RF Test Report

Applicant:	Quectel Wireless Solutions Company Limited
Address:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Product:	Wi-Fi & Bluetooth Module
Model No.:	FCMA62N
Brand Name:	QUECTEL
FCC ID:	XMR2024FCMA62N
Standards:	FCC CFR47 Part 15C
Report No.:	PD20240077RF08
Issue Date:	2024/08/15
Test Result:	PASS *

* **Testing performed at Hefei Panwin Technology Co., Ltd. on the above equipment indicates the product meets the requirements of the relevant standards.**

Reviewed By: Jerry Zhang **Approved By:** Alec Yang

Hefei Panwin Technology Co., Ltd.

Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province,China

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Revision History

Report No.	Version	Description	Issue Date	Note
PD20240077RF08	1	Initial Report	2024/08/15	Valid

CONTENTS

Test Summary

No.	Test Case	FCC Rules	Verdict
1	Output Power Measurement	15.247(b)	PASS
2	6dB and 99% Bandwidth Measurement	15.247(a)(2)	PASS
3	Power Spectral Density Measurement	15.247(e)	PASS
4	Conducted Band Edges and Spurious Emission Measurement	15.247(d)	PASS
5	Radiated Band Edges and Spurious Emission Measurement	15.247(d)	PASS
6	AC Conducted Emission Measurement	15.207	NA
7	Antenna Requirements	15.203 & 15.247(b)	PASS

Date of Testing: 2024/06/14 to 2024/08/15
Date of Sample Received: 2024/06/12

- The samples tested have been evaluated in accordance with the procedures given in the application standards in **Section 2.3** of this report and have been shown to comply with the applicable technical standards.
- All indications of PASS/FAIL in this report are based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.

1 General Information

1.1 Notes of the Test Report

This report is invalid without signature of auditor and approver or with any alterations. The report shall not be partially reproduced without written approval of the testing company. Entrusted test results are only responsible for incoming samples. If there is any objection to the testing report, it shall be raised to the testing company within 15 days from the date of receiving the report. In the test results, "NA" means "not applicable", and the test items marked with "Δ" are subcontracted projects.

1.2 Test Facility

A2LA (Certificate Number: 6849.01)

Hefei Panwin Technology Co., Ltd. has been accredited by American Association for Laboratory Accreditation to perform measurement.

FCC (Designation Number: CN1361, Test Firm Registration Number: 473156)

Hefei Panwin Technology Co., Ltd. has been accredited on the US Federal Communications Commission list of test facilities recognized to perform measurements.

1.3 Testing Laboratory

Company Name	Hefei Panwin Technology Co., Ltd.
Address	Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province,China
Telephone	+86-0551-63811775
Post Code	230031

2 General Description of Equipment under Test

2.1 Details of Application

Applicant	Quectel Wireless Solutions Company Limited
Applicant Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Company Limited
Manufacturer Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

2.2 General Information

Product	Wi-Fi & Bluetooth Module	
Model	FCMA62N	
SN	Conducted	E1Y24E64X000025 E1Y24E64X000061
	Radiated	E1Y24E64X000047 E1Y24E64X000060
Hardware Version	R1.0	
Software Version	/	
Antenna Type	PCB Antenna	
Antenna Gain	-1.20dBi	
Additional Beamforming Gain	NA	
Max. Conducted Power	BLE: 7.58dBm	
Operating voltage	Typical 5.0Vdc	
Type of Modulation	Bluetooth LE 5.3: GFSK	
Operating Frequency Range(s)	Bluetooth LE: 2402 to 2480MHz	
Note: The declared of product specification for EUT and/or Antenna presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.		

2.3 Application Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Condition

3.1 Test Configuration

Test mode

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The worst cases were recorded in this report.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes (Z, X, Y axis), receiver antenna polarization (horizontal and vertical), the worst emission was found in Z position and the worst case was recorded.This report presents the data for the worst polarity.

Test Mode	Data Rate
Bluetooth LE	1Mbps
	2Mbps
	125Kbps
	500Kbps

3.2 Carrier Frequency and Channel

Frequency Band	Channel	Freq.(MHz)	Channel	Freq.(MHz
2400-2483.5 MHz	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

3.3 Equipment List

Conducted

Instrument	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
Spectrum Analyzer	KEYSIGHT	N9020B	PWC0048	1 Year	2024/10/10
RF Control Unit	Tonseced	JS0806-2	PWC0055	/	/
Shielded Chamber	Maorui	MR543	PWC0041	3 Years	2026/08/26
Test Software	Tonseced	JS1120-3 V3.2.22	/	/	/

Radiated

Instrument	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
EMI Test Receiver	R&S	ESR7	PWB0023	1 Year	2024/10/11
Spectrum Analyzer	R&S	FSV3044	PWB0024	1 Year	2024/10/11
Loop Antenna	R&S	HFH2-Z2E	PWB0026	1 Year	2024/10/21
TRILOG Broadband Antenna	Schwarzbeck	VULB9162	PWB0029	1 Year	2024/10/13
Double-Ridged Guide Antenna	ETS-Lindgren	3117	PWB0031	1 Year	2024/10/11
k Type Horn Antenna	Steatite Antennas	QMS-00880	PWB0035	1 Year	2024/10/17
Pre-Amplifier	R&S	OSP220 (OSP-B155G)	PWB0042	1 Year	2024/10/13
Pre-Amplifier	R&S	SCU18F	PWB0034	1 Year	2024/10/11
Pre-Amplifier	R&S	SCU40F1	PWB0036	1 Year	2024/10/11
Pre-Amplifier	COM-MW	DLNA8	PWB0094	1 Year	2024/11/08
Anechoic Chamber	ETS.LINDGREN	Fact 3-2m	PWB0003	3 Years	2026/06/05
Test Software	R&S	ELEKTRA 4.20.2	/	/	/

3.4 Support Equipment List

Equipment	Manufacturer	Description	Model	Serial Number
EVB	QUECTEL	/	/	/
Laptop	Lenovo	/	/	/

3.5 Test Uncertainty

No.	Parameter	Uncertainty
1	DTS Bandwidth	1.9 %
2	Occupied channel bandwidth	1.9 %
3	Duty Cycle	0.11 %
4	Maximum Conducted Output Power	1.18 dB
5	Maximum Power Spectral Density Level	0.98 dB
6	Band-edge Compliance	1.21 dB
7	Unwanted Emissions In Non-restricted Frequency Bands	9kHz-7GHz: 1.21 dB 7GHz-40GHz: 3.31 dB
8	Radiated Band Edges and Spurious Emission	Below 1GHz: 4.88 dB Above 1GHz: 5.06 dB
9	Temperature	3 °C
10	Humidity	1.3 %
11	Supply Voltages	0.006 V

4 Test Items Description

Ambient condition

Shielded Chamber

Temperature [°C]	21.4 to 27.2
Humidity [%RH]	47 to 58
Pressure [kPa]	100.2 to 101.4

Anechoic Chamber

Temperature [°C]	20.1 to 27.1
Humidity [%RH]	42 to 62
Pressure [kPa]	99.4 to 100.9

4.1 Output Power Measurement

4.1.1 Limit of Output Power

Rule Part 15.247 (b) (3) specifies that “For systems using digital modulation in the 902-928 MHz 2400-2483.5 MHz: 1 Watt.”

Average Output Power	≤1W(30dBm)

4.1.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

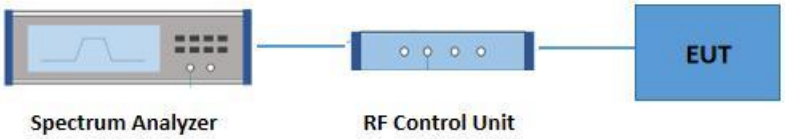
4.1.3 Test Procedures

The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.1.

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

1) Set the RBW ≥DTS bandwidth.
2) Set VBW ≥[3 × RBW].
3) Set span ≥[3 × RBW].
4) Sweep time = auto couple.
5) Detector = peak.
6) Trace mode = max hold.
7) Allow trace to fully stabilize.
8) Use peak marker function to determine the peak amplitude level.

4.1.4 Test Setup



4.1.5Test Results

See Appendix A.1.

4.2 6dB and 99% Bandwidth Measurement

4.2.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz

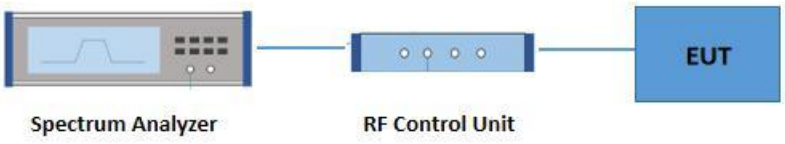
4.2.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
6. Measure and record the results in the test report.

4.2.4 Test Setup



4.2.5 Test Results

See Appendix A.2.

4.3 Power Spectral Density Measurement

4.3.1 Limit of Power Spectral Density

Rule Part 15.247(e) specifies that" For digitally modulated systems, the 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.

