FCC Radio Test Report

FCC ID: YA7-BL1

Report No.	:	BTL-FCCP-1-2407T009
Equipment	:	Rugged Bluetooth Sensor
Model Name	:	BL1, BL1-T
Brand Name	:	ATrack
Applicant	:	ATrack Technology Inc.
Address	:	8F., No. 13 Ln. 120, Sec. 1, Neihu Rd., Neihu Dist., Taipei City 11493, Taiwan
Radio Function	:	Bluetooth Low Energy
FCC Rule Part(s)	:	FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2024/7/18
Date of Test	:	2024/8/23 ~ 2024/8/26
Issued Date	:	2024/9/16

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

Prepared by : Brett Shen
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Approved by : Jerry Chuang
Jerry Chuang, Supervisor

Testing Laboratory
0659

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. BTL assumes no responsibility for the data provided by the Customer, any statements, inferences or generalizations drawn by the customer or others from the reports issued by BTL.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

CONTENTS

REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-1-2407T009	R00	Original Report.	2024/9/16	Valid

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

Standard(s) Section	Description	Test Result	Judgement	Remark
15.207	AC Power Line Conducted Emissions	------	N/A	NOTE (3)
15.205 15.209 15.247(d)	Radiated Emissions	APPENDIX A APPENDIX B APPENDIX C	Pass	------
15.247(a)(2)	Bandwidth	APPENDIX D	Pass	------
15.247(b)(3)	Output Power	APPENDIX E	Pass	------
15.247(e)	Power Spectral Density	APPENDIX F	Pass	------
15.247(d)	Antenna conducted Spurious Emission	APPENDIX G	Pass	------
15.203	Antenna Requirement	------	Pass	------

Statement of Conformity
The statement of conformity is based on the binary decision rule according to IEC Guide 115 and ILAC G8 "simple acceptance" principle. Without considering measurement uncertainty, its specific risk is less than 50% PFA. (PFA: Probability of False Accept)

NOTE:
(1) ”N/A” denotes test is not applicable in this Test Report.
(2) The report format version is TP.1.1.1.
(3) This is a DC input device.

1.1 TEST FACILITY

The test locations stated below are under the TAF Accreditation Number 0659.
The test location(s) used to collect the test data in this report are:
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
(FCC DN: TW0659)
☐ C05 ☐ CB08 ☐ CB11 ☐ SR10 ☒ SR11
No. 72, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
(FCC DN: TW0659)
☐ C06 ☒ CB21 ☐ CB22

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ± **U**, where expanded uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k = 2**, providing a level of confidence of approximately **95 %**.

A. Radiated emissions test :

Test Site	Measurement Frequency Range	U (dB)
CB21	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
	1 GHz ~ 6 GHz	5.21
	6 GHz ~ 18 GHz	5.51
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

B. Conducted test :

Test Item	U (dB)
Occupied Bandwidth	0.5334
Output power	0.3669
Power Spectral Density	0.6591
Conducted Spurious emissions	0.5416
Conducted Band edges	0.5348

NOTE:
Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

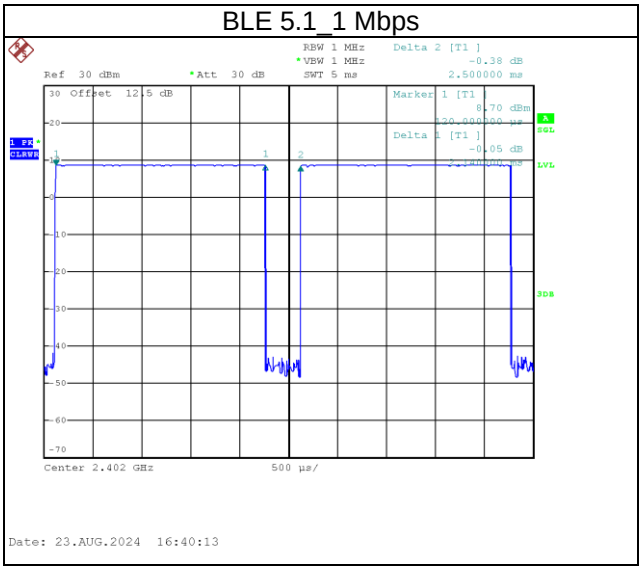
Test Item	Environment Condition	Test Voltage	Tested by
Radiated emissions below 1 GHz	Refer to data	DC 3V	Mark Wang
Radiated emissions above 1 GHz	Refer to data	DC 3V	Mark Wang
Bandwidth	29 °C, 39 %	DC 3V	Ken Lan
Output Power	29 °C, 39 %	DC 3V	Ken Lan
Power Spectral Density	29 °C, 39 %	DC 3V	Ken Lan
Antenna conducted Spurious Emission	29 °C, 39 %	DC 3V	Ken Lan

1.4 DUTY CYCLE

If duty cycle is ≥ 98 %, duty factor is not required.
If duty cycle is < 98 %, duty factor shall be considered.

Remark	Delta 1			Delta 2	On Time/Period	10 log(1/Duty Cycle)
Mode	ON (ms)	Numbers (ON)	On Time (B) (ms)	Period (ON+OFF) (ms)	Duty Cycle (%)	Duty Factor (dB)
BLE (1 Mbps)	2.140	1	2.140	2.500	85.60%	0.68

BLE 5.1_1 Mbps



2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	Rugged Bluetooth Sensor
Model Name	BL1, BL1-T
Brand Name	ATrack
Model Difference	Model Name: BL1 — Temperature Sensor: No Model Name: BL1-T — Temperature Sensor: Yes
Power Source	Battery supplied.
Power Rating	DC 3V
Products Covered	1 * Bluetooth module: NORDIC / nRF52833 1 * RTC battery: Panasonic / CR2450
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK
Transfer Rate	1 Mbps
Output Power Max.	4.78 dBm (0.0030 W)
Test Software Version	NRF DTM V2.6.1
Test Model	BL1-T
Sample Status	Engineering Sample
EUT Modification(s)	N/A

NOTE:
(1) The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

(2) Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

(3) Table for Filed Antenna:

Ant.	Brand	Part Number	Type	Connector	Gain (dBi)
1.	WIESON	ARY196-3092-006-00	PCB	N/A	1.02

(4) The above Antenna information are derived from the antenna data sheet provided by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

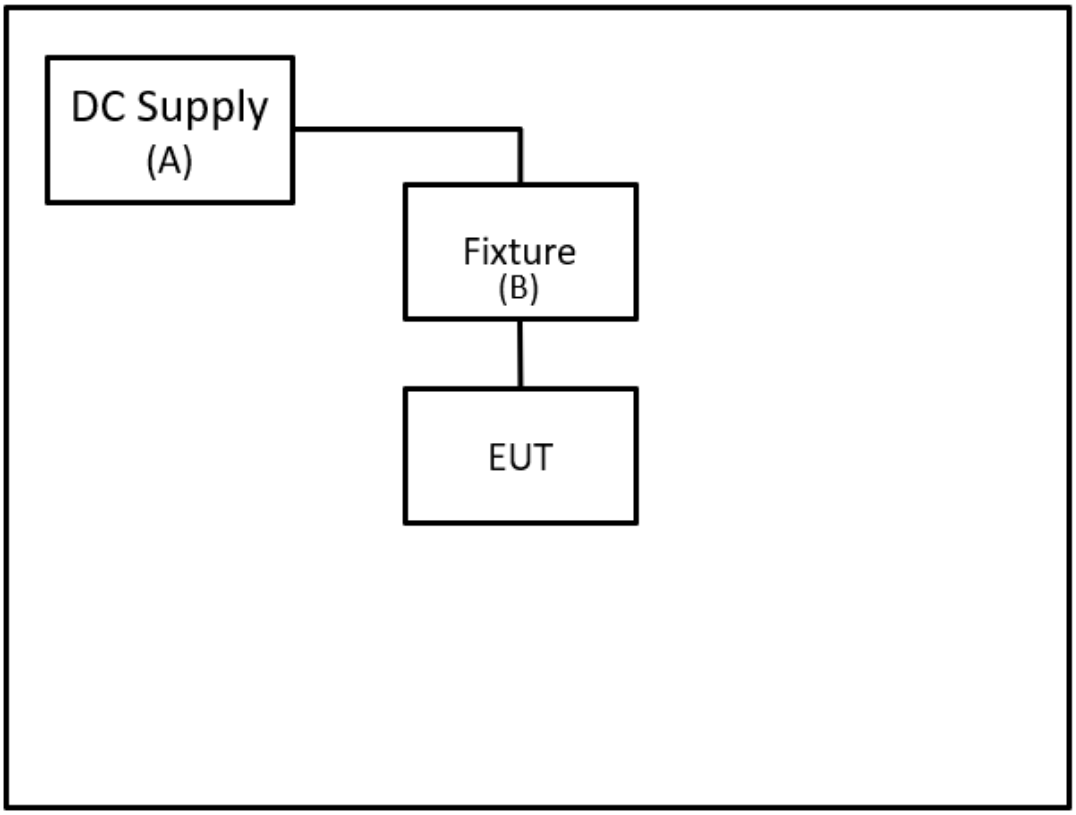
2.2 TEST MODES

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	BLE 5.1 / 1 Mbps	39	-
Transmitter Radiated Emissions (above 1GHz)	BLE 5.1 / 1 Mbps	00/39	Bandedge
	BLE 5.1 / 1 Mbps	00/19/39	Harmonic
Transmitter Radiated Emissions (above 18GHz)	BLE 5.1 / 1 Mbps	39	-
Bandwidth	BLE 5.1 / 1 Mbps	00/19/39	-
Output Power	BLE 5.1 / 1 Mbps	00/19/39	-
Power Spectral Density	BLE 5.1 / 1 Mbps	00/19/39	-
Antenna conducted Spurious Emission	BLE 5.1 / 1 Mbps	00/19/39	-

NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Vertical) is recorded.
(2) All X, Y and Z axes are evaluated, but only the worst case (Y axis) is recorded.
(3) The EUT supports both BLE 4.0 and 5.0, we will pick BLE 5.1 for testing.
(4) All models are evaluated, model BL1-T is the worst and recorded as below test data.

2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.4.



