

Test Report

Verified code: 327861

Report No.: E202208181964-2

Customer: Blueiot (Beijing) Technology Co., Ltd.

Address: 10/F, Tower A, TusPark Innovation Plaza, Haidian District, Beijing, China

Sample Name: Blueiot RTLS Tag

Sample Model: BT1000-d

Receive Sample Date: Aug.30,2022

Test Date: Aug.31,2022 ~ Oct.31,2022

Reference Document: CFR 47, FCC Part 15 Subpart C
RADIO FREQUENCY DEVICES:Subpart C—Intentional Radiators

Test Result: Pass

Prepared by: *Wen. Wen*

Reviewed by: *Wu Haoting*

Approved by: *Xiao Liang*



GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2022-11-17

GUANGZHOU GRG METROLOGY & TEST CO., LTD.

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TABLE OF CONTENTS

1.	TEST RESULT SUMMARY	6
2.	GENERAL DESCRIPTION OF EUT.....	7
2.1	APPLICANT	7
2.2	MANUFACTURER.....	7
2.3	FACTORY	7
2.4	BASIC DESCRIPTION OF EQUIPMENT UNDER TEST	7
2.5	CHANNEL LIST	8
2.6	TEST OPERATION MODE	8
2.7	LOCAL SUPPORTIVE	8
2.8	CONFIGURATION OF SYSTEM UNDER TEST	9
2.9	DUTY CYCLE.....	10
3.	LABORATORY AND ACCREDITATIONS	12
3.1	LABORATORY	12
3.2	ACCREDITATIONS	12
4.	MEASUREMENT UNCERTAINTY	13
5.	LIST OF USED TEST EQUIPMENT AT GRGT	14
6.	RADIATED SPURIOUS EMISSIONS	15
6.1	LIMITS.....	15
6.2	TEST PROCEDURES	15
6.3	TEST SETUP	18
6.4	DATA SAMPLE	19
6.5	TEST RESULTS	20
7.	6dB BANDWIDTH.....	33
7.1	LIMITS.....	33
7.2	TEST PROCEDURES	33
7.3	TEST SETUP	33
7.4	TEST RESULTS.....	33
8.	MAXIMUM PEAK OUTPUT POWER	37
8.1	LIMITS.....	37
8.2	TEST PROCEDURES	37
8.3	TEST SETUP	37
8.4	TEST RESULTS.....	37
9.	POWER SPECTRAL DENSITY	38
9.1	LIMITS.....	38
9.2	TEST PROCEDURES	38
9.3	TEST SETUP	38
9.4	TEST RESULTS.....	39
10.	CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS	43
10.1	LIMITS.....	43
10.2	TEST PROCEDURES	43
10.3	TEST SETUP	43

10.4 TEST RESULTS 44

11. RESTRICTED BANDS OF OPERATION 57

11.1 LIMITS 57

11.2 TEST PROCEDURES 58

11.3 TEST SETUP 58

11.4 TEST RESULTS 59

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM 70

APPENDIX B. PHOTOGRAPH OF THE EUT 70

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E202208181964-2	Original Issue	2022-11-03

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1. TEST RESULT SUMMARY

Technical Requirements		
FCC 47 CFR Part 15 Subpart C 15.247 ANSI C63.10-2013 KDB 558074 D01 15.247 measurement guidance v05r02		
Limit / Severity	Item	Result
§15.203	Antenna Requirement	Pass
§15.207(a)	Conducted Emission	Not Applicable
§15.247(d) & 15.205 & 15.209	Radiated Spurious Emission	Pass
§15.247(b)(3)	Maximum Peak Output Power	Pass
§15.247(e)	Power Spectral Density	Pass
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(d)	Conducted band edges and Spurious Emission	Pass
§15.247(d) & 15.205 & 15.209	Restricted bands of operation	Pass

Note: 1) Not Applicable, the EUT is powered by DC 3.0V.

2) The EUT have two PCB printed antennas. They are from the same BLE RF IC module divide to two antennas and they can not transmitting at the same time. The max gain of antenna 1 is 0dBi, the max gain of antenna 2 is 0dBi. Which accordance 15.203 is considered sufficient to comply with the provisions of this section.