4.3.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.3.3 Test Procedures

The testing follows ANSI C63.10-2013 clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1) Set analyzer center frequency to DTS channel center frequency.
2) Set the span to 1.5 times the DTS bandwidth.
3) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4) Set the VBW ≥ [3 × RBW].
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level within the RBW.
10)If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

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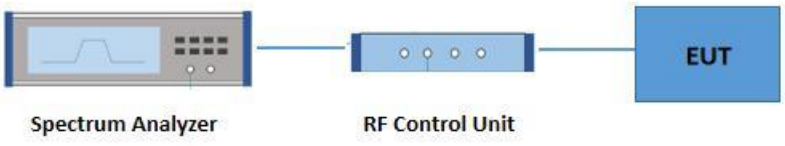
4.3.4 Test Setup



4.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.3.

4.4 Conducted Band Edges and Spurious Emission Measurement

4.4.1 Limit of Conducted Band Edges and Spurious Emission

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.

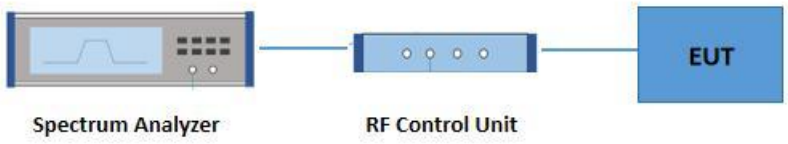
4.4.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test

4.4.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 11.13.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.4.4 Test Setup



4.4.5 Test Result

Please refer to Appendix A.4.

4.5 Radiated Band Edges and Spurious Emission Measurement

4.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100	3
88 -216	150	3
216 - 960	200	3
Above 960	500	3

4.5.2 Measuring Instruments

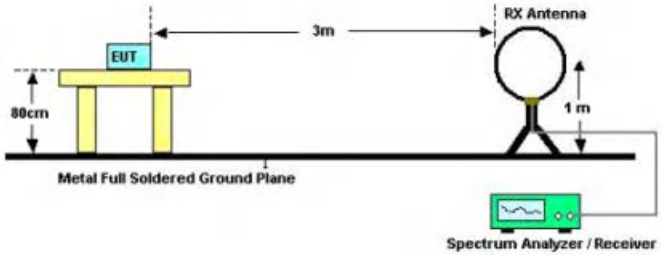
The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.5.3 Test Procedures

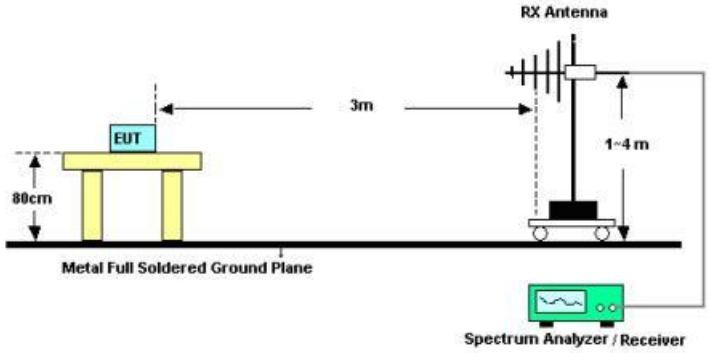
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level -Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured.
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
   (3) Set RBW = 1 MHz, VBW= 3MHz for ≥ 1 GHz for peak measurement
   For average measurement:
   VBW= 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

4.5.4 Test Setup

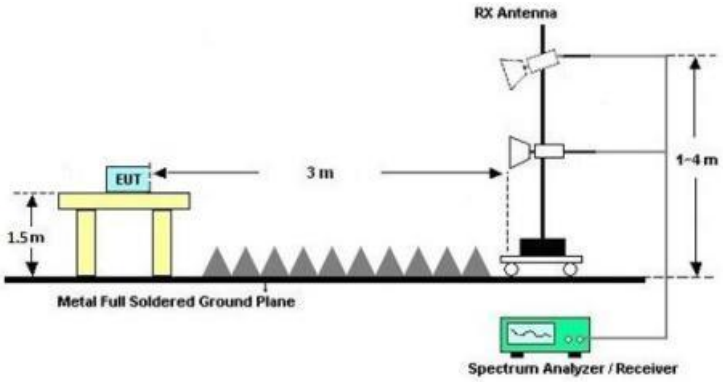
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



4.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

4.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.1.

4.5.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHzwhichever is lower)

Please refer to Appendix B.1.

4.5.8 Duty Cycle

Please refer to Appendix A.5.

4.6 AC Conducted Emission Measurement

4.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

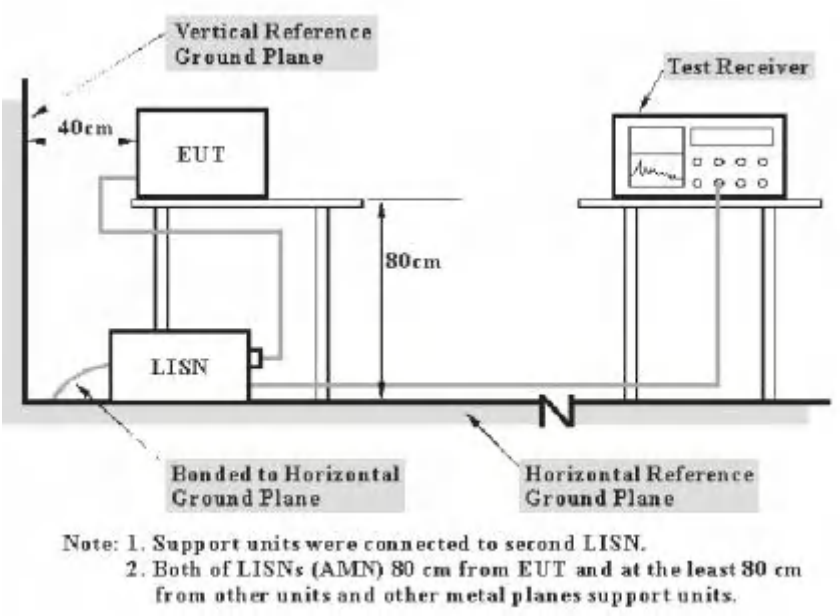
4.6.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth =9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

4.6.4 Test Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

4.9.5 Uncertainty Measurement

Where relevant,the following measurement uncertainty levels have been estimated for tests performed on the EUT. The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

CASE	Uncertainty
Continuous Emission (AC port)	2.92 dB

4.9.6 Test Result

Remark: The product is DC powered, this test item is not applicable.

4.7 Antenna Requirements

4.7.1 Standard Applicable

15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.7.2 Antenna Anti-Replacement Construction

The antenna is Internal on the main PCB and no consideration of replacement. The best case gain of the antenna is -1.20dBi.

Appendix A – Test Results of Conducted Test

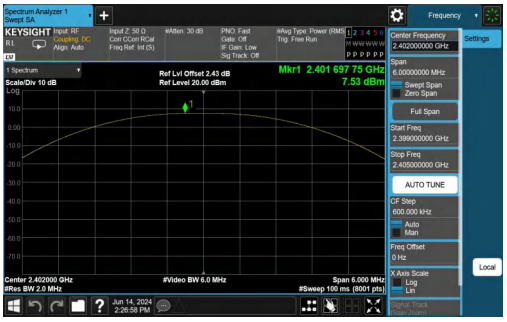
A.1 Conducted Output Power

Test Result Peak

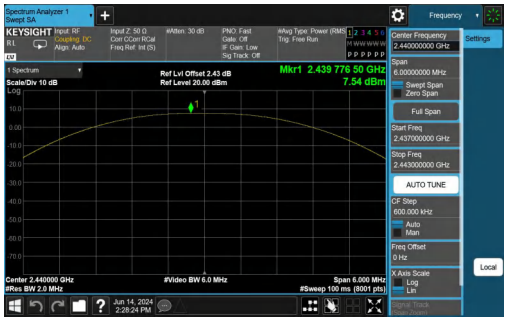
Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	7.53	≤30	6.33	≤36	PASS
BLE_1M	Ant1	2440	7.54	≤30	6.34	≤36	PASS
BLE_1M	Ant1	2480	7.03	≤30	5.83	≤36	PASS
BLE_2M	Ant1	2402	7.58	≤30	6.38	≤36	PASS
BLE_2M	Ant1	2440	7.58	≤30	6.38	≤36	PASS
BLE_2M	Ant1	2480	7.07	≤30	5.87	≤36	PASS
BLE_125K	Ant1	2402	7.57	≤30	6.37	≤36	PASS
BLE_125K	Ant1	2440	7.58	≤30	6.38	≤36	PASS
BLE_125K	Ant1	2480	7.05	≤30	5.85	≤36	PASS
BLE_500K	Ant1	2402	7.58	≤30	6.38	≤36	PASS
BLE_500K	Ant1	2440	7.56	≤30	6.36	≤36	PASS
BLE_500K	Ant1	2480	7.04	≤30	5.84	≤36	PASS

