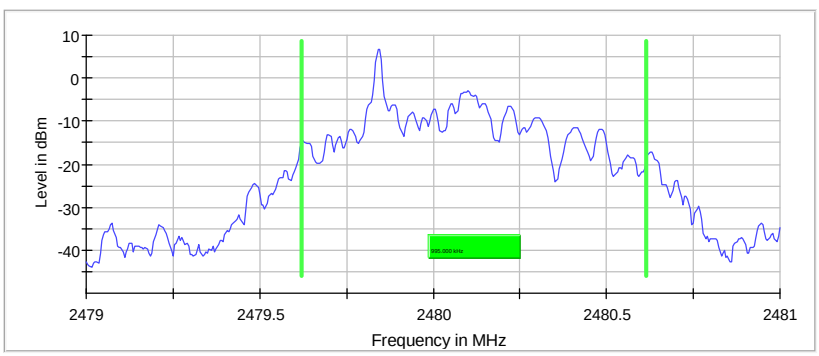
Plot #5

2440 MHz	Mode: BTLE



Plot #6

2480 MHz	Mode: BTLE



8.5 Radiated Transmitter Spurious Emissions and Restricted Bands

8.5.1 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.

8.5.2 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

8.5.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	2	BLE continuous fixed channel	Nominal

8.5.4 Measurement result:

Note: the EUT is tested under two operational modes

1. BLE + UBW simultaneous transmission mode (BLE low/mid/high channel combined with UBW channel 9)
2. BLE only (spot check middle channel only, low/high channels are covered under simultaneous transmission)

Note: for simultaneous transmission, the worst case is determined to be the BLE channel 39 (high channel) + UWB channel 9 at data rate 6.8 Mbits. Following plots include:

1. BLE channel 39 + UWB channel 9
2. BLE channel 19

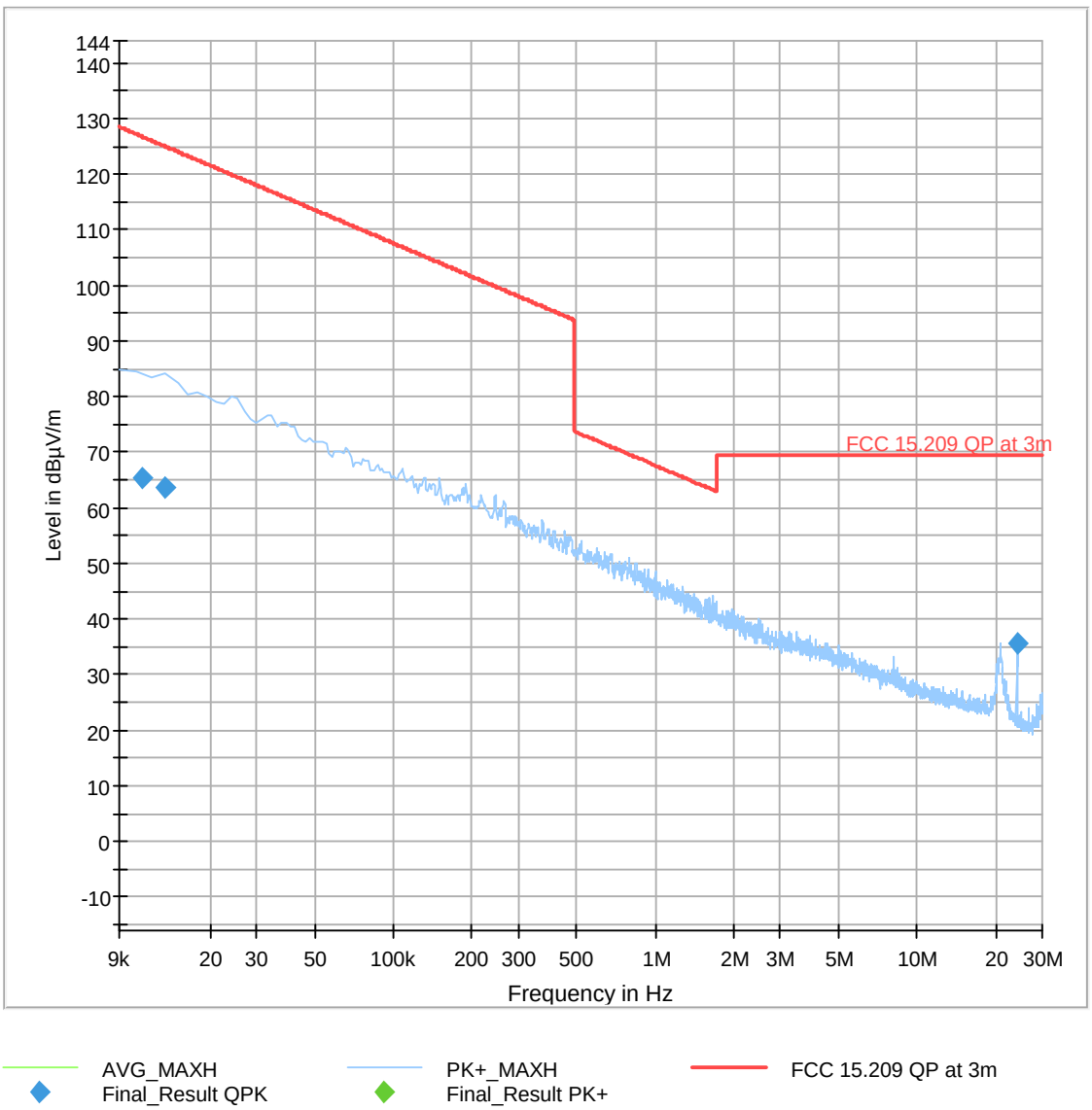
Plot #	Operation Mode	Scan Frequency	Spurious emission level with lowest margin	Limit	Result
1-6	BLE channel 39 + UWB channel 9	9 kHz – 40 GHz	51.85 dBµV/m at 7.44 GHz	See section 8.6.2	Pass
7-11	BLE channel 19	9 kHz – 40 GHz	61.70 dBµV/m at 40 GHz	See section 8.6.2	Pass