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2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name: Blueiot (Beijing) Technology Co., Ltd.
Address: 10/F, Tower A, TusPark Innovation Plaza, Haidian District, Beijing, China

2.2 MANUFACTURER

Name: Blueiot (Beijing) Technology Co., Ltd.
Address: 10/F, Tower A, TusPark Innovation Plaza, Haidian District, Beijing, China

2.3 FACTORY

Name: Blueiot (Beijing) Technology Co., Ltd.
Address: 10/F, Tower A, TusPark Innovation Plaza, Haidian District, Beijing, China

2.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: Blueiot RTLS Tag
Model No.: BT1000-d
Adding Model: /
Trade Name: Blueiot
FCC ID: 2AZOM-BT1000D
Power supply: DC 3.0V power supplied by battery
Battery Specification: Model: CR2032
Nominal Voltage: 3.0Vdc
Frequency Band: 2402-2480MHz
Antenna 1:
Maximum conducted peak output Power: BLE_1MHz: 8.93dBm
Antenna 2:
BLE_1MHz: 8.09dBm
Modulation type: GFSK for 1Mbps
Channel space: 2MHz
Antenna Specification: PCB printed antenna 1 with 0dBi gain (Max.), antenna 2 with 0dBi gain (Max.)
Temperature Range: -20°C~+70°C
Hardware Version: V0.1.1
Software Version: V1020
Sample No: E202208181964-0002
Note: /

2.5 CHANNEL LIST

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

* is the test frequency

2.6 TEST OPERATION MODE

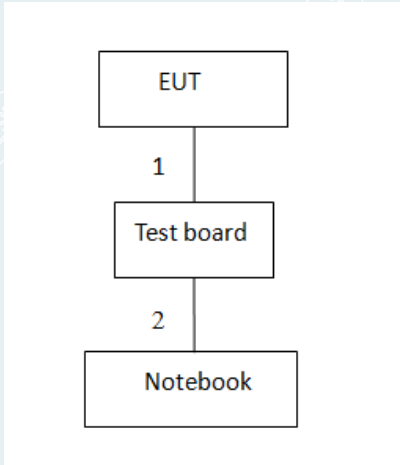
Mode No.	Description of the modes
1	Bluetooth (BLE) fixed frequency transmitting

2.7 LOCAL SUPPORTIVE

Name of equipment	Manufacturer	Model	Serial number	Note
Notebook	LENOVO	TianYi 310-14ISK	MP18DLC6	/
Test board	/	/	/	/

No.	Cable Type	Qty.	Shielded Type	Ferrite Core (Qty.)	Length
1	DC cable	1	No	0	0.15m
2	USB extension cable	1	No	0	1m

2.8 CONFIGURATION OF SYSTEM UNDER TEST



Test software:

Software version	Test level
nRF connect	8

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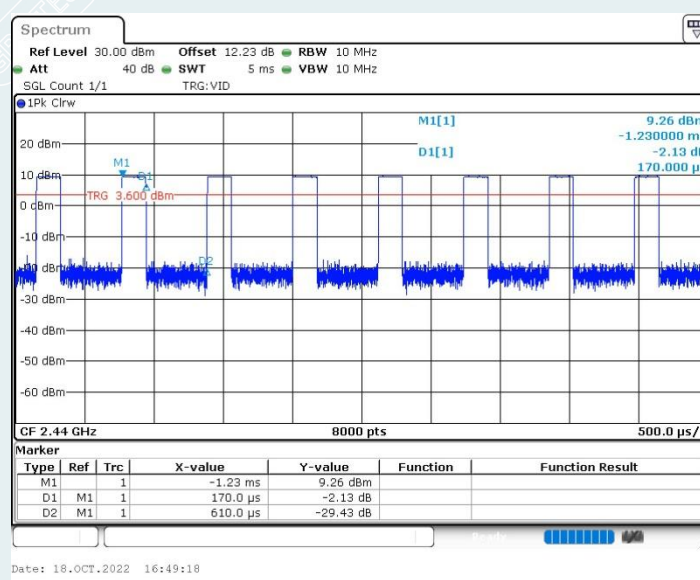
2.9 DUTY CYCLE