Test Graphs

BLE_1M-Ant1-2402-PASS

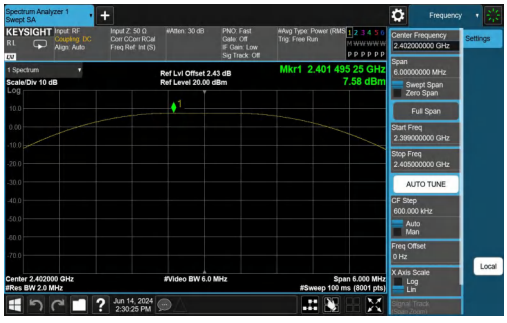


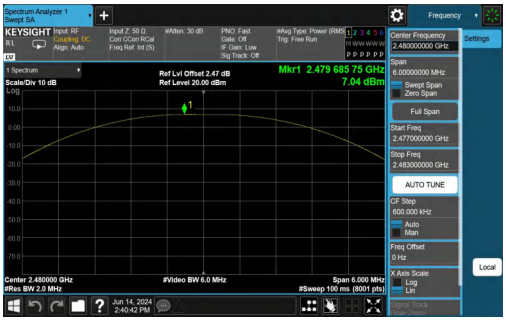
BLE_1M-Ant1-2440-PASS



BLE_1M-Ant1-2480-PASS

BLE_2M-Ant1-2402-PASS



BLE_2M-Ant1-2440-PASS	BLE_2M-Ant1-2480-PASS
	
BLE_125K-Ant1-2402-PASS	BLE_125K-Ant1-2440-PASS
	
BLE_125K-Ant1-2480-PASS	BLE_500K-Ant1-2402-PASS
	
BLE_500K-Ant1-2440-PASS	BLE_500K-Ant1-2480-PASS
	

A.2 6dB and 99% Bandwidth

Test Result 6dB Bandwidth

Test Mode	Antenna	Frequency[MHz]	FL[MHz]	FH[MHz]	DTS BW[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	2401.636	2402.352	0.716	0.5	PASS
BLE_1M	Ant1	2440	2439.640	2440.356	0.716	0.5	PASS
BLE_1M	Ant1	2480	2479.640	2480.352	0.712	0.5	PASS
BLE_2M	Ant1	2402	2401.416	2402.588	1.172	0.5	PASS
BLE_2M	Ant1	2440	2439.420	2440.588	1.168	0.5	PASS
BLE_2M	Ant1	2480	2479.420	2480.592	1.172	0.5	PASS
BLE_125K	Ant1	2402	2401.672	2402.340	0.668	0.5	PASS
BLE_125K	Ant1	2440	2439.672	2440.340	0.668	0.5	PASS
BLE_125K	Ant1	2480	2479.672	2480.344	0.672	0.5	PASS
BLE_500K	Ant1	2402	2401.680	2402.352	0.672	0.5	PASS
BLE_500K	Ant1	2440	2439.680	2440.352	0.672	0.5	PASS
BLE_500K	Ant1	2480	2479.680	2480.352	0.672	0.5	PASS

Test Result 99% Bandwidth

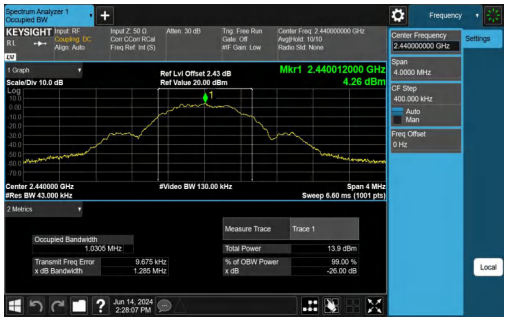
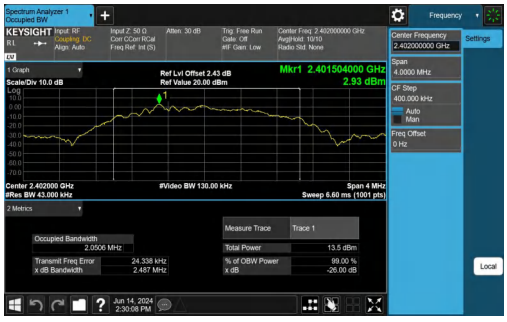
Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.0316	2401.4924	2402.5240	---	---
BLE_1M	Ant1	2440	1.0305	2439.4944	2440.5249	---	---
BLE_1M	Ant1	2480	1.0287	2479.4953	2480.5240	---	---
BLE_2M	Ant1	2402	2.0506	2400.9990	2403.0496	---	---
BLE_2M	Ant1	2440	2.0488	2439.0002	2441.0490	---	---
BLE_2M	Ant1	2480	2.0500	2479.0005	2481.0505	---	---
BLE_125K	Ant1	2402	1.0518	2401.4779	2402.5297	---	---
BLE_125K	Ant1	2440	1.0525	2439.4769	2440.5294	---	---
BLE_125K	Ant1	2480	1.0536	2479.4762	2480.5298	---	---
BLE_500K	Ant1	2402	1.0219	2401.4969	2402.5188	---	---
BLE_500K	Ant1	2440	1.0200	2439.4974	2440.5174	---	---
BLE_500K	Ant1	2480	1.0227	2479.4968	2480.5195	---	---

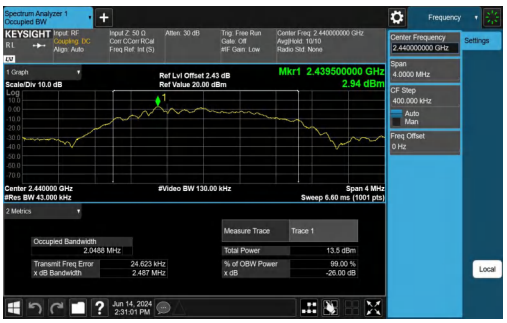
Test Graphs_6dB Bandwidth

BLE_1M-Ant1-2402-PASS	BLE_1M-Ant1-2440-PASS
	
BLE_1M-Ant1-2480-PASS	**BLE_2M-Ant1-2402-PASS**
	
BLE_2M-Ant1-2440-PASS	**BLE_2M-Ant1-2480-PASS**
	
BLE_125K-Ant1-2402-PASS	**BLE_125K-Ant1-2440-PASS**
	
BLE_125K-Ant1-2480-PASS	**BLE_500K-Ant1-2402-PASS**

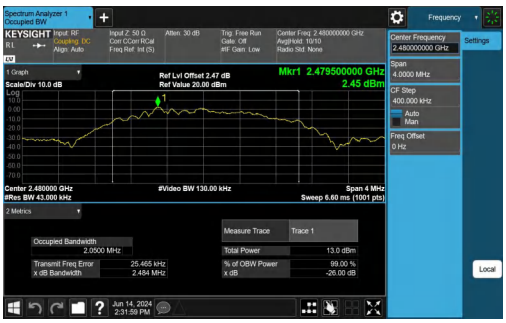
	
BLE_500K-Ant1-2440-PASS	BLE_500K-Ant1-2480-PASS
	

Test Graphs_99% Bandwidth

BLE_1M-Ant1-2402	BLE_1M-Ant1-2440
	
BLE_1M-Ant1-2480	BLE_2M-Ant1-2402
	
BLE_2M-Ant1-2440	BLE_2M-Ant1-2480



BLE_125K-Ant1-2402



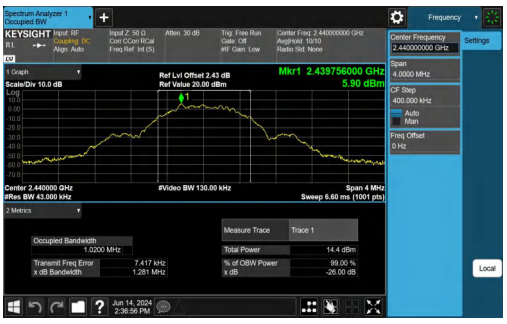
BLE_125K-Ant1-2440

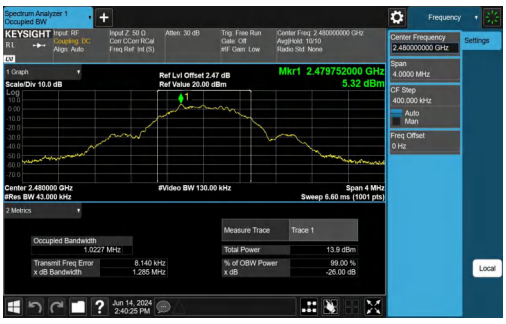
BLE_125K-Ant1-2480

BLE_500K-Ant1-2402

BLE_500K-Ant1-2440

BLE_500K-Ant1-2480





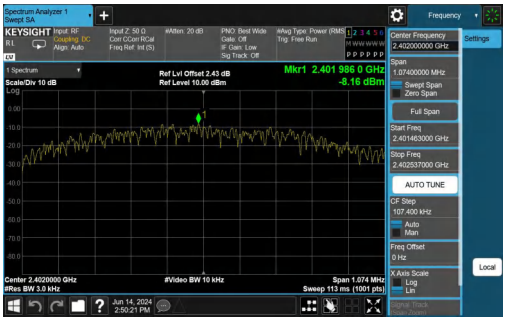
A.3 Power Spectral Density

Test Result

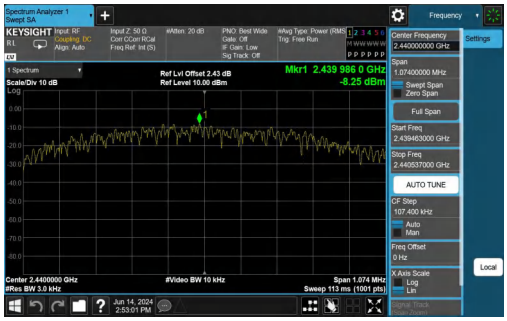
Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-8.16	≤8.00	PASS
BLE_1M	Ant1	2440	-8.25	≤8.00	PASS
BLE_1M	Ant1	2480	-8.69	≤8.00	PASS
BLE_2M	Ant1	2402	-10.77	≤8.00	PASS
BLE_2M	Ant1	2440	-10.75	≤8.00	PASS
BLE_2M	Ant1	2480	-11.27	≤8.00	PASS
BLE_125K	Ant1	2402	1.44	≤8.00	PASS
BLE_125K	Ant1	2440	1.39	≤8.00	PASS
BLE_125K	Ant1	2480	0.84	≤8.00	PASS
BLE_500K	Ant1	2402	1.22	≤8.00	PASS
BLE_500K	Ant1	2440	1.17	≤8.00	PASS
BLE_500K	Ant1	2480	0.64	≤8.00	PASS