8.5.5 Measurement Plots: BLE + UWB simultaneous transmission

Plot # 1: 9 kHz – 30 MHz

Final_Result

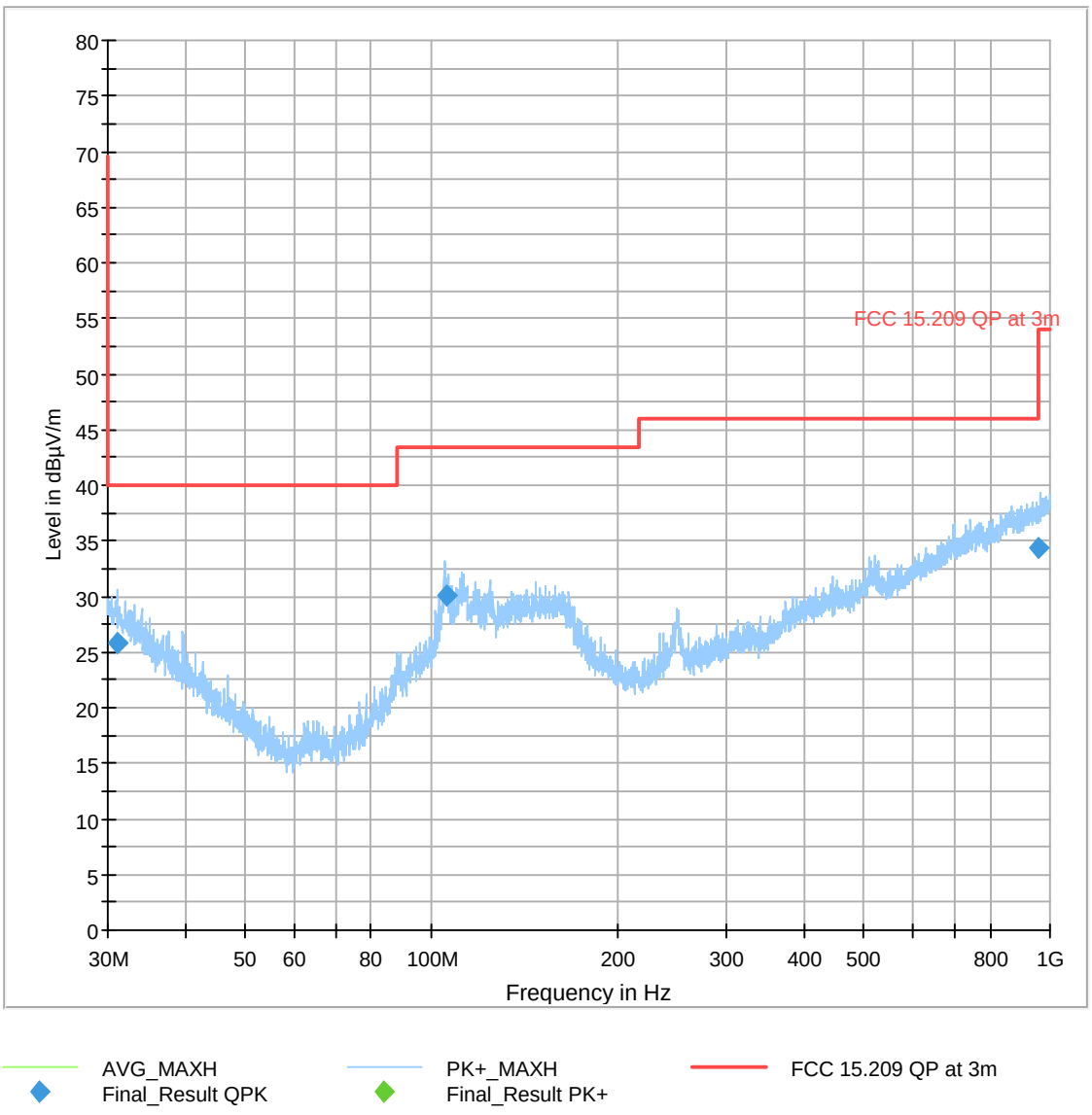
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
0.011	65.484	---	126.79	61.31	500.0	0.200	100.0	V	49.0	28.2	0.2	0.0	28.0	37.3
0.014	63.571	---	124.98	61.41	500.0	0.200	100.0	V	331.0	26.8	0.2	0.0	26.6	36.8
24.001	35.460	---	69.50	34.04	500.0	9.000	100.0	V	166.0	16.7	0.5	0.0	16.2	18.7



Plot # 2: 30 MHz – 1 GHz

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
31.123	25.833	---	40.00	14.17	500.0	120.000	338.0	H	10.0	25.1	0.7	0.0	24.4	0.7
106.001	30.003	---	43.50	13.50	500.0	120.000	107.0	V	173.0	23.5	1.2	0.0	22.3	6.5
961.567	34.327	---	53.98	19.65	500.0	120.000	319.0	H	106.0	32.8	3.3	0.0	29.5	1.6