Environment: 25.8°C/60%RH/101.0kPa
 Tested By: Qin Tingting

Voltage: DC 3V
 Date: 2022-10-18

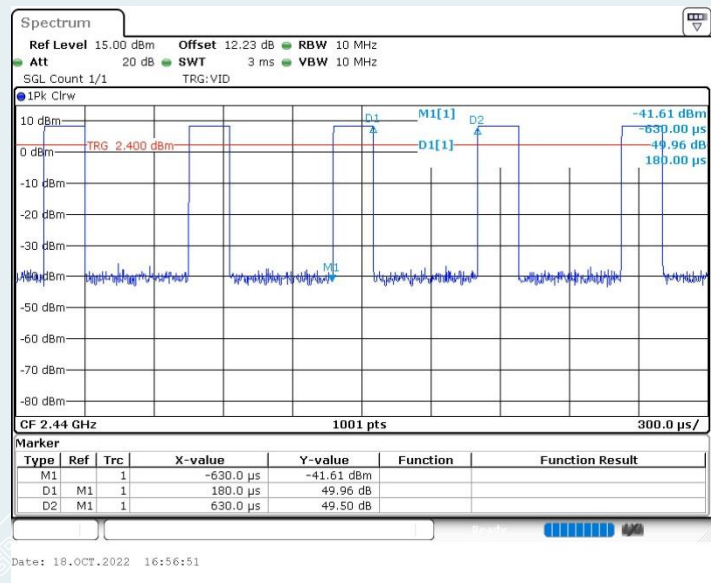
Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	DC [%]	T [s]
BLE_1M	Ant1	2440	0.17	0.61	27.87	0.00017
BLE_1M	Ant2	2440	0.18	0.63	28.57	0.00018

Ant1_BLE_1M_2440 MHz



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Ant2_BLE_1M_2440 MHz



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3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co., Ltd.

Add.: No.1301 Guangang Road Xinlan Community, Guanlan Street, Longhua District
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P.C.: 518110

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3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA A2LA(Certificate #2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada ISED (Company Number: 24897, CAB identifier:CN0069)

USA FCC (Registration Number: 759402, Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site,
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4. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement		Frequency	Uncertainty
Radiated Emission	Horizontal	9kHz~30MHz	5.1dB
		30MHz~200MHz	4.5dB
		200MHz~1000MHz	4.4dB
		1GHz~18GHz	5.6dB
		18GHz~26.5GHz	3.7dB
	Vertical	9kHz~30MHz	5.1dB
		30MHz~200MHz	4.4dB
		200MHz~1000MHz	4.5dB
		1GHz~18GHz	5.6dB
		18GHz~26.5GHz	3.7dB

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
RF power conducted	0.8dB
Occupied channel bandwidth	0.4dB
Unwanted emission, conducted	0.7dB
Humidity	6%
Temperature	2°C

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95%. This uncertainty represents an expanded uncertainty factor of $k=2$.

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5. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission & Restricted bands of operation				
Test S/W	EZ	CCS-03A1		
Test Receiver	R&S	ESR7	102444	2023-09-02
Preamplifier	EMEC	EM330	I00426	2023-03-05
Bi-log Antenna	Schwarzbeck	VULB9160	VULB9160-3401	2022-10-27
Loop Antenna	TESEQ	HLA6121	52599	2023-04-02
Spectrum Analyzer	KEYSIGHT	N9010A	MY52221469	2023-06-29
Horn Antenna	Schwarzbeck	BBHA 9120D	02143	2023-07-27
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-497	2023-09-27
Amplifier	Tonscend	TAP01018048	AP20E8060075	2023-05-05
Amplifier	Tonscend	TAP184050	AP20E806071	2023-05-05
Test S/W	Tonscend	JS36-RE/2.5.1.5		
6dB Bandwidth & Conducted band edges and Spurious Emission & Power Spectral Density				
Spectrum Analyzer	R&S	FSV30	104381	2022-12-10
BT/WIFI System	Tonscend	JS1120-3		
Maximum Peak Output Power				
Pulse power sensor	Anritsu	MA2411B	1126150	2023-03-01
Power meter	Anritsu	ML2495A	1204003	2023-02-28

Note: The calibration interval of the above test instruments is 12 months.

6. RADIATED SPURIOUS EMISSIONS

6.1 LIMITS

In any 100kHz 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 20dB below that in the 100kHz 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. Attenuation below the general limits specified in §15.209(a) is not required.

Frequency (MHz)	Quasi-peak($\mu\text{V/m}$)	Measurement distance(m)	Quasi-peak(dB $\mu\text{V/m}$)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

NOTE:

- (1) The emission limits for the ranges 9-90kHz and 110-490kHz are based on measurements employing a linear average detector.
- (2) The lower limit shall apply at the transition frequencies.
- (3) Above 18GHz test distance is 1m, so the Peak Limit=74+20*log(3/1)=83.54 (dB $\mu\text{V/m}$).
The Avg Limit=54+20*log(3/1)=63.54 (dB $\mu\text{V/m}$).

6.2 TEST PROCEDURES

1) Sequence of testing 9kHz to 30MHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The measurement distance is 3meter.
- The EUT was set into operation.

Pre measurement:

- The turntable rotates from 0 °to 360 °.
- The antenna height is 1.0 meter.
- The antenna is polarized X,Y and Z.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- Identified emissions during the pre measurement the software maximizes by rotating the turntable position (0 °to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

2) Sequence of testing 30MHz to 1GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 °to 360 °and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1GHz to 18GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 4 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 °to 360 °and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18GHz**Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The measurement distance is 1 meter.
- The EUT was set into operation.