Test Graphs

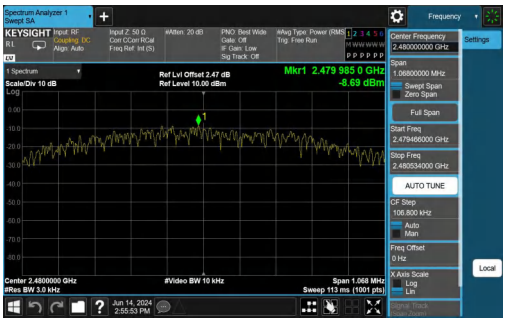
BLE_1M-Ant1-2402-PASS



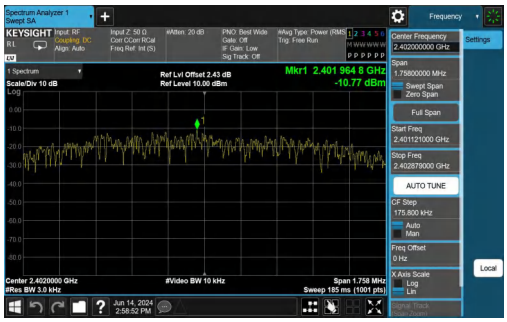
BLE_1M-Ant1-2440-PASS



BLE_1M-Ant1-2480-PASS

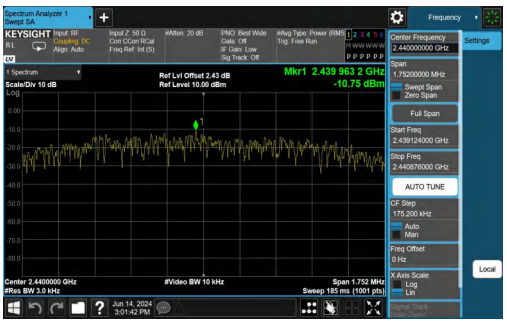


BLE_2M-Ant1-2402-PASS

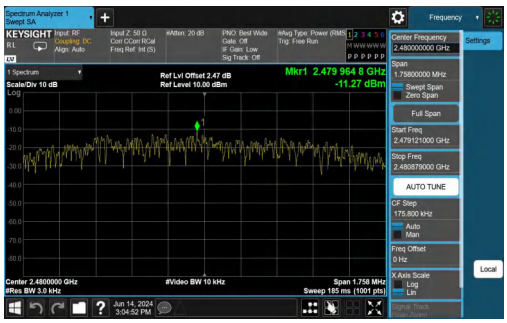


BLE_2M-Ant1-2440-PASS

BLE_2M-Ant1-2480-PASS

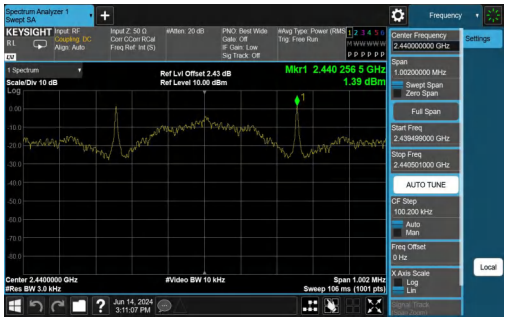


BLE_125K-Ant1-2402-PASS

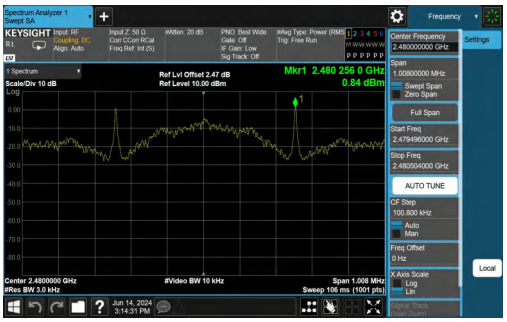


BLE_125K-Ant1-2440-PASS

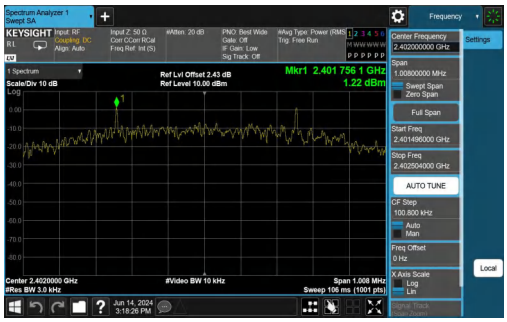
BLE_125K-Ant1-2480-PASS



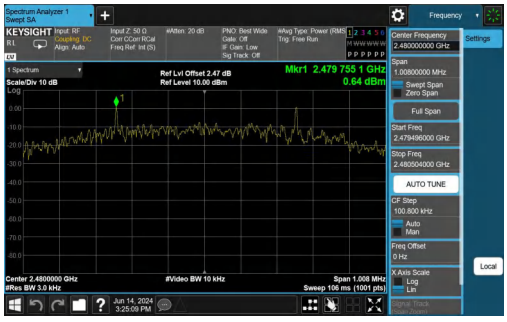
BLE_500K-Ant1-2402-PASS



BLE_500K-Ant1-2440-PASS



BLE_500K-Ant1-2480-PASS



A.4 Conducted Band Edges and Spurious Emission

Test Result

Band Edges

Test Mode	Antenna	Ch Name	Frequency[MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	6.87	-53.95	≤-13.13	PASS
BLE_1M	Ant1	High	2480	6.34	-55.31	≤-13.66	PASS
BLE_2M	Ant1	Low	2402	7.15	-24.54	≤-12.85	PASS
BLE_2M	Ant1	High	2480	6.64	-53.03	≤-13.36	PASS
BLE_125K	Ant1	Low	2402	4.89	-53.19	≤-15.11	PASS
BLE_125K	Ant1	High	2480	4.33	-53.61	≤-15.67	PASS
BLE_500K	Ant1	Low	2402	7.49	-52.86	≤-12.51	PASS
BLE_500K	Ant1	High	2480	6.97	-56.11	≤-13.03	PASS

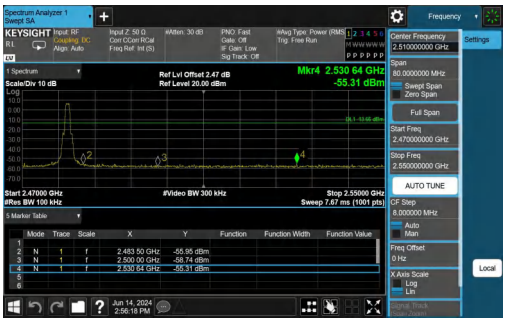
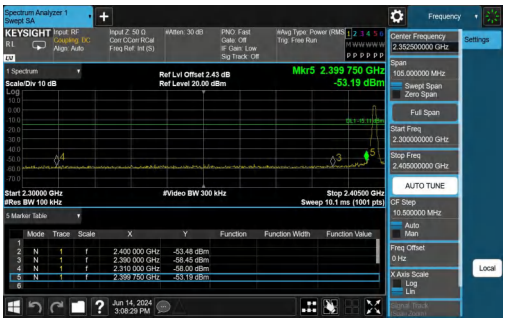
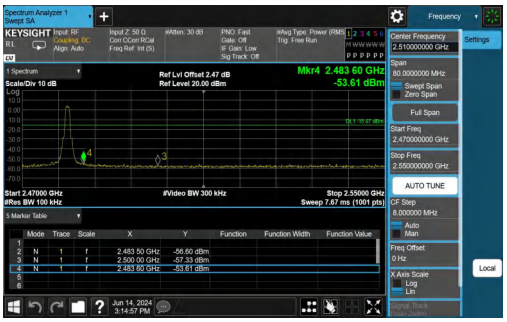
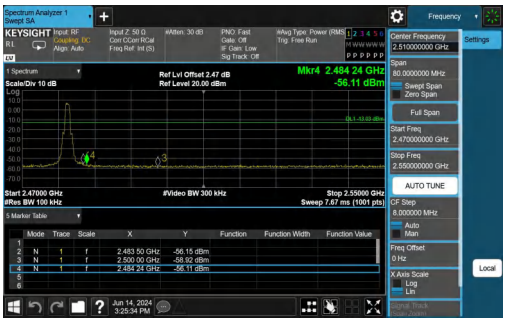
Spurious Emission