2.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	DC Supply	LXI	DSP-080-019HD	N/A	Furnished by test lab.
B	Fixture	N/A	N/A	N/A	Supplied by test requester.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
-	-	-	-	-	-

3 RADIATED EMISSIONS TEST

3.1 LIMIT

In case the emission fall within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

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
960~1000	500	3

LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Radiated Emissions (dBuV/m)		Measurement Distance (meters)
	Peak	Average	
Above 1000	74	54	3

NOTE:
(1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).
(4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level (dBµV)		Correct Factor (dB/m)		Measurement Value (dBµV/m)
41.91	+	-8.36	=	33.55

Measurement Value (dBµV/m)		Limit Value (dBµV/m)		Margin Level (dB)
33.55	-	43.50	=	-9.95

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average

Mode	VBW(Hz)
BLE (1M)	481.93

Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

3.2 TEST PROCEDURE

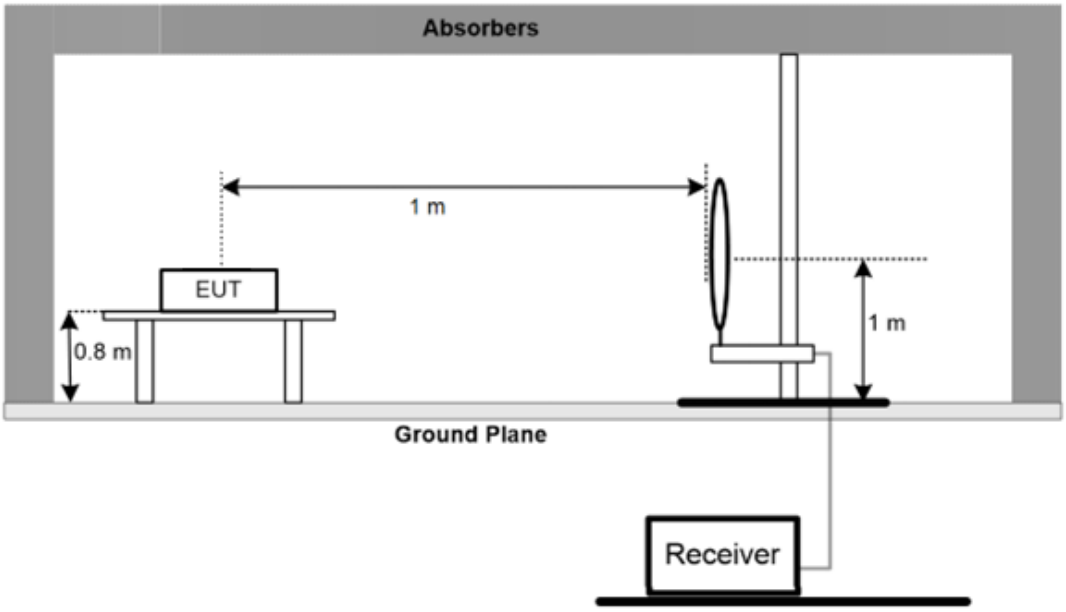
a. The measuring distance of 1 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 30MHz)
b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
c. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
d. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
f. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
g. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
h. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn‘t perform. (below 1GHz)
i. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn‘t perform. (above 1GHz)
j. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

3.3 DEVIATION FROM TEST STANDARD

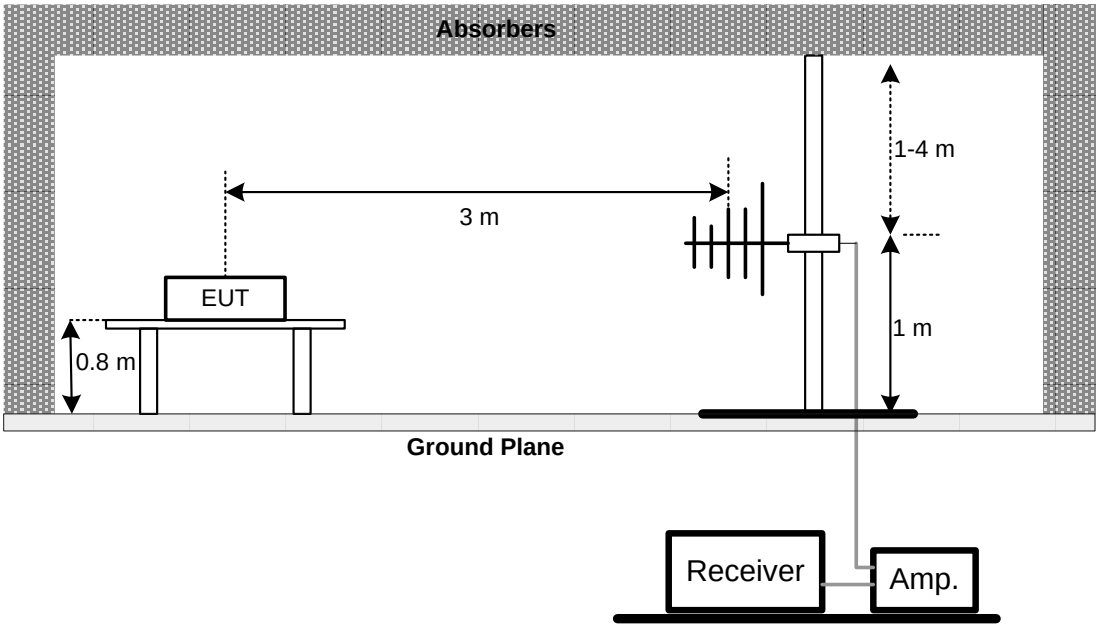
No deviation.

3.4 TEST SETUP

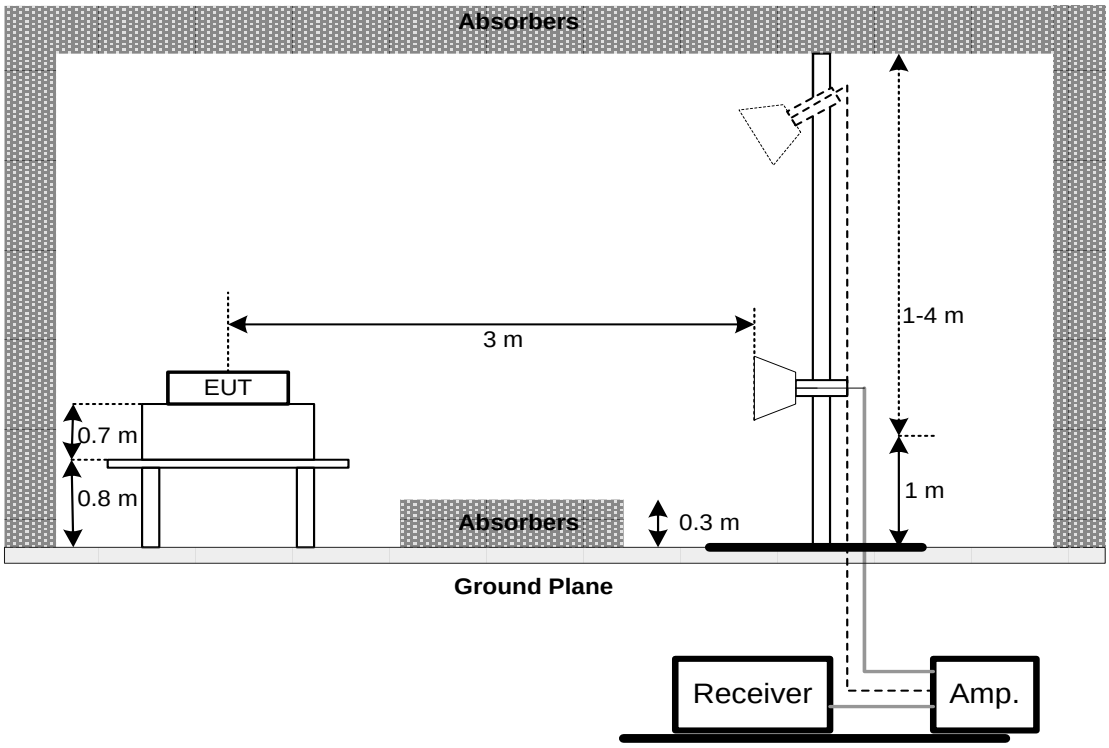
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



3.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

3.6 TEST RESULT – 9kHz TO 30 MHz

Please refer to the APPENDIX A.

3.7 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX B.

3.8 TEST RESULT – ABOVE 1 GHZ

Please refer to the APPENDIX C.

NOTE:

(1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

4 BANDWIDTH TEST

4.1 APPLIED PROCEDURES / LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

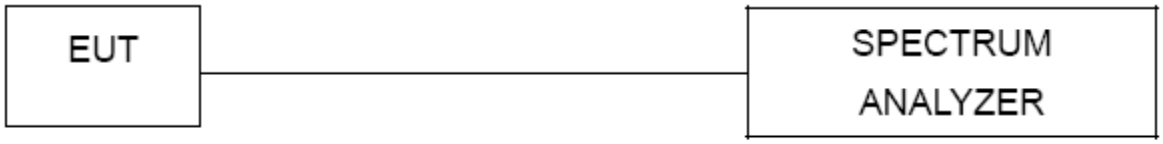
4.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 2.5 ms.

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

Please refer to the APPENDIX D.

5 OUTPUT POWER TEST

5.1 APPLIED PROCEDURES / LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

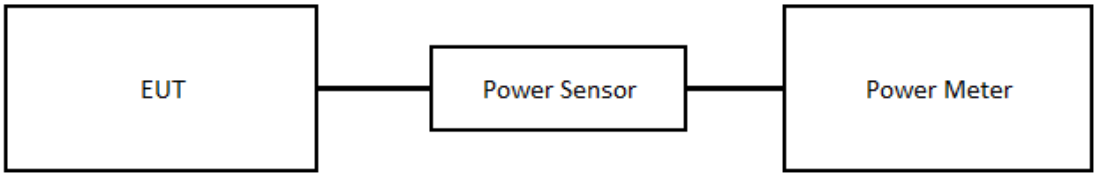
5.2 TEST PROCEDURE

a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
b. The maximum peak conducted output power was performed in accordance with FCC KDB 558074 D01 15.247 Meas Guidance.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

5.6 TEST RESULTS

Please refer to the APPENDIX E.