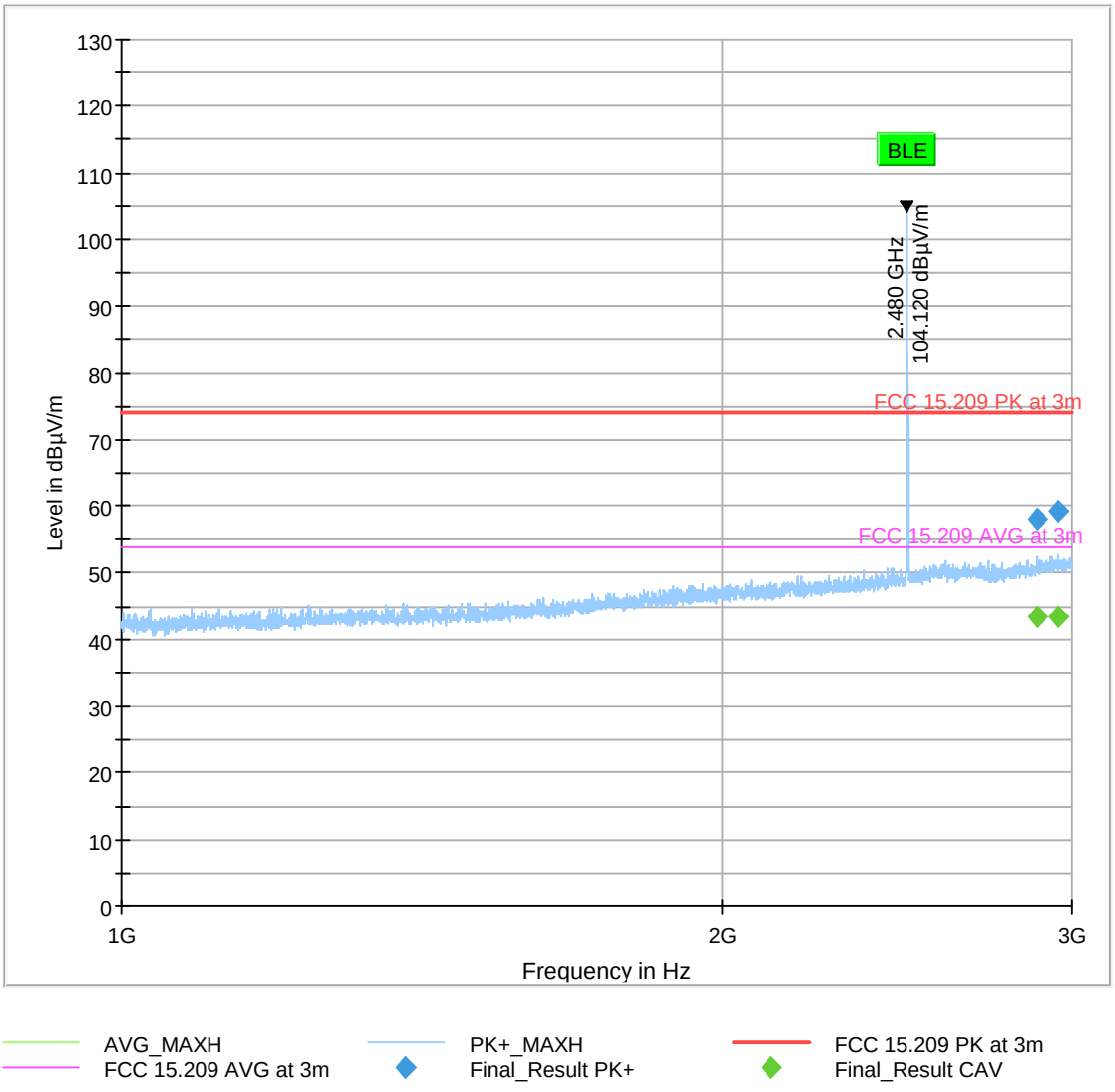


Plot # 3: 1 GHz – 3 GHz

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)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2879.989	58.119	---	73.98	15.86	500.0	1000.000	201.0	H	257.0	35.4	6.2	0.0	29.2	22.7
2879.989	---	43.421	53.98	10.56	500.0	1000.000	201.0	H	257.0	35.4	6.2	0.0	29.2	8.0
2953.146	59.241	---	73.98	14.74	500.0	1000.000	396.0	H	106.0	35.7	6.1	0.0	29.7	23.5
2953.146	---	43.490	53.98	10.49	500.0	1000.000	396.0	H	106.0	35.7	6.1	0.0	29.7	7.7

Note: the emission at 2.4 GHz is the wanted BLE signal, which is irrelevant to the limit.

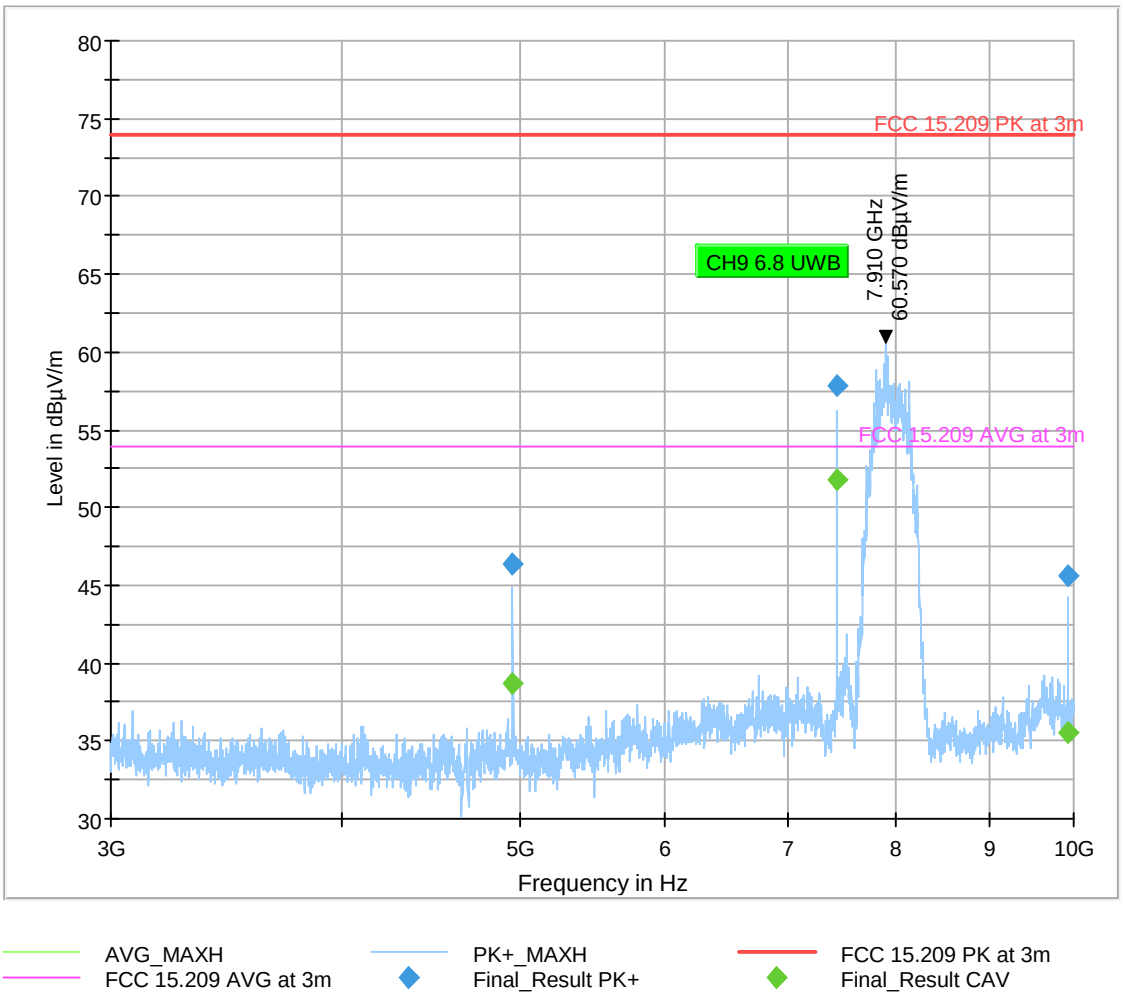


Plot # 4: 3 GHz – 10 GHz

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)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
4959.650	---	38.670	53.98	15.31	500.0	1000.000	100.0	H	350.0	-4.0	7.6	-45.7	34.1	42.6
4959.650	46.369	---	73.98	27.61	500.0	1000.000	100.0	H	350.0	-4.0	7.6	-45.7	34.1	50.3
7439.517	57.892	---	73.98	16.09	500.0	1000.000	241.0	H	167.0	-1.7	9.1	-46.7	35.9	59.6
7439.517	---	51.851	53.98	2.13	500.0	1000.000	241.0	H	167.0	-1.7	9.1	-46.7	35.9	53.6
9919.267	45.588	---	73.98	28.39	500.0	1000.000	100.0	H	357.0	1.1	10.0	-46.3	37.4	44.5
9919.267	---	35.488	53.98	18.49	500.0	1000.000	100.0	H	357.0	1.1	10.0	-46.3	37.4	34.4