Test Mode	Antenna	Frequency[MHz]	Freq Range[MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	30~1000	6.87	-59.58	≤-13.13	PASS
BLE_1M	Ant1	2402	1000~26500	6.87	-54.98	≤-13.13	PASS
BLE_1M	Ant1	2440	30~1000	6.88	-69.07	≤-13.12	PASS
BLE_1M	Ant1	2440	1000~26500	6.88	-43.34	≤-13.12	PASS
BLE_1M	Ant1	2480	30~1000	6.34	-53.16	≤-13.66	PASS
BLE_1M	Ant1	2480	1000~26500	6.34	-54.61	≤-13.66	PASS
BLE_2M	Ant1	2402	30~1000	7.15	-69.13	≤-12.85	PASS
BLE_2M	Ant1	2402	1000~26500	7.15	-54.62	≤-12.85	PASS
BLE_2M	Ant1	2440	30~1000	7.16	-68.48	≤-12.84	PASS
BLE_2M	Ant1	2440	1000~26500	7.16	-55.11	≤-12.84	PASS
BLE_2M	Ant1	2480	30~1000	6.64	-66.33	≤-13.36	PASS
BLE_2M	Ant1	2480	1000~26500	6.64	-55.11	≤-13.36	PASS
BLE_125K	Ant1	2402	30~1000	4.89	-68.77	≤-15.11	PASS
BLE_125K	Ant1	2402	1000~26500	4.89	-55.14	≤-15.11	PASS
BLE_125K	Ant1	2440	30~1000	4.90	-56.87	≤-15.1	PASS
BLE_125K	Ant1	2440	1000~26500	4.90	-54.91	≤-15.1	PASS
BLE_125K	Ant1	2480	30~1000	4.33	-68.25	≤-15.67	PASS
BLE_125K	Ant1	2480	1000~26500	4.33	-54.64	≤-15.67	PASS
BLE_500K	Ant1	2402	30~1000	7.49	-68.66	≤-12.51	PASS
BLE_500K	Ant1	2402	1000~26500	7.49	-55.24	≤-12.51	PASS
BLE_500K	Ant1	2440	30~1000	7.49	-60.25	≤-12.51	PASS
BLE_500K	Ant1	2440	1000~26500	7.49	-54.34	≤-12.51	PASS
BLE_500K	Ant1	2480	30~1000	6.97	-69.01	≤-13.03	PASS

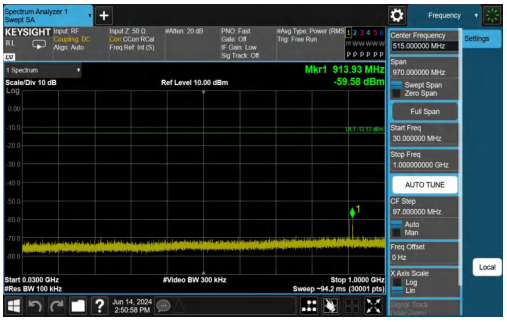
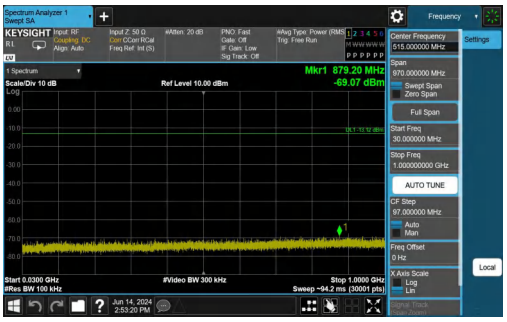
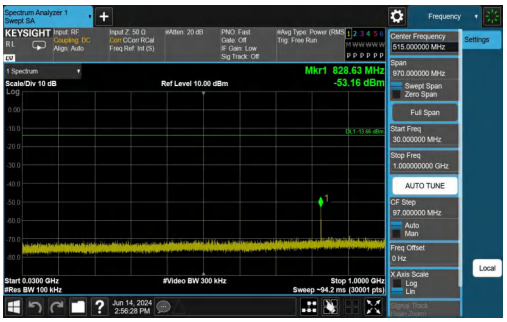
BLE_500K	Ant1	2480	1000~26500	6.97	-55.15	≤-13.03	PASS

Test Graphs

Band Edges

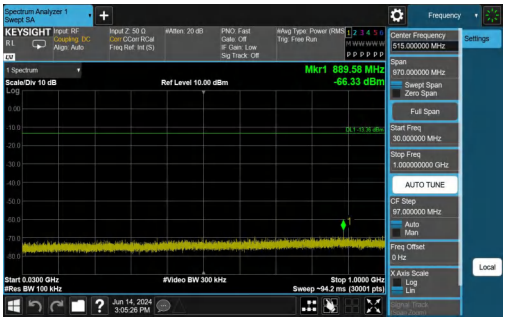
BLE_1M-Ant1-2402-PASS	BLE_1M-Ant1-2480-PASS
	
BLE_2M-Ant1-2402-PASS	BLE_2M-Ant1-2480-PASS
	
BLE_125K-Ant1-2402-PASS	BLE_125K-Ant1-2480-PASS
	
BLE_500K-Ant1-2402-PASS	BLE_500K-Ant1-2480-PASS
	

Spurious Emission

BLE_1M-Ant1-2402-30~1000-PASS	BLE_1M-Ant1-2402-1000~26500-PASS
	
BLE_1M-Ant1-2440-30~1000-PASS	BLE_1M-Ant1-2440-1000~26500-PASS
	
BLE_1M-Ant1-2480-30~1000-PASS	BLE_1M-Ant1-2480-1000~26500-PASS
	
BLE_2M-Ant1-2402-30~1000-PASS	BLE_2M-Ant1-2402-1000~26500-PASS
	
BLE_2M-Ant1-2440-30~1000-PASS	BLE_2M-Ant1-2440-1000~26500-PASS

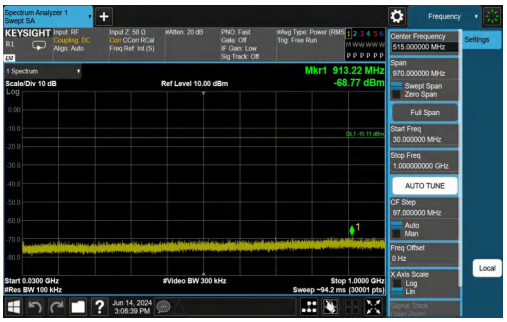
BLE_2M-Ant1-2480-30~1000-PASS

BLE_2M-Ant1-2480-1000~26500-PASS



BLE_125K-Ant1-2402-30~1000-PASS

BLE_125K-Ant1-2402-1000~26500-PASS



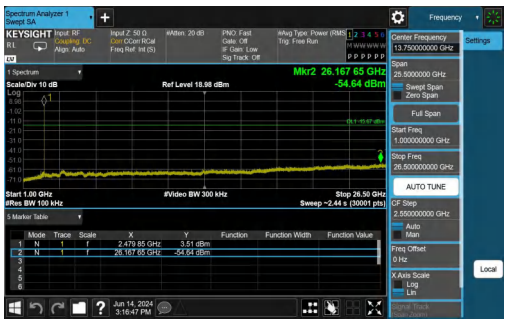
BLE_125K-Ant1-2440-30~1000-PASS

BLE_125K-Ant1-2440-1000~26500-PASS

BLE_125K-Ant1-2480-30~1000-PASS

BLE_125K-Ant1-2480-1000~26500-PASS

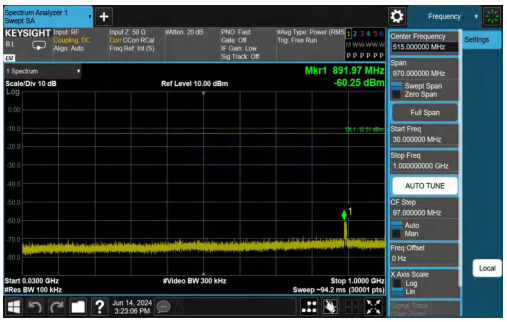
BLE_500K-Ant1-2402-30~1000-PASS



BLE_500K-Ant1-2402-1000~26500-PASS

BLE_500K-Ant1-2440-30~1000-PASS

BLE_500K-Ant1-2440-1000~26500-PASS



BLE_500K-Ant1-2480-30~1000-PASS

BLE_500K-Ant1-2480-1000~26500-PASS

A.5 Duty Cycle

Test Result

Test Mode	Antenna	Frequency[MHz]	ON Time[ms]	Period[ms]	Duty Cycle[%]	Duty Cycle Factor[dB]
BLE_1M	Ant1	2402	0.39	0.63	61.90	2.08
BLE_1M	Ant1	2440	0.39	0.63	61.90	2.08
BLE_1M	Ant1	2480	0.39	0.63	61.90	2.08
BLE_2M	Ant1	2402	0.21	0.63	33.33	4.77
BLE_2M	Ant1	2440	0.21	0.63	33.33	4.77
BLE_2M	Ant1	2480	0.21	0.63	33.33	4.77
BLE_125K	Ant1	2402	3.10	5.00	62.00	2.08
BLE_125K	Ant1	2440	3.10	3.75	82.67	0.83
BLE_125K	Ant1	2480	3.10	3.75	82.67	0.83
BLE_500K	Ant1	2402	1.06	1.25	84.80	0.72
BLE_500K	Ant1	2440	1.06	1.25	84.80	0.72
BLE_500K	Ant1	2480	1.06	1.25	84.80	0.72