6 POWER SPECTRAL DENSITY TEST

6.1 APPLIED PROCEDURES / LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

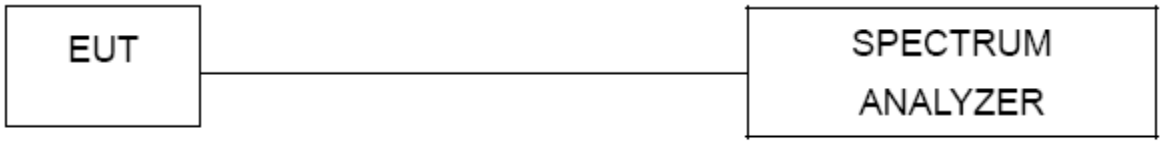
6.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting: RBW=3KHz, VBW=10 KHz, Sweep time = auto.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Please refer to the APPENDIX F.

7 ANTENNA CONDUCTED SPURIOUS EMISSION

7.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

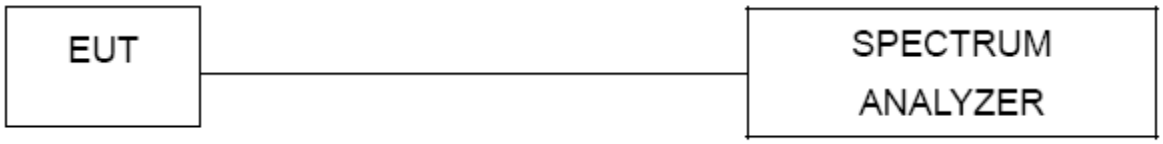
7.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 10 ms.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Please refer to the APPENDIX G.

8 LIST OF MEASURING EQUIPMENTS

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC330N	980850	2023/9/6	2024/9/5
2	Preamplifier	EMCI	EMC118A45SE	980819	2024/3/6	2025/3/5
3	Pre-Amplifier	EMCI	EMC184045SE	980907	2023/9/21	2024/9/20
4	Preamplifier	EMCI	EMC001340	980579	2023/9/6	2024/9/5
5	Test Cable	EMCI	EMC104-SM-1000	180809	2024/3/8	2025/3/7
6	Test Cable	EMCI	EMC104-SM-SM-3000	220322	2024/3/8	2025/3/7
7	Test Cable	EMCI	EMC104-SM-SM-7000	220324	2024/3/8	2025/3/7
8	EXA Signal Analyzer	keysight	N9020B	MY57120120	2024/2/23	2025/2/22
9	Loop Ant	Electro-Metrics	EMCI-LPA600	291	2023/9/12	2024/9/11
10	Horn Antenna	RFSPIN	DRH18-E	211202A18EN	2024/5/9	2025/5/8
11	Horn Ant	Schwarzbeck	BBHA 9170D	1136	2024/5/17	2025/5/16
12	Log-bicon Antenna	Schwarzbeck	VULB9168	1369	2024/6/14	2025/6/13
13	6dB Attenuator	EMCI	EMCI-N-6-06	AT-06001	2024/6/14	2025/6/13
14	Test Cable	EMCI	EMC101G-KM-KM-3000	220329	2024/3/13	2025/3/12
15	Test Cable	EMCI	EMC102-KM-KM-1000	220327	2024/3/13	2025/3/12
16	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Bandwidth						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 40	101139	2024/3/8	2025/3/7

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Power Meter	Anritsu	ML2495A	1128008	2024/5/11	2025/5/10
2	Power Sensor	Anritsu	MA2411B	1126001	2024/5/11	2025/5/10

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 40	101139	2024/3/8	2025/3/7

Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 40	101139	2024/3/8	2025/3/7

Remark: “N/A” denotes no model name, no serial no. or no calibration specified.
All calibration period of equipment list is one year.

9 EUT TEST PHOTO

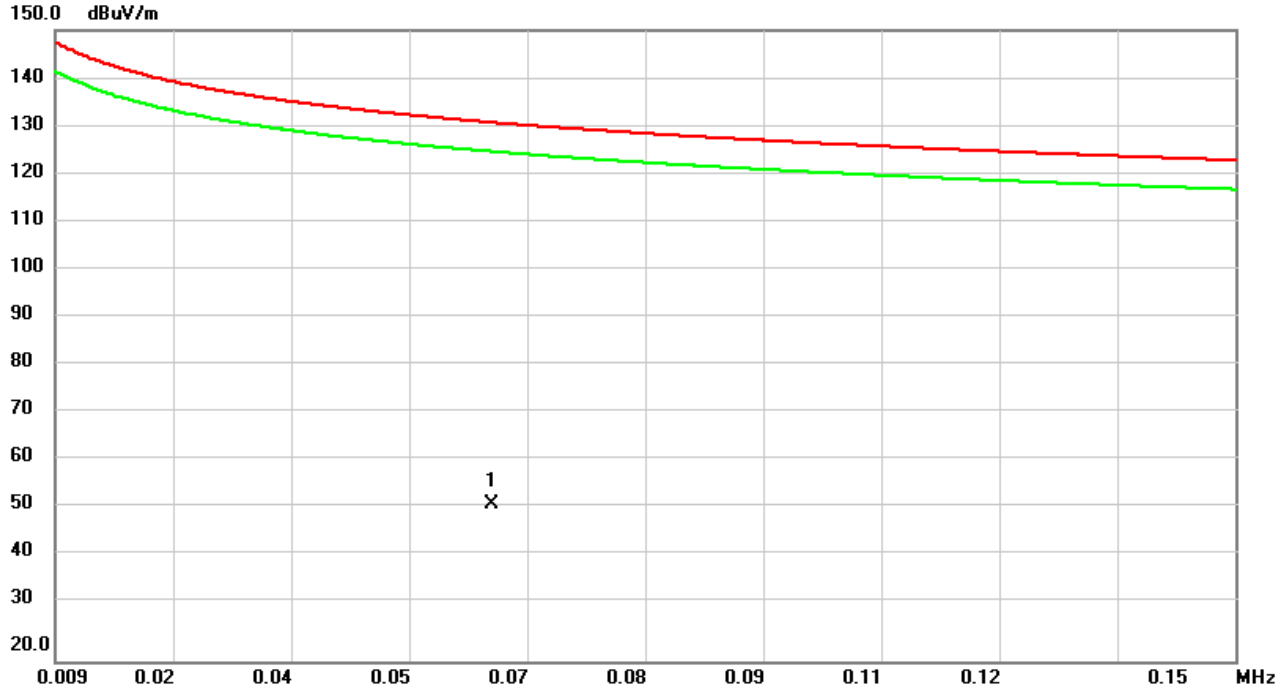
Please refer to document Appendix No.: TP-2407T009-FCCP-1 (APPENDIX-TEST PHOTOS).

10 EUT PHOTOS

Please refer to document Appendix No.: EP-2407T009-1 (APPENDIX-EUT PHOTOS).

APPENDIX A RADIATED EMISSIONS - 9 KHZ TO 30 MHZ

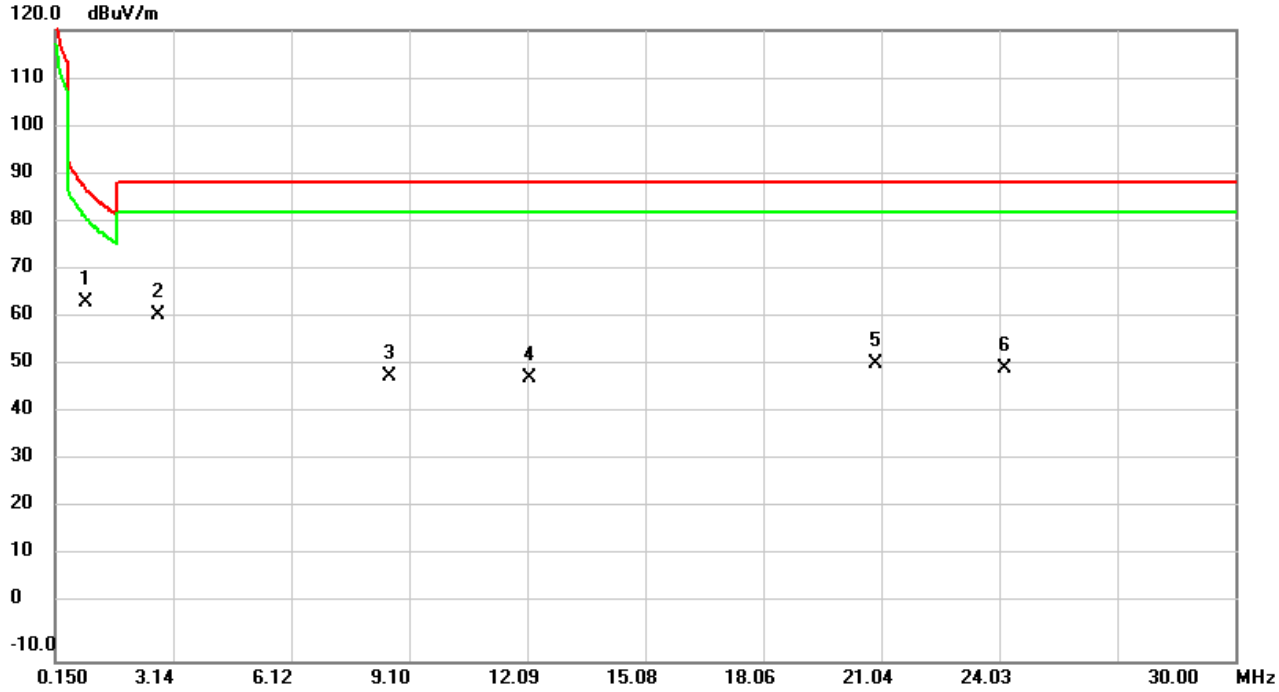
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0611	30.62	21.88	52.50	130.96	-78.46	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