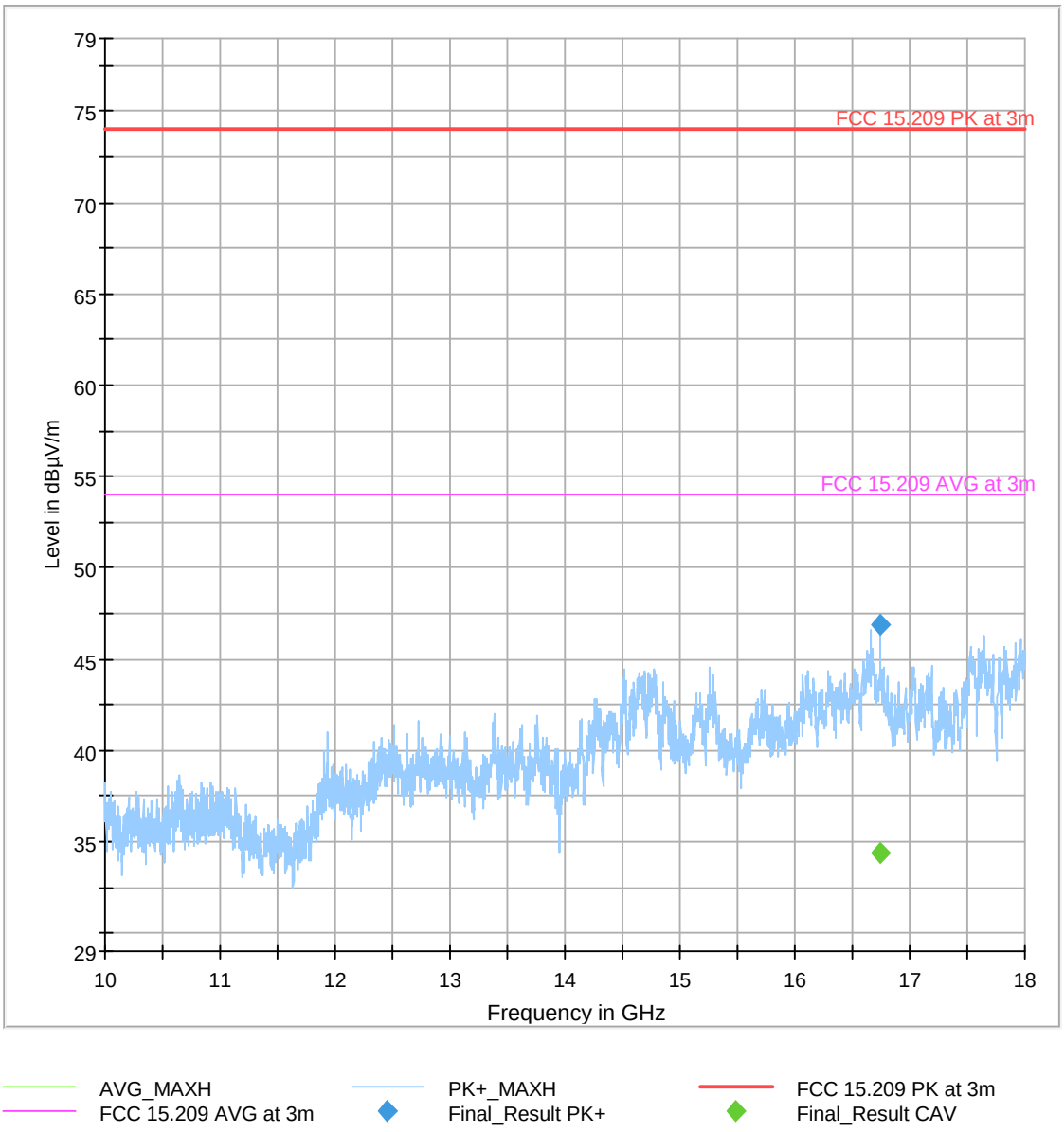
Note: the emission at 7.9 GHz is the wanted UWB signal, which is irrelevant to the limit.