Test Graphs

NTNV-BLE_1M-Ant1-2402

NTNV-BLE_1M-Ant1-2440

NTNV-BLE_1M-Ant1-2480

NTNV-BLE_2M-Ant1-2402

NTNV-BLE_2M-Ant1-2440

NTNV-BLE_2M-Ant1-2480

NTNV-BLE_125K-Ant1-2402

NTNV-BLE_125K-Ant1-2440

NTNV-BLE_125K-Ant1-2480

NTNV-BLE_500K-Ant1-2402

NTNV-BLE_500K-Ant1-2440

NTNV-BLE_500K-Ant1-2480

Appendix B – Test Results of Radiated Test

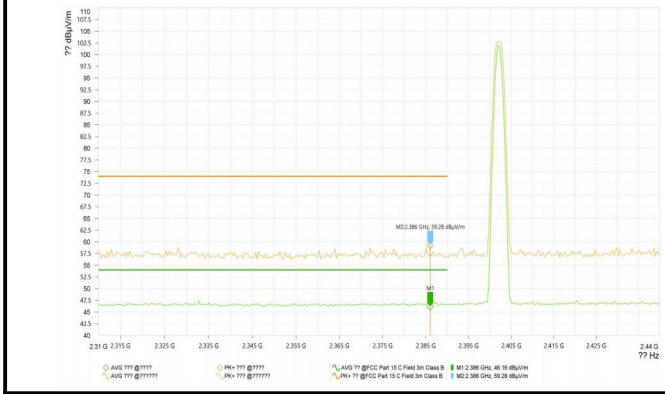
B.1 Radiated Band Edges and Spurious Emission

Test Result_Band Edges

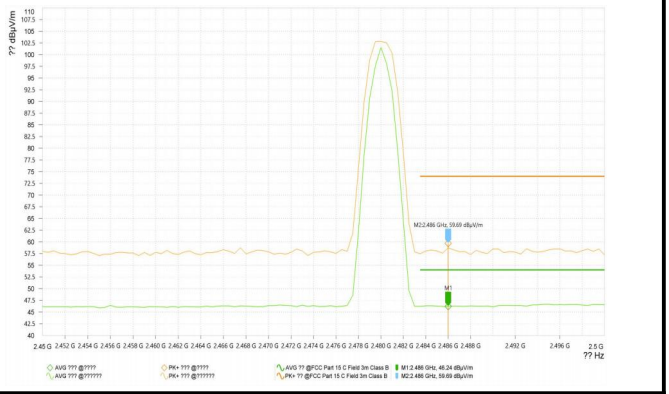
Test Mode & Test Freq.[MHz]	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit dBμV/m]	AVG Margin [dB]	Polarization	Azimuth [deg]
BLE_1M_2402	2,386.050	59.28	74.00	14.72	46.16	54.00	7.84	H	125.9
BLE_1M_2480	2,486.000	59.69	74.00	14.31	46.24	54.00	7.76	V	0
BLE_2M_2402	2,370.450	59.26	74.00	14.74	45.85	54.00	8.15	H	17.6
BLE_2M_2480	2,486.500	60.00	74.00	14.00	46.22	54.00	7.78	H	359.9
BLE_125K_2402	2,384.750	59.19	74.00	14.81	45.98	54.00	8.02	H	195.7
BLE_125K_2480	2,491.500	60.65	74.00	13.35	46.29	54.00	7.71	H	343.5
BLE_500K_2402	2,383.125	59.09	74.00	14.91	45.90	54.00	8.10	H	278.2
BLE_500K_2480	2,486.500	60.34	74.00	13.66	46.18	54.00	7.82	H	17.4

Test Graphs_Band Edges

BLE_1M_2402



BLE_1M_2480



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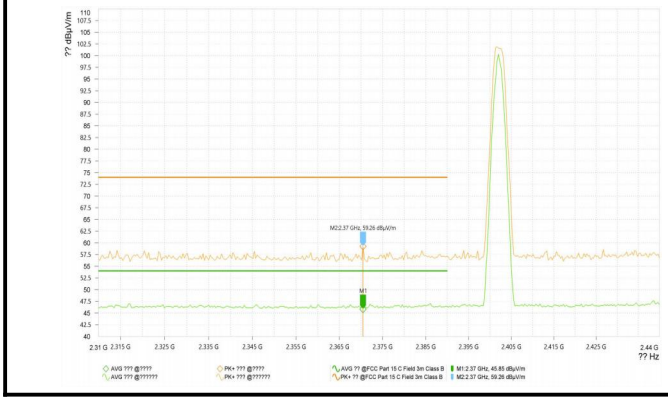

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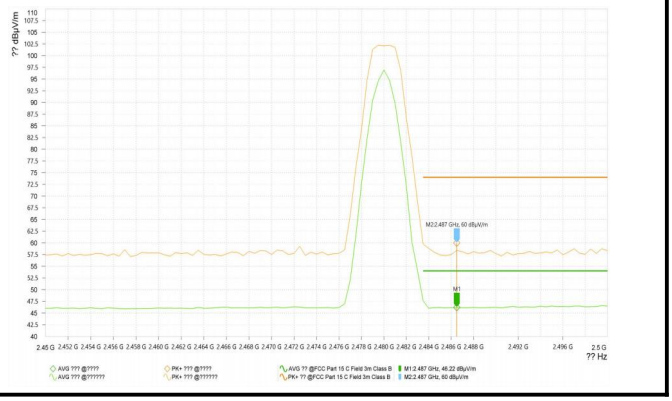
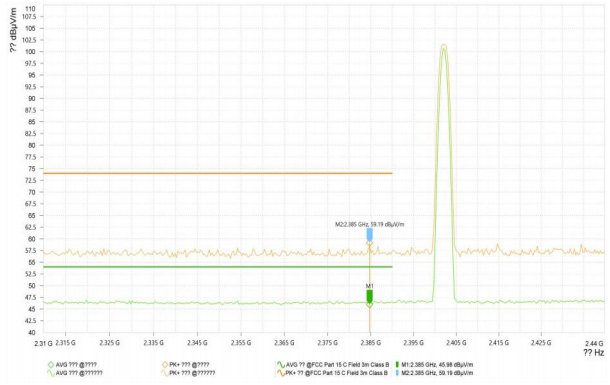
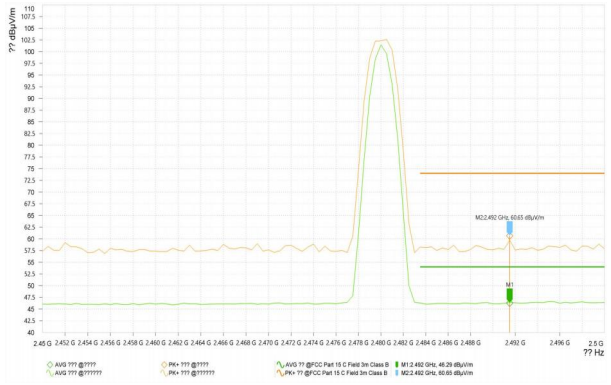
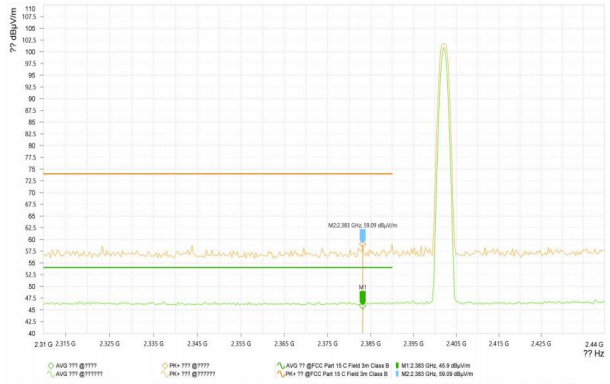
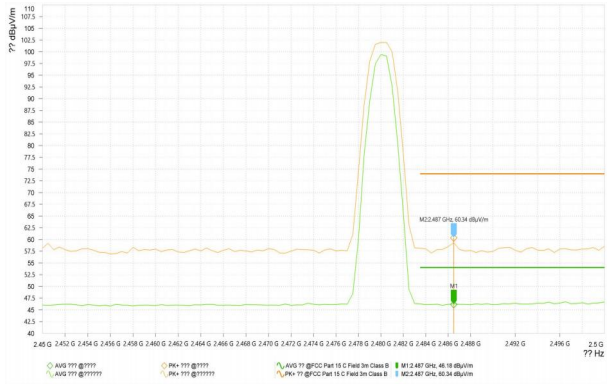


BLE_125K_2402	BLE_125K_2480
	
BLE_500K_2402	**BLE_500K_2480**
	

Test Result_Spurious Emission

Note1: Test result Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier the Emissions in the frequency band 9kHz-30MHz and above 18GHz are more than 20dB below the limit are not reported.