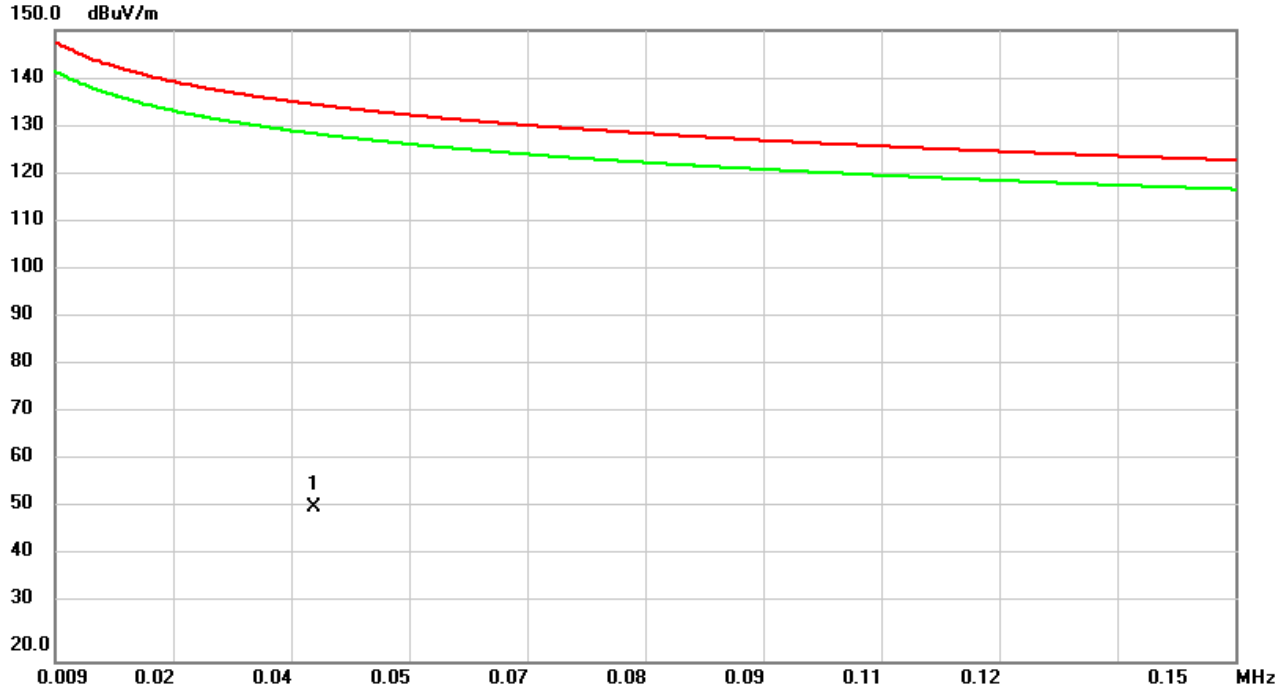
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.9241	62.25	1.54	63.79	87.36	-23.57	QP	
2		2.7638	64.68	-3.28	61.40	88.62	-27.22	QP	
3		8.6065	52.21	-3.51	48.70	88.62	-39.92	QP	
4		12.1467	51.82	-3.36	48.46	88.62	-40.16	QP	
5		20.9255	54.89	-3.66	51.23	88.62	-37.39	QP	
6		24.1643	52.27	-2.11	50.16	88.62	-38.46	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

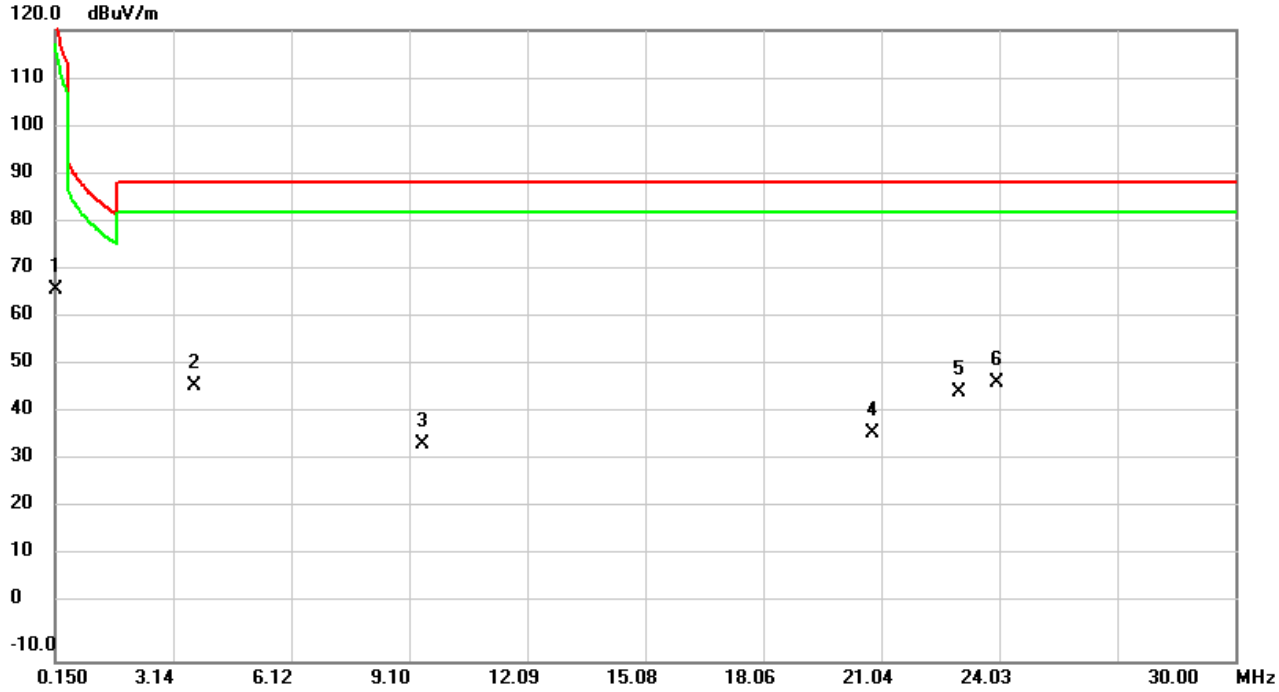
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0400	25.79	25.83	51.62	134.64	-83.02	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%

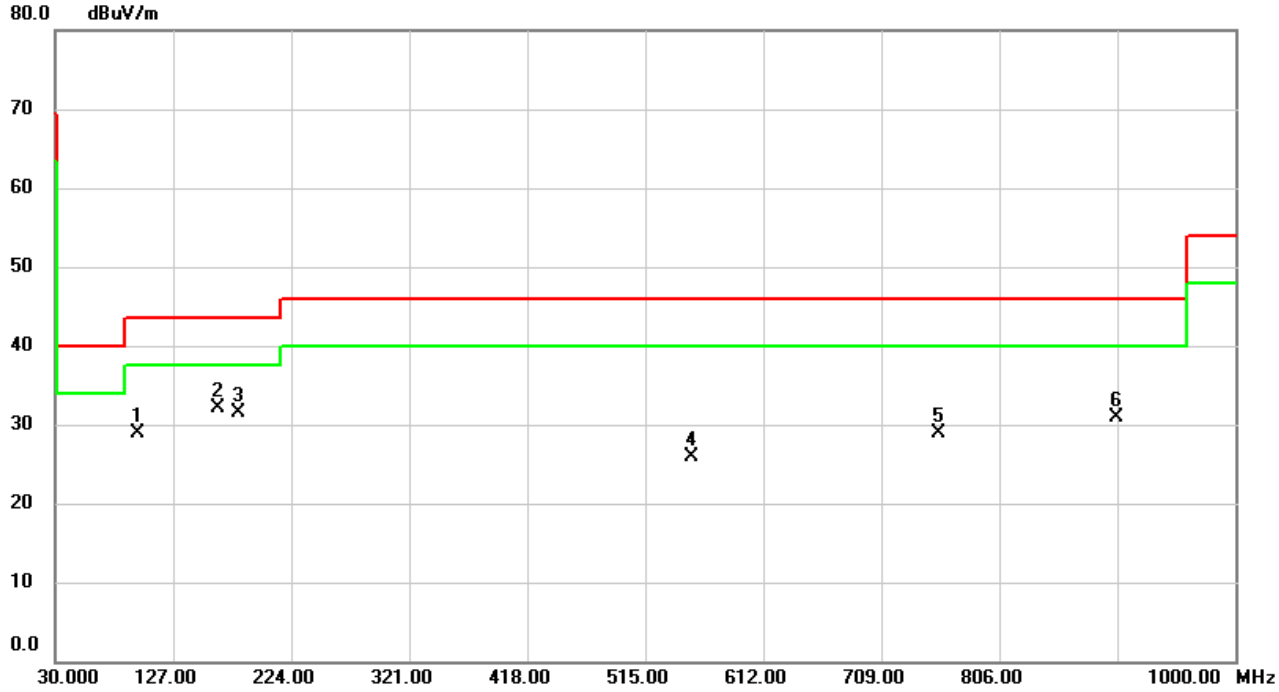


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1500	52.05	14.47	66.52	123.16	-56.64	AVG	
2		3.6603	50.78	-3.97	46.81	88.62	-41.81	QP	
3		9.4462	38.15	-3.31	34.84	88.62	-53.78	QP	
4		20.8131	40.82	-3.71	37.11	88.62	-51.51	QP	
5		23.0001	48.00	-2.67	45.33	88.62	-43.29	QP	
6	*	23.9563	49.74	-2.22	47.52	88.62	-41.10	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX B RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