Plot # 5: 10 GHz – 18 GHz

Final_Result

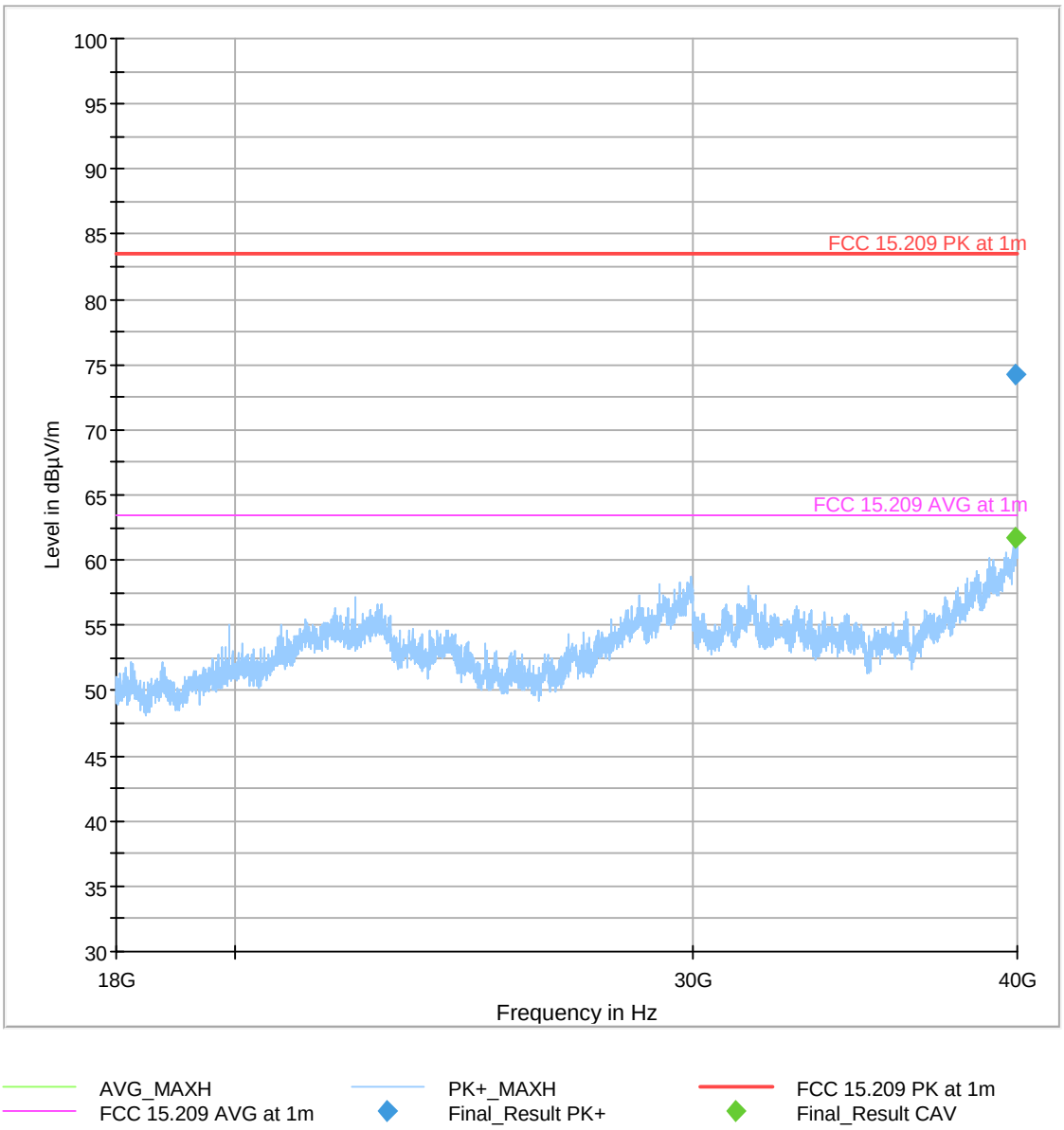
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
16745.733	---	34.336	53.98	19.64	500.0	1000.000	100.0	H	87.0	13.7	15.1	-42.7	41.3	20.6
16745.733	46.895	---	73.98	27.08	500.0	1000.000	100.0	H	87.0	13.7	15.1	-42.7	41.3	33.2



Plot # 6: 18 GHz – 40 GHz

Final_Result

Frequency	MaxPeak (dBµV/m	CAverage	Limit (dBµV/m	Margin	Meas.	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m	Sig Pat	Preamp	Trd Corr.	Raw Rec
39915.625	---	61.698	63.50	1.80	500.0	1000.000	325.0	H	59.0	24.3	12.7	0.0	11.6	37.4
39915.625	74.245	---	83.50	9.25	500.0	1000.000	325.0	H	59.0	24.3	12.7	0.0	11.6	49.9