Note2: 'Low' indicates a frequency range below 1GHz, and 'High' indicates a frequency range above 1GHz.

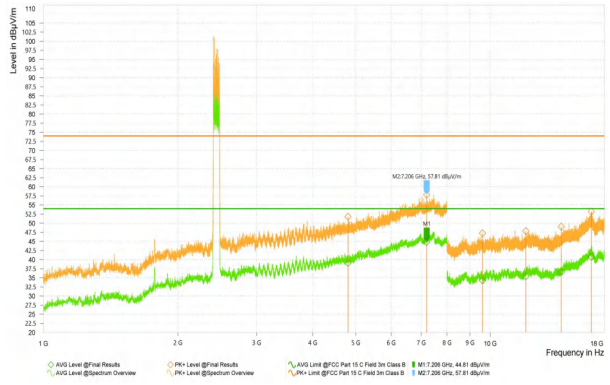
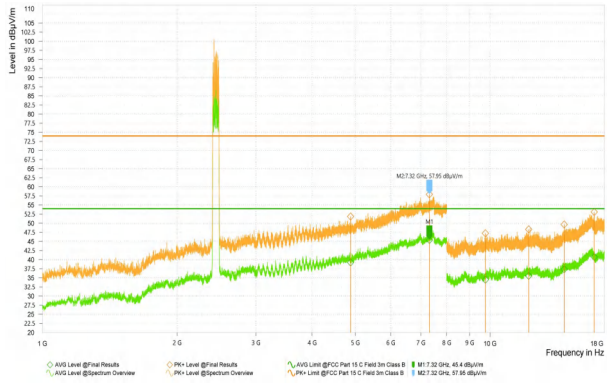
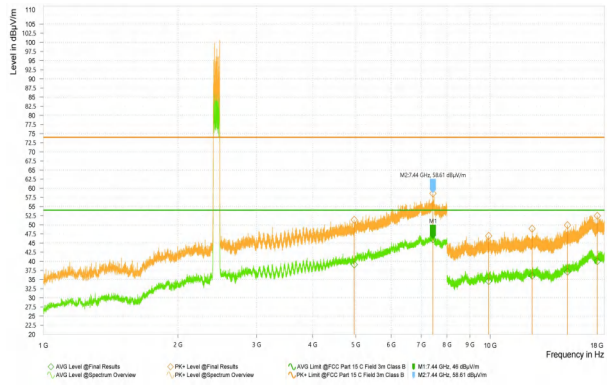
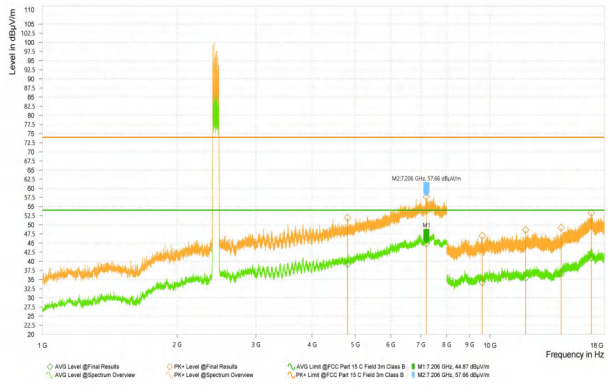
Test Mode & Test Freq.[MHz]	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit dBμV/m]	AVG Margin [dB]	Polarization	Azimuth [deg]
BLE_1M_2402_High	4,804.000	51.78	74.00	22.22	39.09	54.00	14.91	H	171.8
	7,206.000	57.81	74.00	16.19	44.81	54.00	9.19	H	23.6
	9,608.000	47.25	74.00	26.75	34.27	54.00	19.73	V	345.4
	12,010.000	47.82	74.00	26.18	35.42	54.00	18.58	H	360
	14,412.000	49.06	74.00	24.94	36.59	54.00	17.41	V	360
	16,814.000	53.21	74.00	20.79	40.79	54.00	13.21	H	157
BLE_1M_2440_High	4,880.000	51.87	74.00	22.13	39.25	54.00	14.75	H	185.8
	7,320.000	57.95	74.00	16.05	45.40	54.00	8.60	V	0
	9,760.000	47.24	74.00	26.76	34.51	54.00	19.49	V	0
	12,200.000	48.31	74.00	25.69	35.54	54.00	18.46	H	0
	14,640.000	49.65	74.00	24.35	37.34	54.00	16.66	H	17.5
	17,080.000	53.08	74.00	20.92	40.72	54.00	13.28	H	280.2
BLE_1M_2480_High	4,960.000	51.38	74.00	22.62	39.11	54.00	14.89	H	305.7
	7,440.000	58.61	74.00	15.39	46.00	54.00	8.00	H	330.5
	9,920.000	46.97	74.00	27.03	34.59	54.00	19.41	H	360
	12,400.000	48.94	74.00	25.06	36.03	54.00	17.97	H	0
	14,880.000	49.92	74.00	24.08	37.16	54.00	16.84	H	201.8
	17,360.000	52.47	74.00	21.53	40.04	54.00	13.96	H	154.6
BLE_2M_2402_High	4,804.000	51.93	74.00	22.07	39.19	54.00	14.81	H	358.7
	7,206.000	57.66	74.00	16.34	44.87	54.00	9.13	V	156.2
	9,608.000	46.98	74.00	27.02	34.23	54.00	19.77	H	218
	12,010.000	48.58	74.00	25.43	35.54	54.00	18.46	H	346.2
	14,412.000	49.19	74.00	24.81	36.64	54.00	17.36	H	204.1
	16,814.000	53.29	74.00	20.71	41.00	54.00	13.00	V	0
BLE_2M_2440_High	4,880.000	53.03	74.00	20.97	39.20	54.00	14.80	H	47.6
	7,320.000	57.39	74.00	16.61	45.18	54.00	8.82	H	199
	9,760.000	46.80	74.00	27.20	34.49	54.00	19.51	H	205.4
	12,200.000	48.32	74.00	25.68	35.59	54.00	18.41	H	343.2
	14,640.000	49.82	74.00	24.18	37.22	54.00	16.78	H	360
	17,080.000	52.92	74.00	21.08	40.69	54.00	13.31	H	360
BLE_2M_2480_High	4,960.000	51.60	74.00	22.40	39.07	54.00	14.93	V	1.7
	7,440.000	58.39	74.00	15.61	45.94	54.00	8.06	H	359.4

	9,920.000	46.94	74.00	27.06	34.40	54.00	19.60	V	247
	12,400.000	48.81	74.00	25.19	35.93	54.00	18.07	V	181.4
	14,880.000	49.43	74.00	24.57	37.02	54.00	16.98	H	345.9
	17,360.000	52.72	74.00	21.28	40.04	54.00	13.96	H	360
BLE_125K_2402_High	4,804.000	51.96	74.00	22.04	39.09	54.00	14.91	H	261.9
	7,206.000	57.19	74.00	16.81	44.75	54.00	9.25	H	11.4
	9,608.000	46.68	74.00	27.32	34.24	54.00	19.76	V	0
	12,010.000	48.16	74.00	25.84	35.61	54.00	18.39	V	214.6
	14,412.000	48.87	74.00	25.13	36.45	54.00	17.55	H	211
	16,814.000	53.50	74.00	20.50	40.88	54.00	13.12	V	182.5
BLE_125K_2440_High	4,880.000	52.73	74.00	21.27	39.28	54.00	14.72	H	1.2
	7,320.000	57.74	74.00	16.26	45.20	54.00	8.80	V	156.2
	9,760.000	46.89	74.00	27.11	34.46	54.00	19.54	H	12.4
	12,200.000	48.25	74.00	25.75	35.61	54.00	18.39	H	360
	14,640.000	49.97	74.00	24.03	37.15	54.00	16.85	H	158.3
	17,080.000	53.14	74.00	20.86	40.66	54.00	13.34	V	0
BLE_125K_2480_High	4,960.000	52.02	74.00	21.98	39.19	54.00	14.81	H	53.2
	7,440.000	58.62	74.00	15.38	45.88	54.00	8.12	H	360
	9,920.000	46.98	74.00	27.02	34.55	54.00	19.45	H	76.2
	12,400.000	49.68	74.00	24.32	35.99	54.00	18.01	H	360
	14,880.000	49.81	74.00	24.19	37.27	54.00	16.73	H	217
	17,360.000	52.49	74.00	21.51	40.04	54.00	13.96	H	140.6
BLE_500K_2402_High	4,804.000	51.52	74.00	22.48	39.11	54.00	14.89	H	360
	7,206.000	57.42	74.00	16.58	44.86	54.00	9.14	V	0
	9,608.000	46.72	74.00	27.28	34.30	54.00	19.70	V	76.1
	12,010.000	49.04	74.00	24.96	35.67	54.00	18.33	V	201.7
	14,412.000	50.12	74.00	23.88	36.67	54.00	17.33	H	360
	16,814.000	53.55	74.00	20.45	41.01	54.00	12.99	V	201.7
BLE_500K_2440_High	4,880.000	51.66	74.00	22.34	39.31	54.00	14.69	H	169.3
	7,320.000	57.67	74.00	16.33	45.20	54.00	8.80	H	104.6
	9,760.000	47.54	74.00	26.46	34.45	54.00	19.55	V	200.5
	12,200.000	48.09	74.00	25.91	35.65	54.00	18.35	H	0
	14,640.000	49.78	74.00	24.22	37.14	54.00	16.86	H	360
	17,080.000	53.05	74.00	20.95	40.64	54.00	13.36	H	216.9
BLE_500K_2480_High	4,960.000	52.39	74.00	21.61	39.20	54.00	14.80	H	0
	7,440.000	58.25	74.00	15.75	45.94	54.00	8.06	H	155
	9,920.000	47.23	74.00	26.77	34.67	54.00	19.33	H	201.8
	12,400.000	48.39	74.00	25.61	36.01	54.00	17.99	H	286.2
	14,880.000	49.56	74.00	24.44	37.44	54.00	16.56	H	140.7