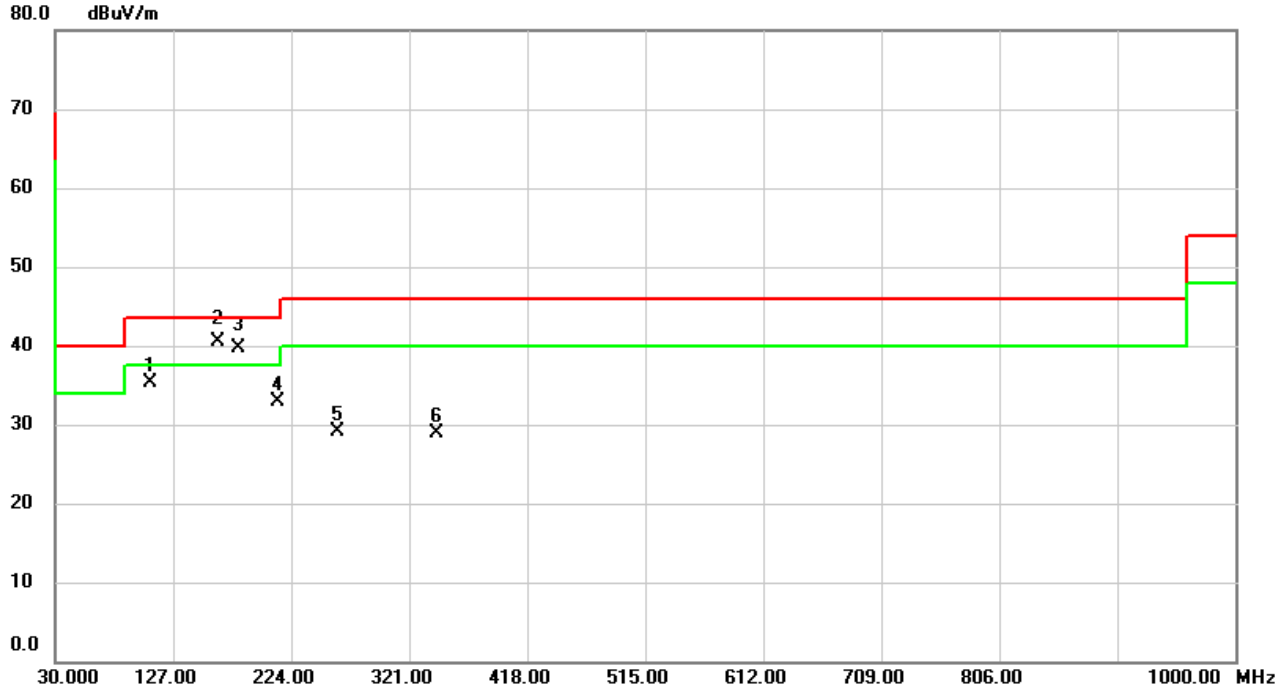
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		98.3203	45.93	-16.99	28.94	43.50	-14.56	peak	
2	*	163.8923	44.26	-12.17	32.09	43.50	-11.41	peak	
3		180.2530	45.10	-13.56	31.54	43.50	-11.96	peak	
4		552.7975	31.68	-5.68	26.00	46.00	-20.00	peak	
5		755.6570	30.58	-1.68	28.90	46.00	-17.10	peak	
6		902.6443	31.04	-0.09	30.95	46.00	-15.05	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%

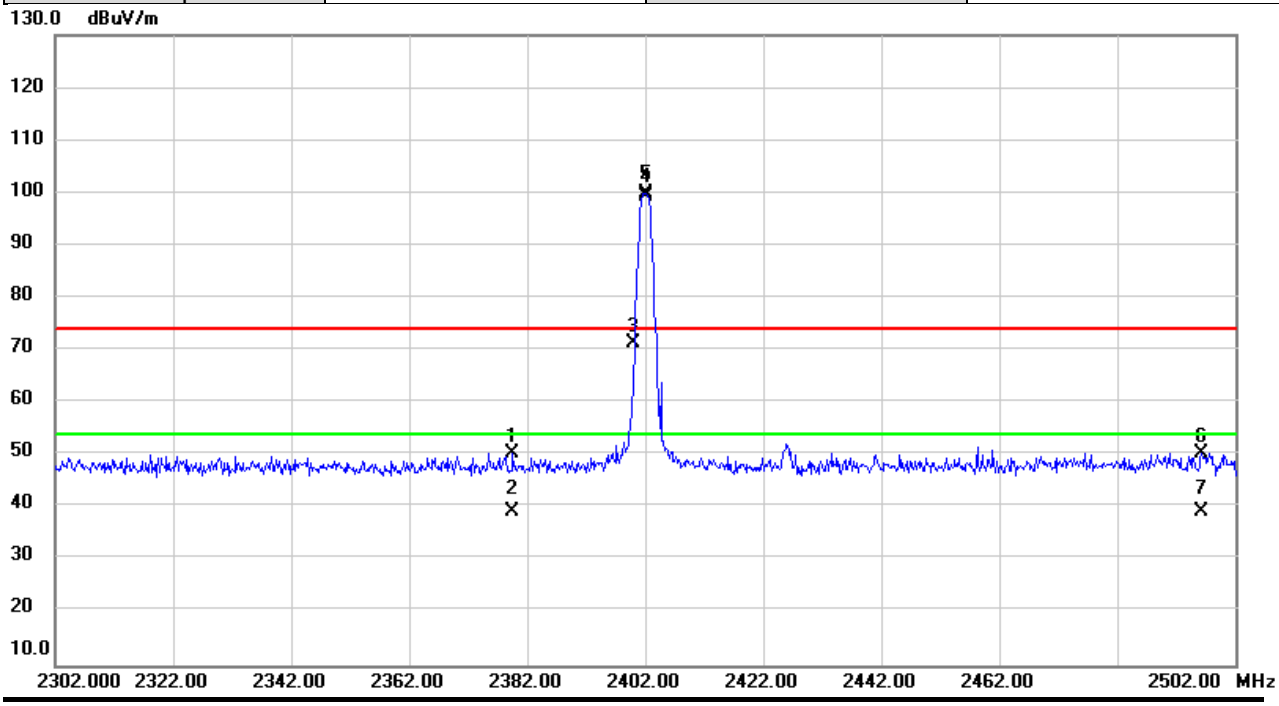


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		108.7963	50.69	-15.41	35.28	43.50	-8.22	peak	
2	*	163.7630	52.74	-12.16	40.58	43.50	-2.92	QP	
3	!	180.2530	53.20	-13.56	39.64	43.50	-3.86	QP	
4		213.0390	48.53	-15.56	32.97	43.50	-10.53	peak	
5		262.2180	42.07	-12.92	29.15	46.00	-16.85	peak	
6		343.8920	39.39	-10.53	28.86	46.00	-17.14	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX C RADIATED EMISSIONS - ABOVE 1 GHZ

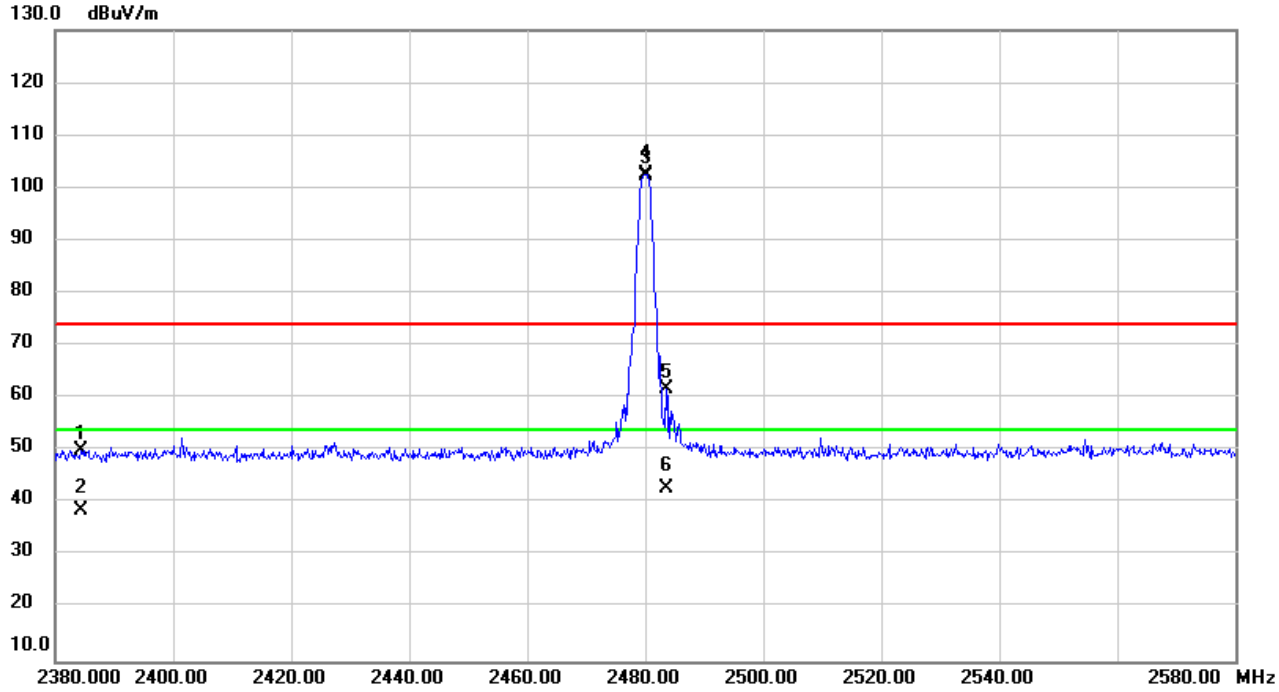
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2402MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2379.507	55.27	-5.02	50.25	74.00	-23.75	peak	
2		2379.507	44.36	-5.02	39.34	54.00	-14.66	AVG	
3		2400.000	76.31	-4.99	71.32	74.00	-2.68	peak	NoLimit
4	X	2402.000	104.85	-5.00	99.85	74.00	25.85	peak	NoLimit
5	*	2402.000	104.26	-5.00	99.26	54.00	45.26	AVG	NoLimit
6		2496.280	55.26	-4.87	50.39	74.00	-23.61	peak	
7		2496.280	44.20	-4.87	39.33	54.00	-14.67	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