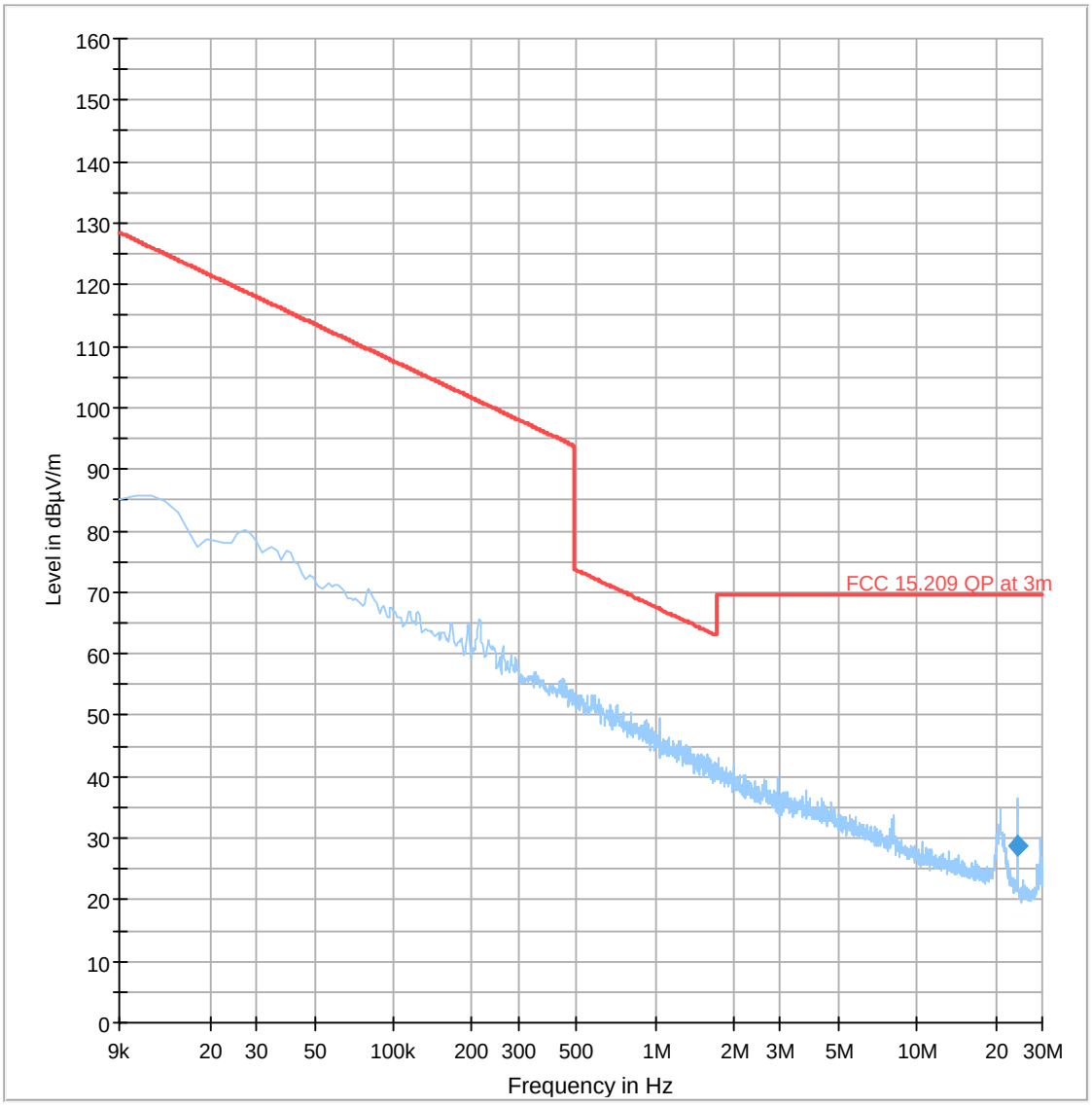


8.5.6 Measurement Plots: BLE only transmission

Plot # 7: 9 kHz – 30 MHz

Final_Result

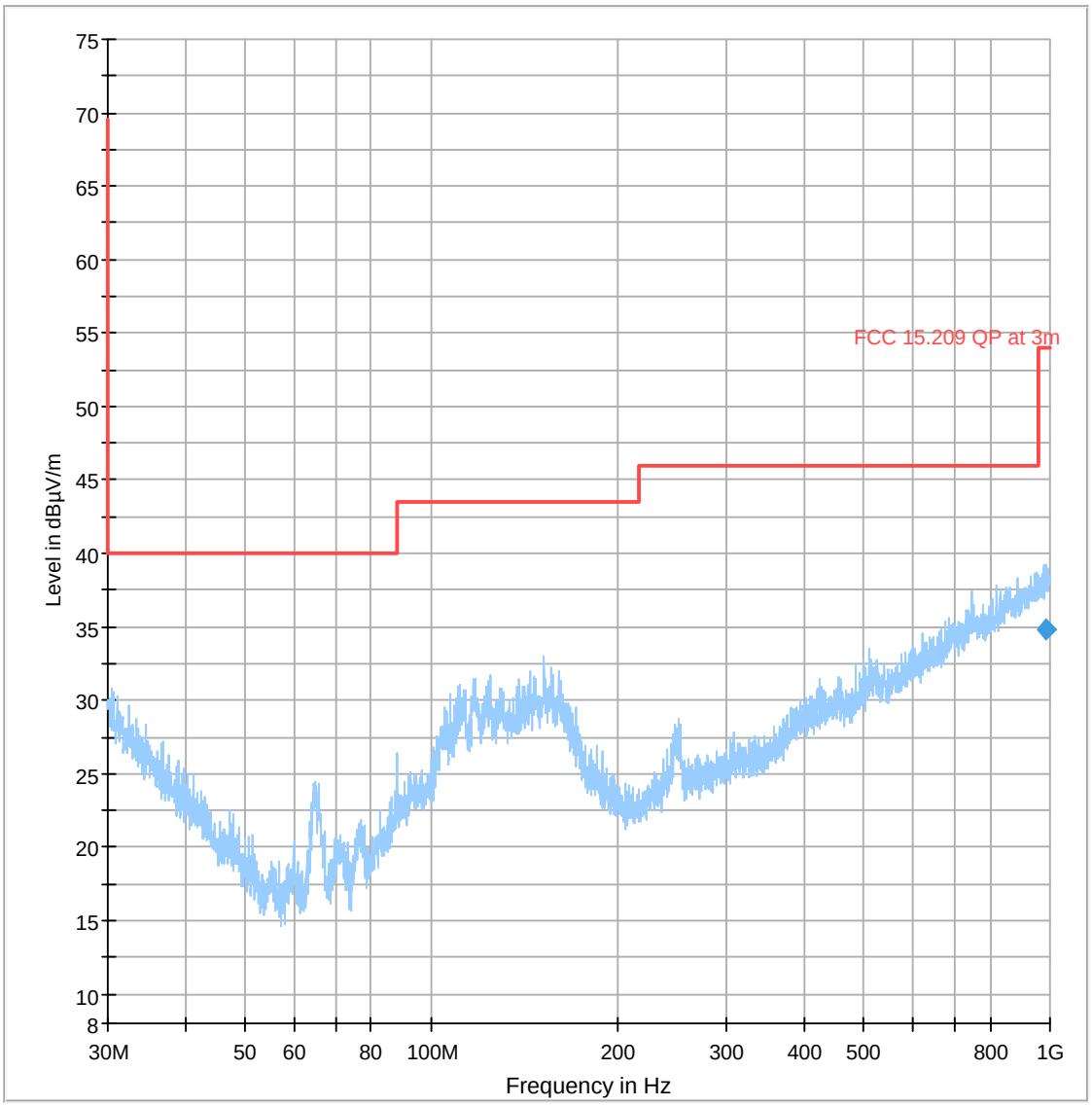
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
24.107	28.837	---	69.50	40.66	500.0	9.000	100.0	V	73.0	16.7	0.5	0.0	16.2	12.1



Plot # 8: 30 MHz – 1 GHz

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
983.528	34.794	---	53.98	19.19	500.0	120.000	160.0	V	263.0	32.9	3.4	0.0	29.6	1.9