	17,360.000	53.39	74.00	20.61	39.88	54.00	14.12	H	75

Test Mode & Test Freq.[MHz]	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Polarization	Azimuth [deg]
BLE_2M_2402_Low	32.910	25.17	40.00	14.83	V	96.3
	59.962	26.60	40.00	13.40	V	145.2
	119.941	23.40	43.50	20.10	V	176.9
	242.861	18.18	46.00	27.82	V	183.1
	564.039	16.84	46.00	29.16	V	273.7
	960.068	25.12	54.00	28.88	H	0.8

Test Graphs_Spurious Emission

BLE_1M_2402_High	BLE_1M_2440_High
	
BLE_1M_2480_High	**BLE_2M_2402_High**
	
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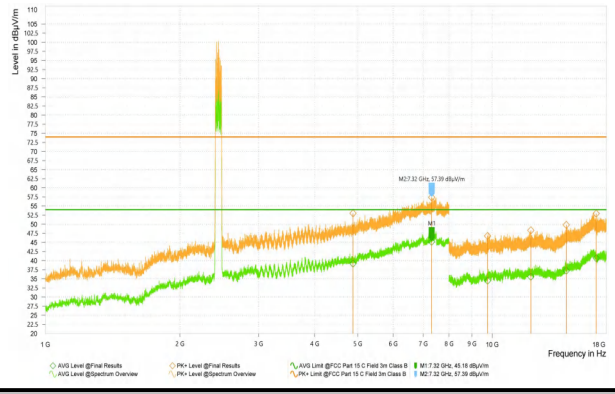

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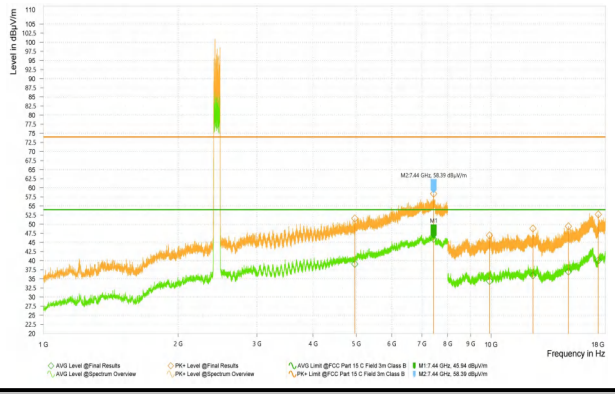

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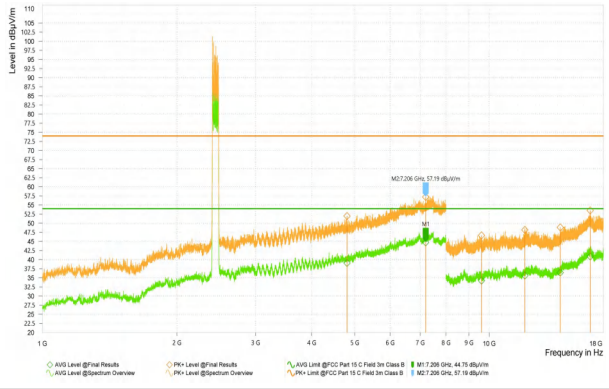

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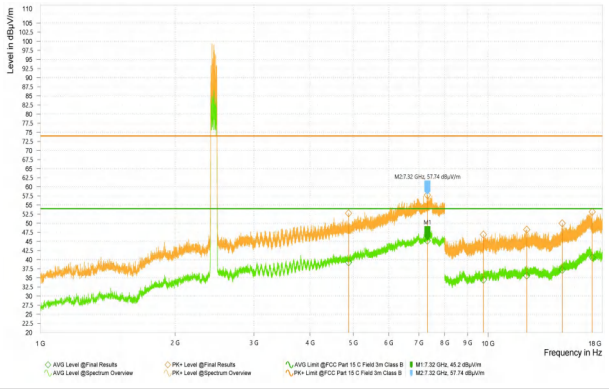

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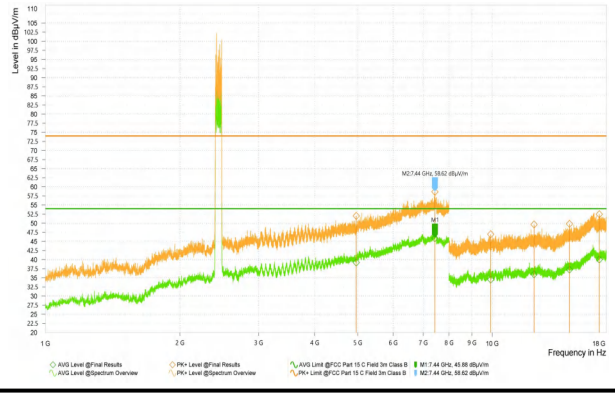

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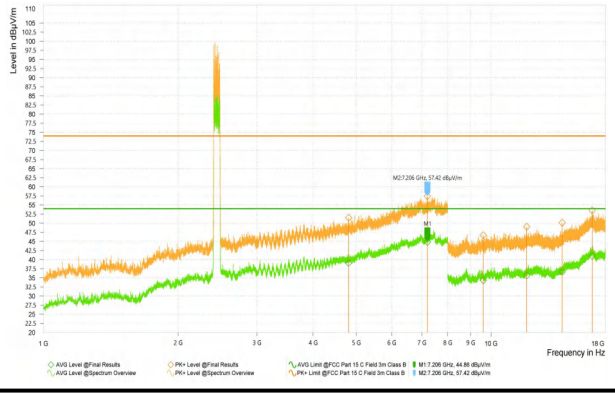
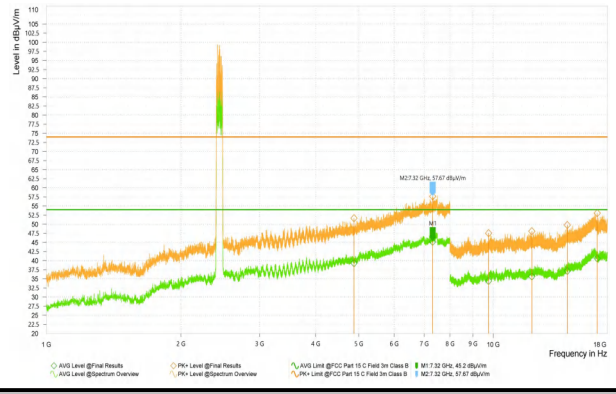
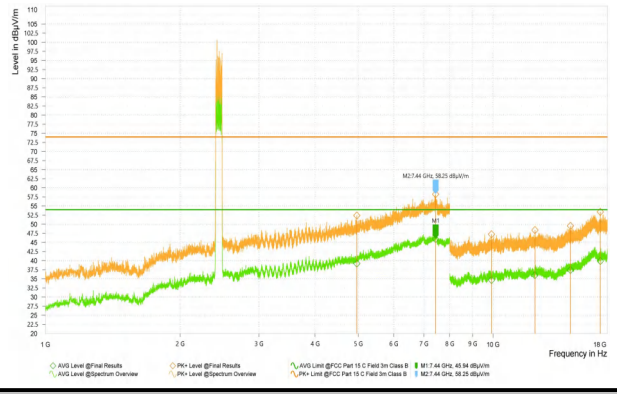
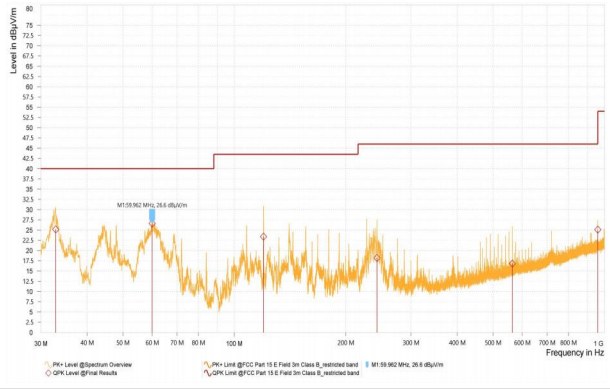


BLE_500K_2480_High

	
BLE_2M_2402_Low	/
	/

Appendix C – The EUT Appearance

Refer to “Attachment A.1: Photographs of EUT” file.

Appendix D – Test Setup Photograph

Refer to “Attachment A.3: RF Test Setup Photograph” file.

******End of the Report******