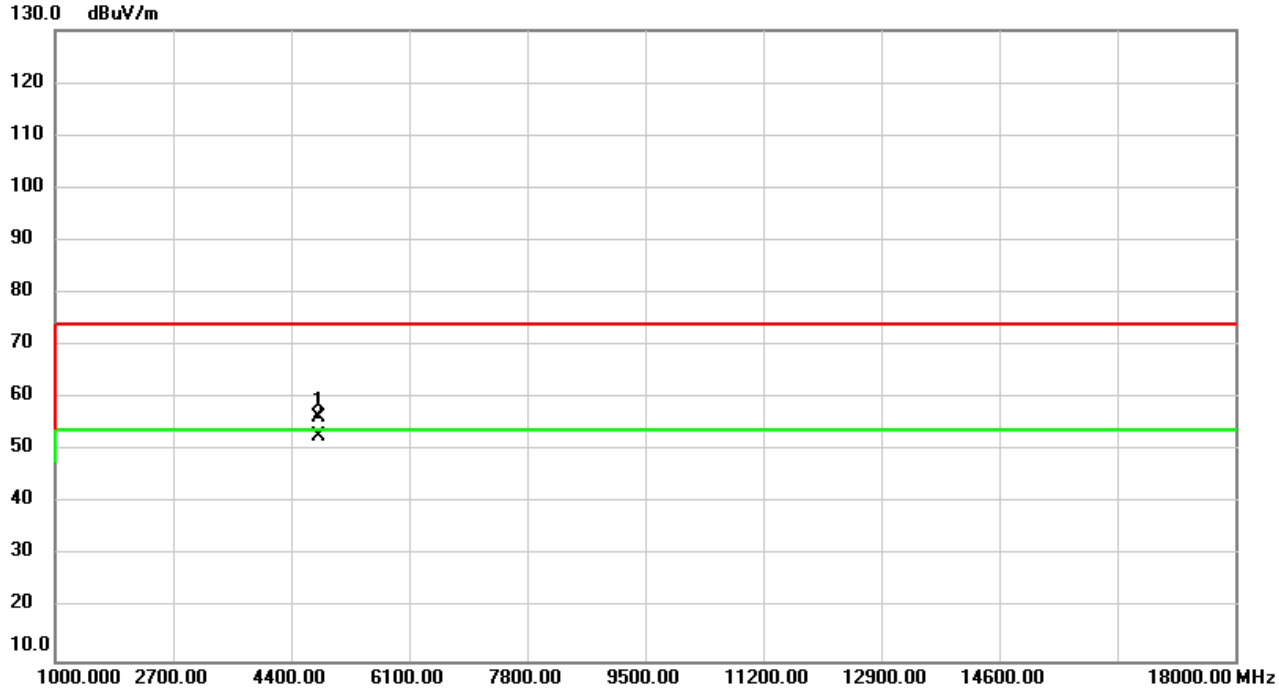
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2480MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2384.520	55.09	-5.01	50.08	74.00	-23.92	peak	
2		2384.520	43.70	-5.01	38.69	54.00	-15.31	AVG	
3	X	2480.000	107.56	-4.89	102.67	74.00	28.67	peak	NoLimit
4	*	2480.000	107.01	-4.89	102.12	54.00	48.12	AVG	NoLimit
5		2483.500	66.56	-4.87	61.69	74.00	-12.31	peak	
6		2483.500	47.72	-4.87	42.85	54.00	-11.15	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

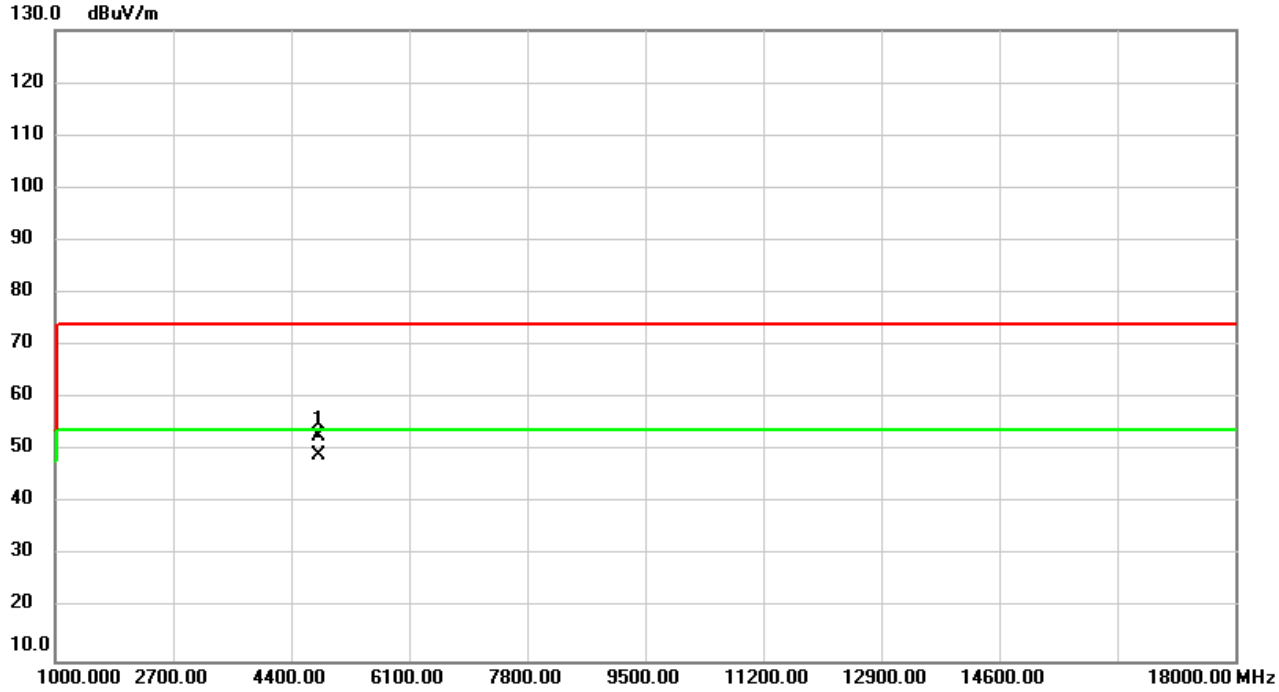
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2402MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	55.43	0.88	56.31	74.00	-17.69	peak	
2	*	4804.000	51.88	0.88	52.76	54.00	-1.24	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2402MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	51.94	0.88	52.82	74.00	-21.18	peak	
2	*	4804.000	48.22	0.88	49.10	54.00	-4.90	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Vertical
Temp	27°C	Hum.	66%

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	55.83	1.03	56.86	74.00	-17.14	peak	
2	*	4880.000	52.59	1.03	53.62	54.00	-0.38	AVG	

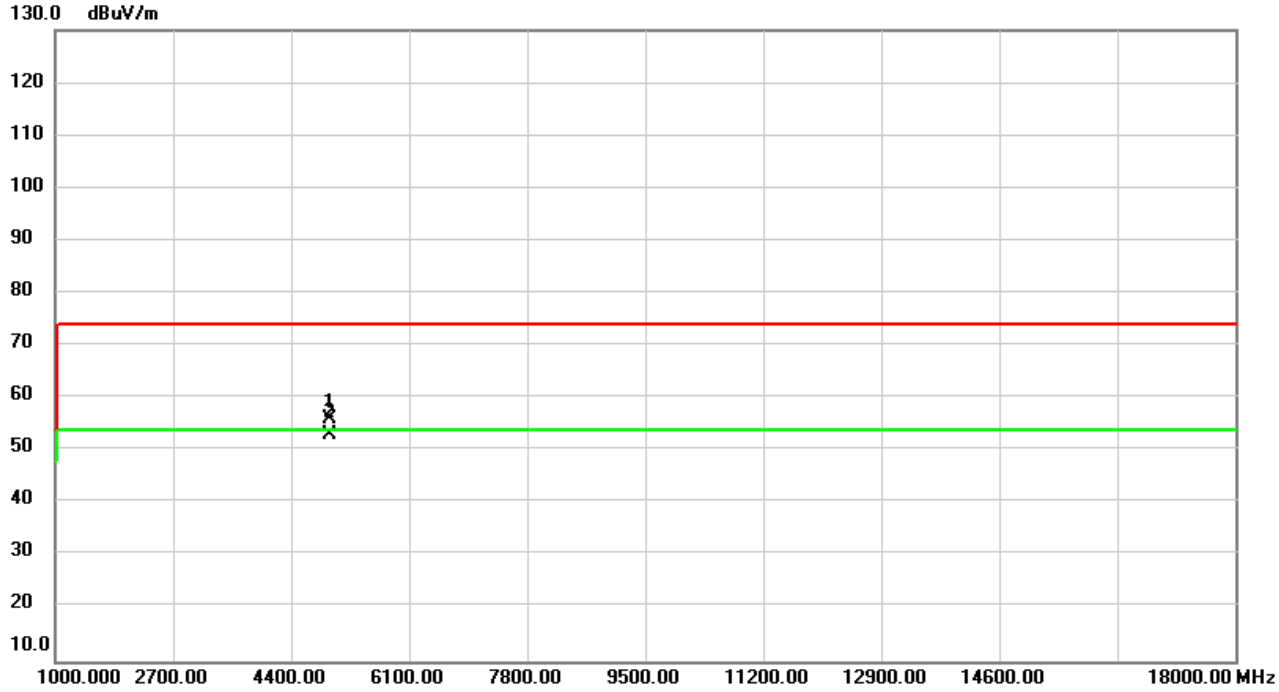
REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	52.54	1.03	53.57	74.00	-20.43	peak	
2	*	4880.000	49.09	1.03	50.12	54.00	-3.88	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