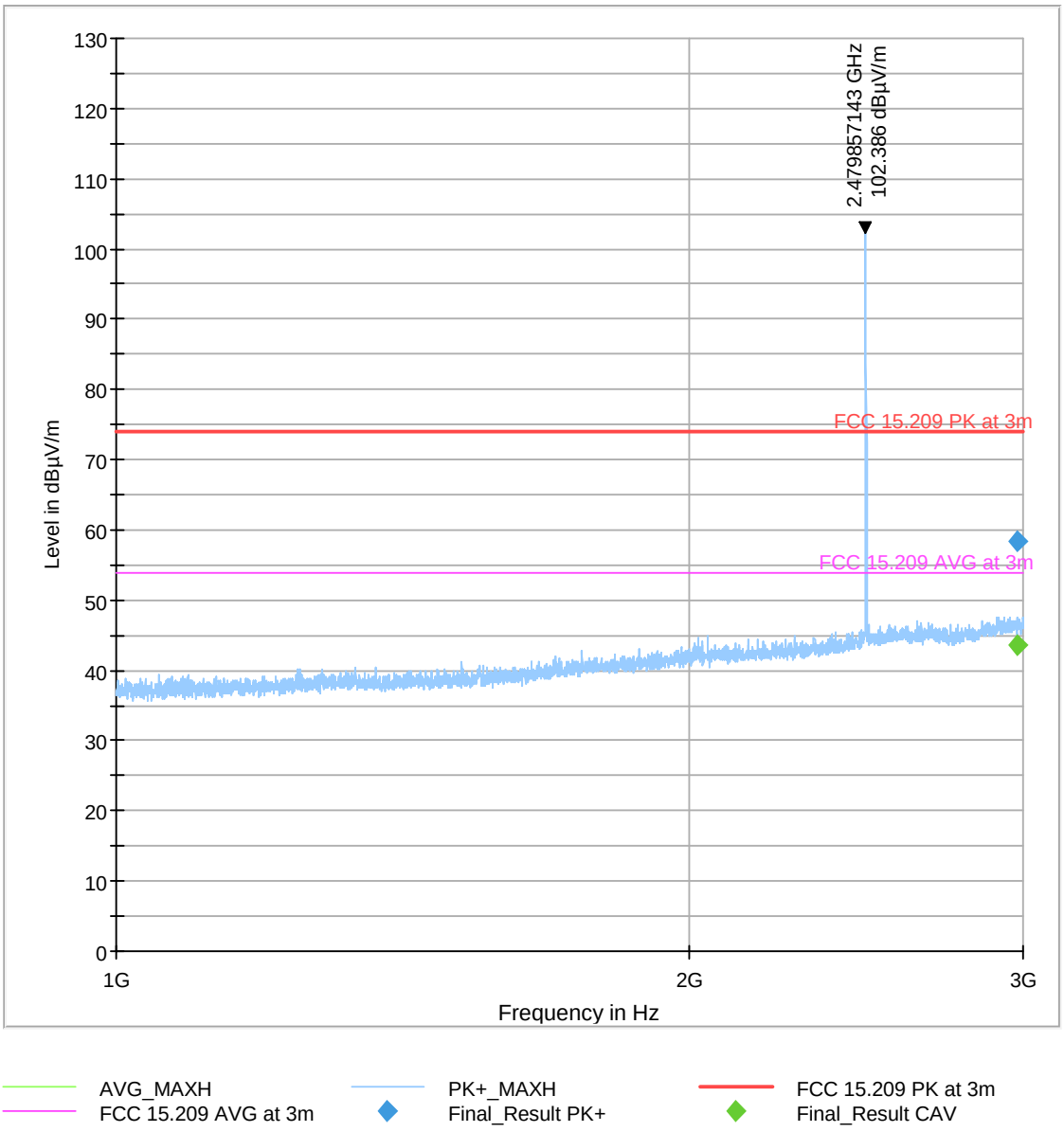


Plot # 9: 1 GHz – 3 GHz

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)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2980.155	---	43.676	53.98	10.30	500.0	1000.000	116.0	H	173.0	35.9	6.0	0.0	29.9	7.8
2980.155	58.342	---	73.98	15.64	500.0	1000.000	116.0	H	173.0	35.9	6.0	0.0	29.9	22.4

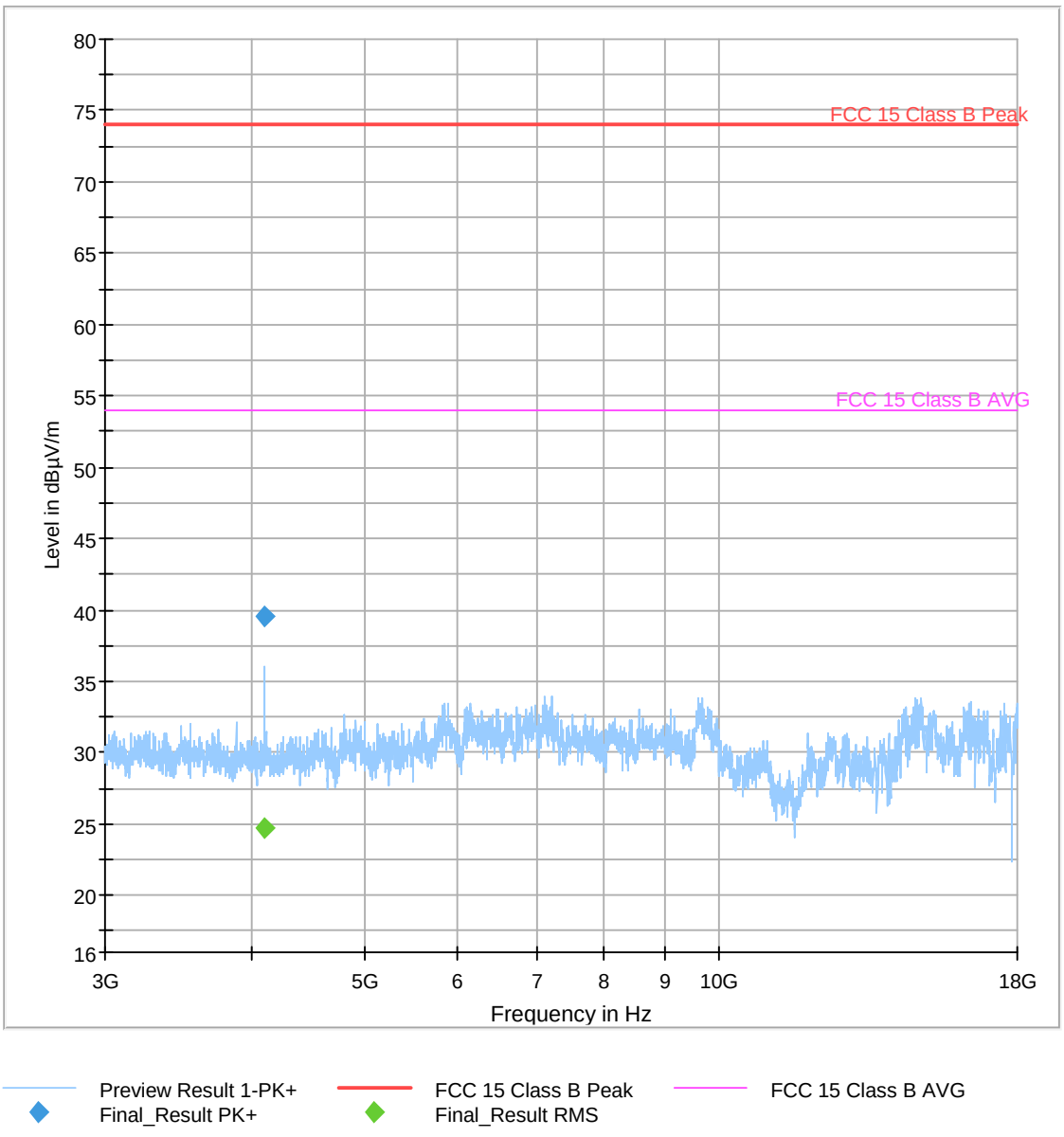
Note: the emission at 2.4 GHz is the wanted BLE signal, which is irrelevant to the limit.



Plot # 10: 3 GHz – 18 GHz

Final_Result

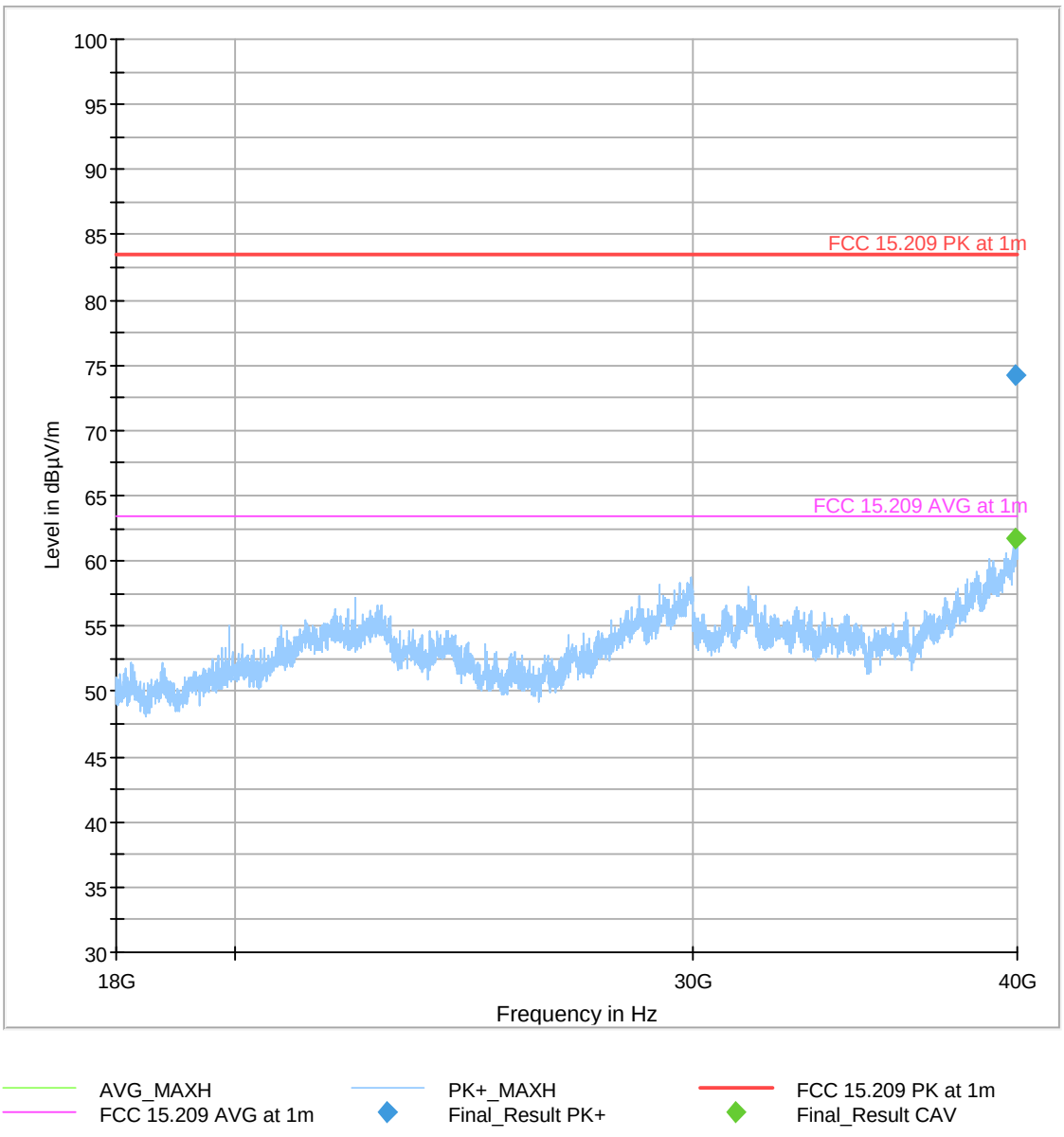
Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
4102.750	---	24.728	53.98	29.25	500.0	1000.000	331.0	V	125.0	-33.8	-	-46.6	33.3	58.5
4102.750	39.581	---	73.98	34.40	500.0	1000.000	331.0	V	125.0	-33.8	-	-46.6	33.3	73.4



Plot # 11: 18 GHz – 40 GHz

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)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
39915.625	---	61.698	63.50	1.80	500.0	1000.000	325.0	H	59.0	24.3	12.7	0.0	11.6	37.4
39915.625	74.245	---	83.50	9.25	500.0	1000.000	325.0	H	59.0	24.3	12.7	0.0	11.6	49.9



9 Test Setup Photos

Setup photos are included in supporting file name:
"RIVIA_069_24001_FCC15247_RSS247_Setup_Photos.pdf"

10 Test Equipment and Ancillaries Used for Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
BILOG ANTENNA	A.H. SYSTEMS	BiLA2G	569	3 Years	10/30/2023
HORN ANTENNA	EMCO	3115	00035111	3 Years	10/26/2023
HORN ANTENNA	ETS LINDGREN	3117-PA	00167061	3 Years	9/25/2023
HORN ANTENNA	ETS LINDGREN	3116C-PA	00166821	3 Years	10/26/2023
HORN ANTENNA	A.H. Systems	SAS-200/572	141	N/A	07/31/2024
HORN ANTENNA	A.R.A	MWH-2640-283	220021	N/A	03/26/2021
Amplifier 18GHz-26.5GHz	Miteq	JS4-18002650-26-5A	710618	N/A	-
Double Amplifier 26GHz-40GHz	Miteq	JS4-26004000-25-5A JS4-26004000-30-5A	742174 742177	N/A	-
ESW.EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101715	3 Years	10/24/2023
DIGITAL THERMOMETER	Control Company	4410,90080-03	230712972	3 Years	10/18/2023
Signal Analyzer	R&S	FSV40	101022	3 Years	09/25/2023
Software	EMC32	Version 10.50.40	-	N/A	-

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 Revision History

Date	Report name	Changes to report	Prepared by
2024-10-11	RIVIA_069_24001_FCC15.247_RSS247	Initial version	Guangcheng Huang
2024-10-15	RIVIA_069_24001_FCC15.247_RSS247_Rev1	Updates: PSD, antenna gain, typo, result summary table, description of band edge test method, 99% OBW, adding declaration of similarity	Guangcheng Huang

12 Annex: Declaration of Similarity

RIVIAN

14600 Myford Rd
Irvine CA, 92606

Declaration of Similarity

TO WHOM IT MAY CONCERN

We, Rivian Automotive LLC., hereby declare that the following Models of Keyfob 2.0 are electrically identical and have the same electromagnetic emissions and electromagnetic compatibility characteristics. The models only difference is cosmetic on the cover.

Model	FCC ID	IC	Description
R1TKFB	2AW3A-2WWG24R1TKFB	26958-2WWG24R1TKF	Automotive Vehicle Access Keyfob (R1T)
R1SKFB	2AW3A-2WWG24R1SKFB	26958-2WWG24R1SKF	Automotive Vehicle Access Keyfob (R1S)

Sincerely,

Sep Zaker

Director, Homologation

E: sepzaker@rivian.com

RIVIAN

Rivian Internal

<<< The End >>>