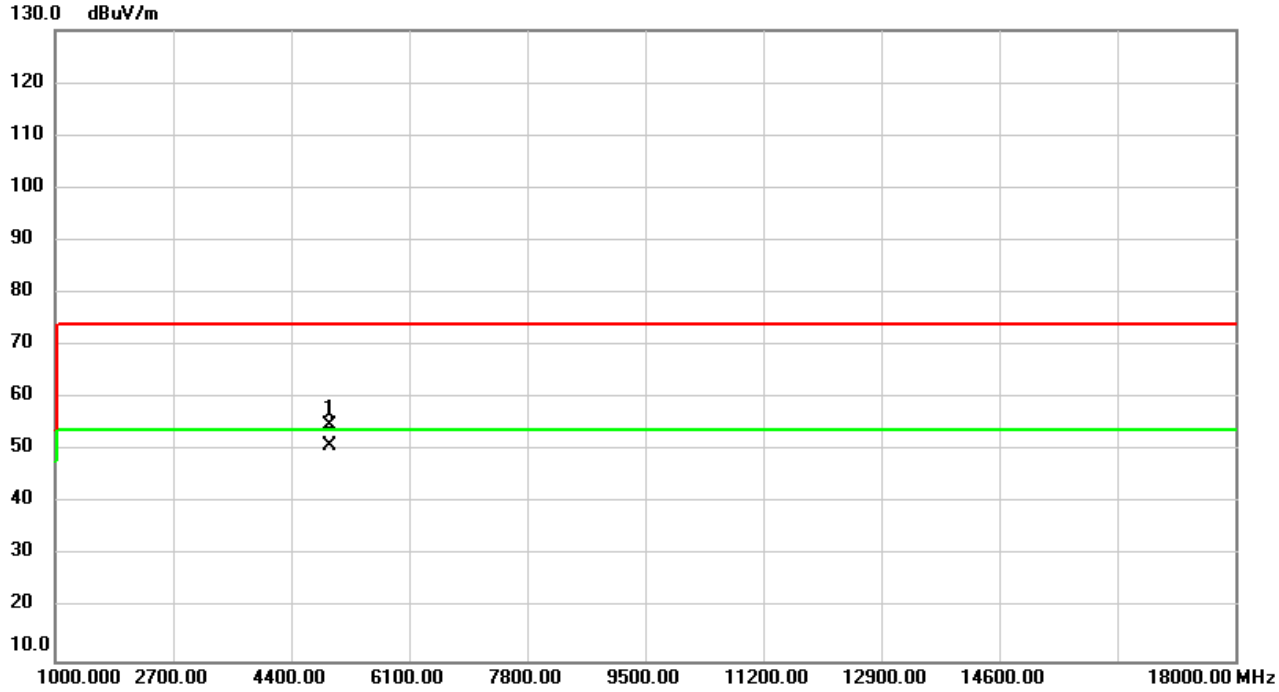
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2480MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	54.81	1.21	56.02	74.00	-17.98	peak	
2	*	4960.000	51.89	1.21	53.10	54.00	-0.90	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

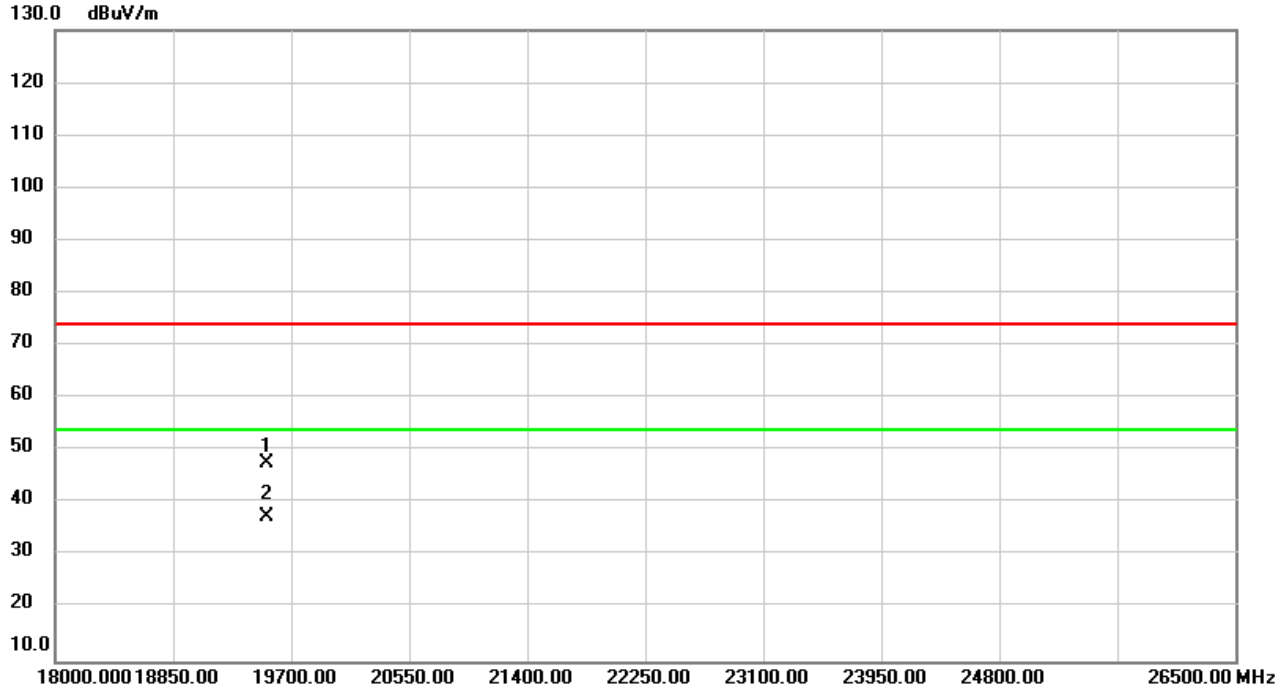
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2480MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	53.55	1.21	54.76	74.00	-19.24	peak	
2	*	4960.000	49.79	1.21	51.00	54.00	-3.00	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

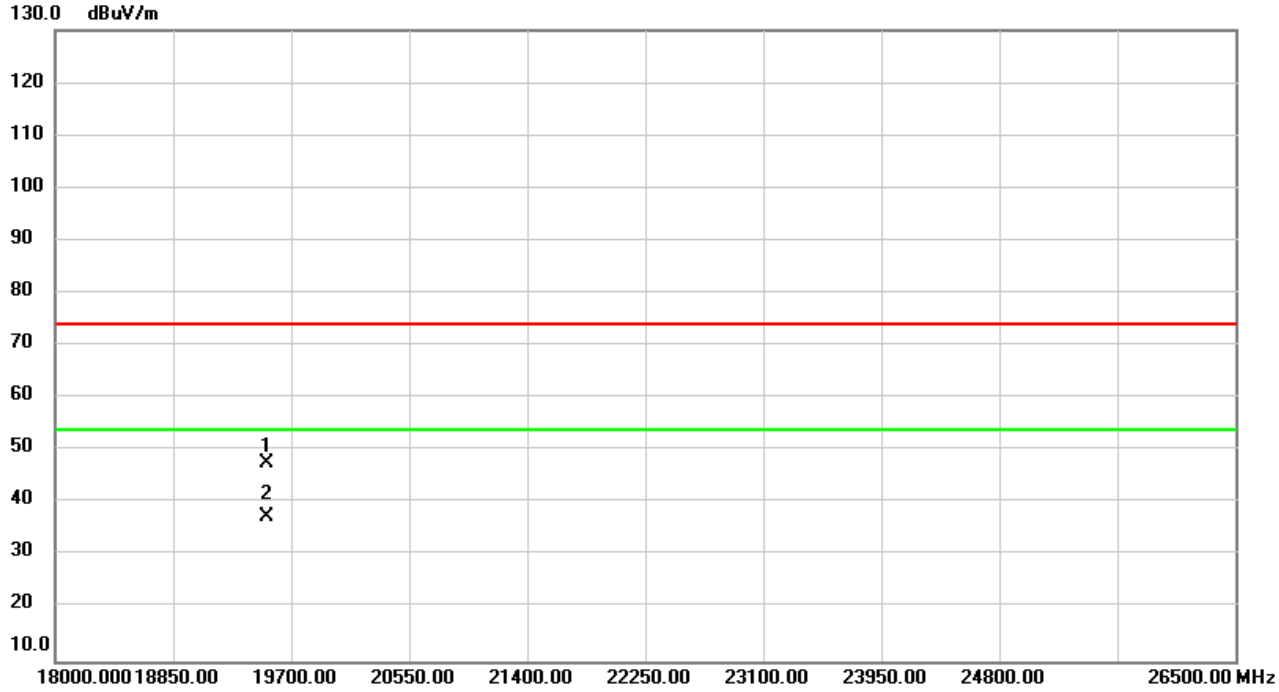
Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Vertical
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		19520.00	53.30	-5.61	47.69	74.00	-26.31	peak	
2	*	19520.00	43.12	-5.61	37.51	54.00	-16.49	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.1 (1 Mbps)	Test Date	2024/8/23
Test Frequency	2440MHz	Polarization	Horizontal
Temp	27°C	Hum.	66%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		19520.00	53.26	-5.61	47.65	74.00	-26.35	peak	
2	*	19520.00	42.96	-5.61	37.35	54.00	-16.65	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

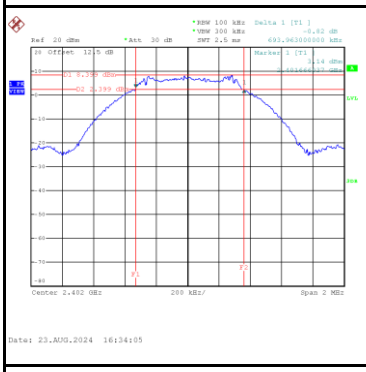
APPENDIX D BANDWIDTH

Test Mode:	BLE 5.1_1 Mbps

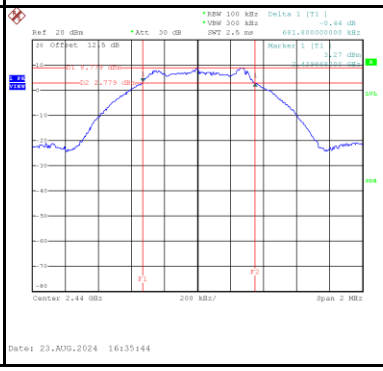
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.69	1.05	500	Pass
2440	0.68	1.06	500	Pass
2480	0.69	1.06	500	Pass

6dB Bandwidth

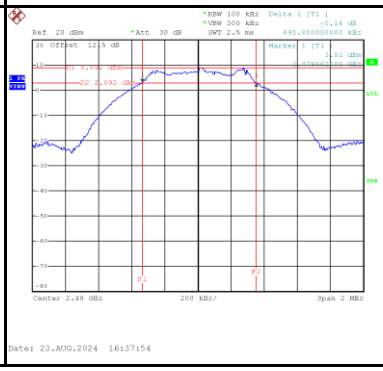
2402 MHz



2440 MHz

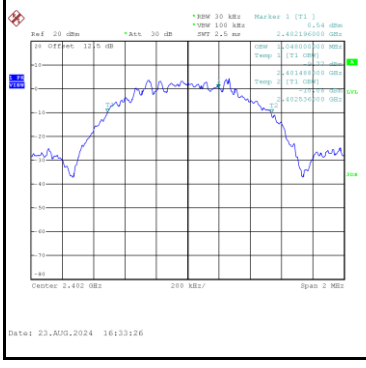


2480 MHz

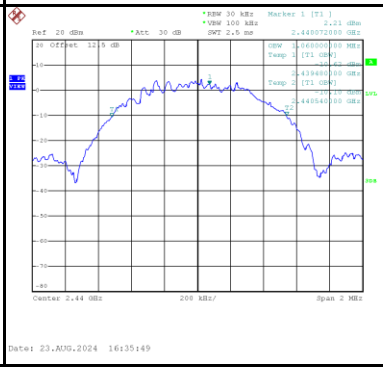


99% Occupied BW

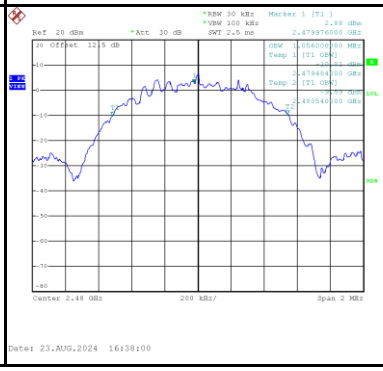
2402 MHz



2440 MHz



2480 MHz



APPENDIX E OUTPUT POWER

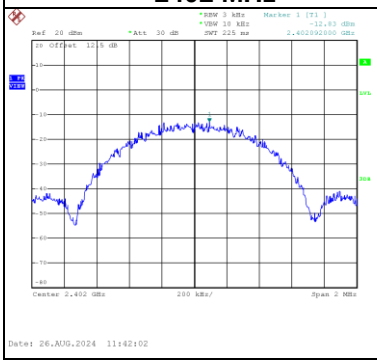
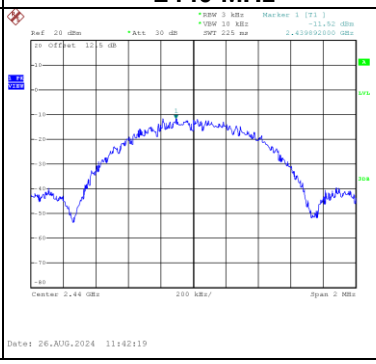
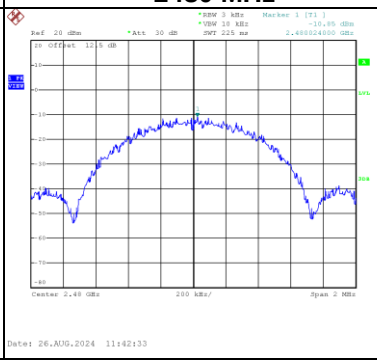
Test Mode :	BLE 5.1_1 Mbps	Tested Date	2024/8/23

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.32	0.0021	30.00	1.0000	Pass
2440	4.56	0.0029	30.00	1.0000	Pass
2480	4.78	0.0030	30.00	1.0000	Pass

APPENDIX F POWER SPECTRAL DENSITY TEST

Test Mode :	BLE 5.1_1 Mbps

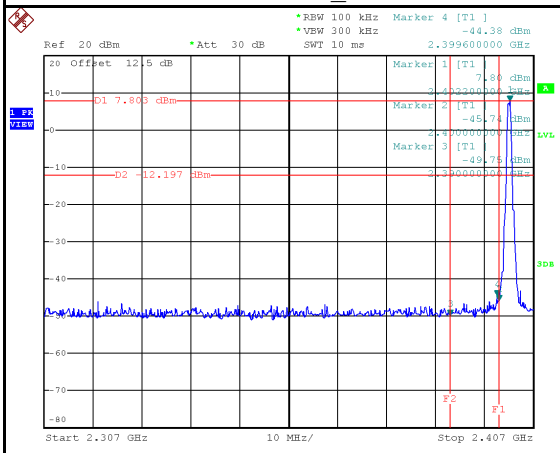
Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-12.83	8	Pass
2440	-11.52	8	Pass
2480	-10.85	8	Pass

2402 MHz	2440 MHz	2480 MHz
		

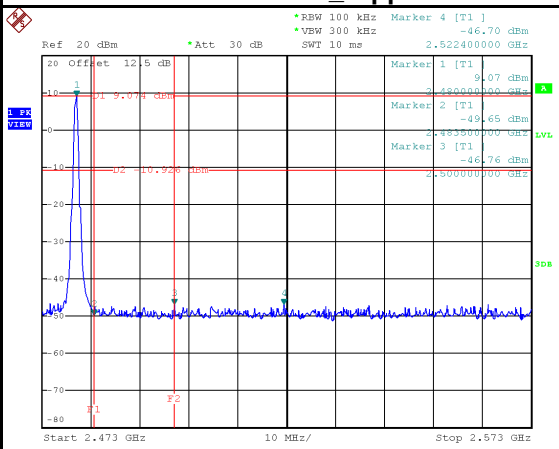
APPENDIX G ANTENNA CONDUCTED SPURIOUS EMISSION

Test Mode :	BLE 5.1_1 Mbps

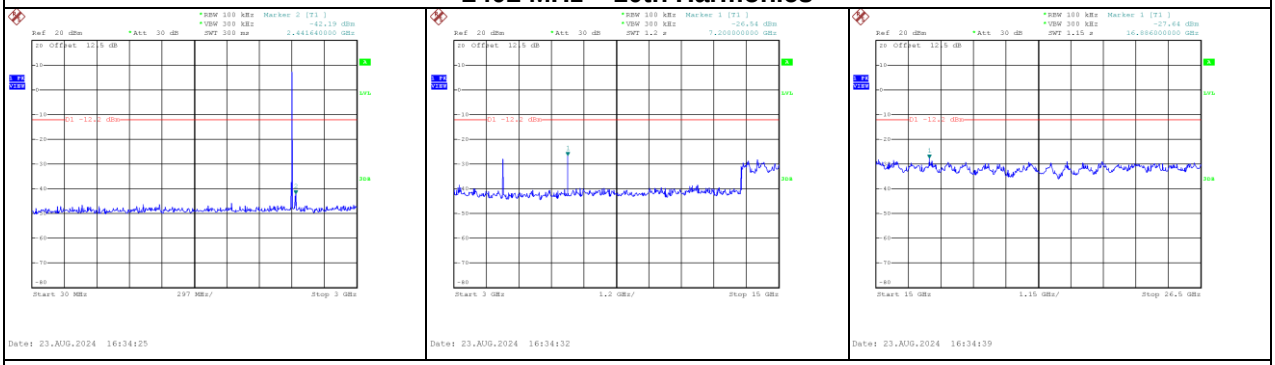
2402 MHz_ Lower



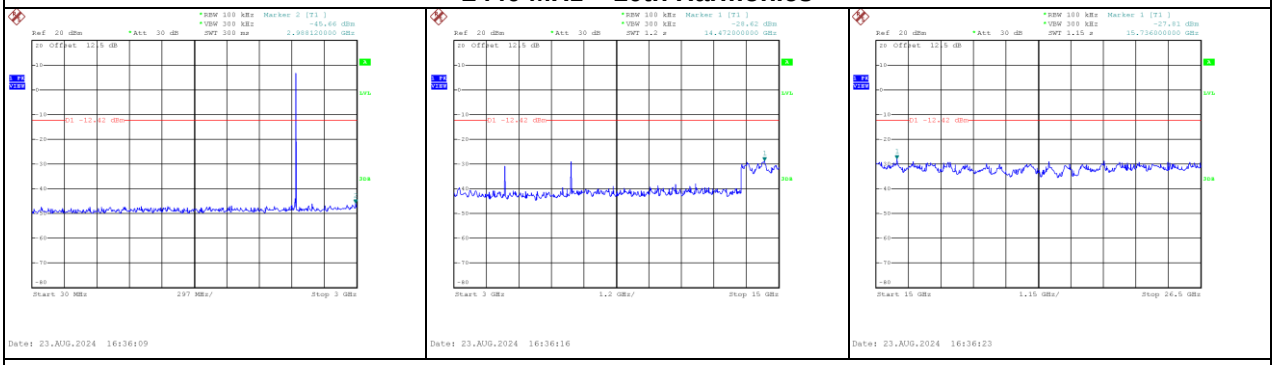
2480 MHz_ Upper



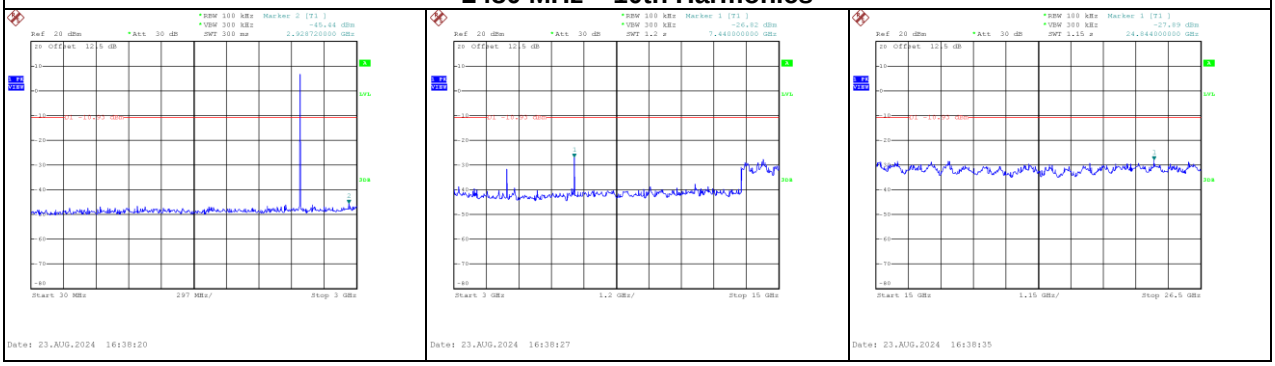
2402 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2480 MHz – 10th Harmonics



End of Test Report