Pre measurement:

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the pre measurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

NOTE:

- (a).The frequency from 9kHz to 150kHz, Set RBW=300Hz(for Peak & AVG), VBW=300Hz(for Peak & AVG). The frequency from 150kHz to 30MHz, Set RBW=9kHz, VBW=9kHz, (for QP Detector).
- (b).The frequency from 30MHz to 1GHz, Set RBW=120kHz, VBW=300kHz, (for QP Detector).
- (c).The frequency above 1GHz, for Peak detector: Set RBW=1MHz,VBW=3MHz.
- (d). The frequency above 1GHz, for Avg detector: Set RBW=1MHz,if the EUT is configured to transmit with duty cycle $\geq 98\%$, set $VBW \leq RBW/100$ (i.e.,10kHz) but not less than 10 Hz. If the EUT duty cycle is $< 98\%$, set $VBW \geq 1/T$, Where T is defined in section 2.9.

6.3 TEST SETUP

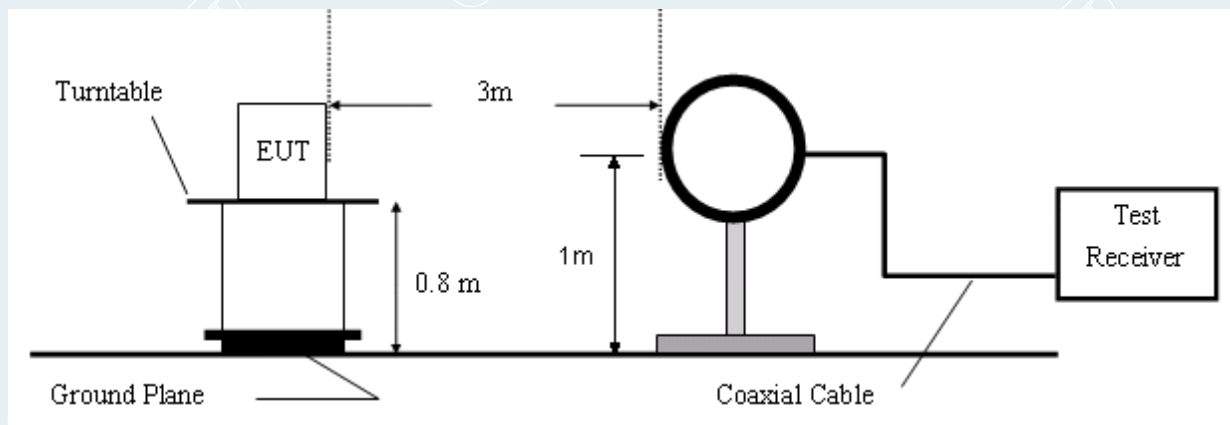


Figure 1. 9kHz to 30MHz radiated emissions test configuration

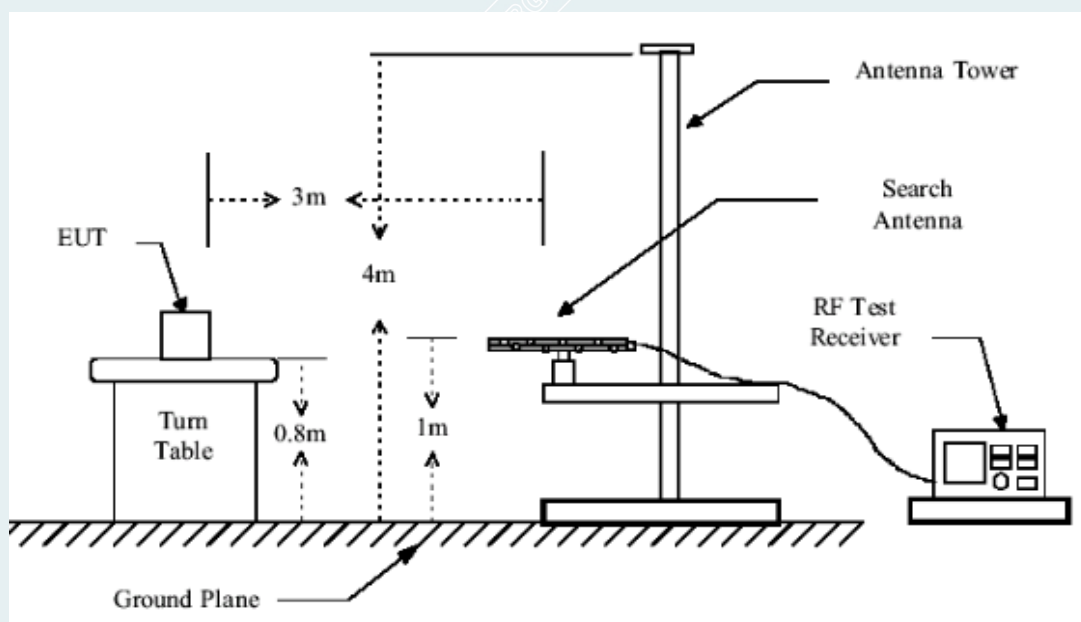


Figure 2. 30MHz to 1GHz radiated emissions test configuration

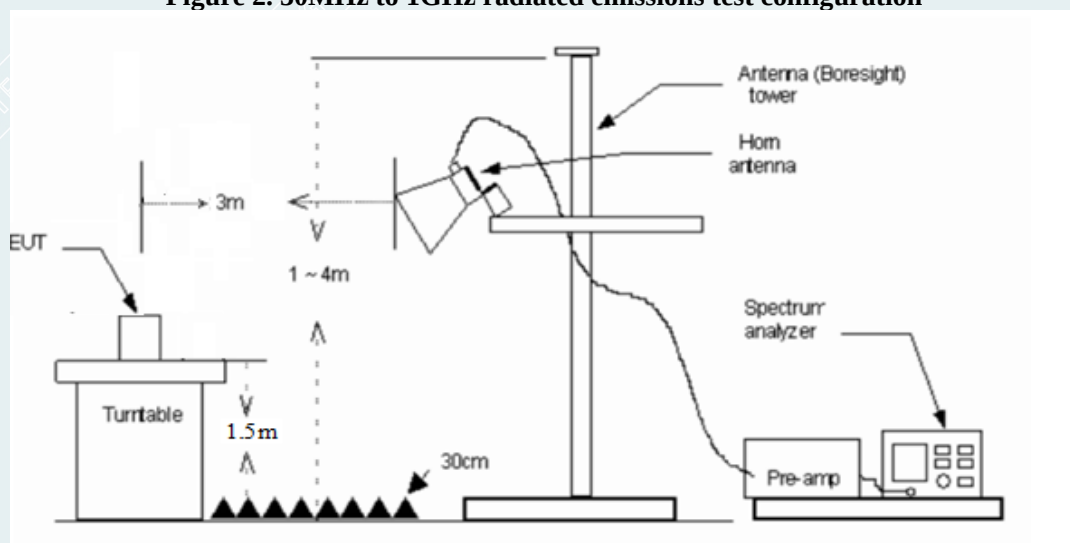


Figure 3. 1GHz to 18GHz radiated emissions test configuration

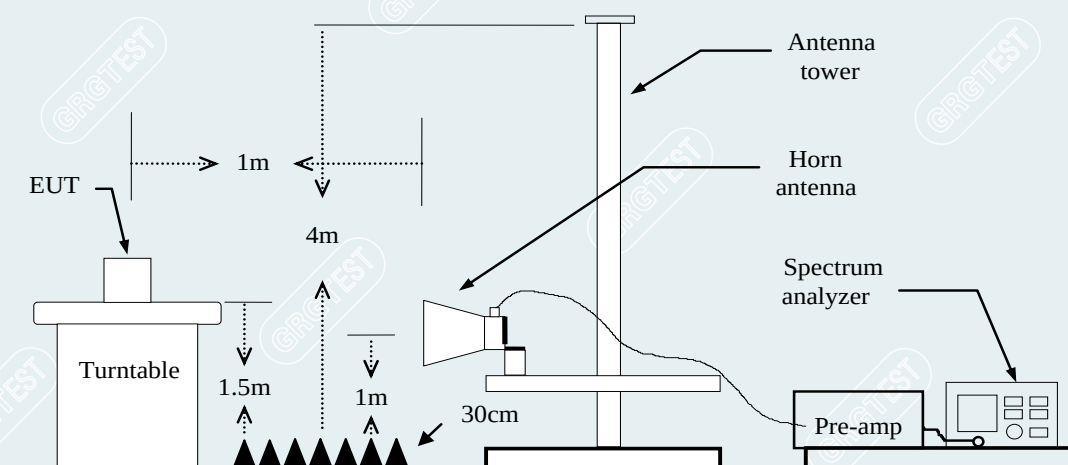


Figure 4. 18GHz to 26.5GHz radiated emissions test configuration

6.4 DATA SAMPLE

30MHz to 1GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	37.06	-15.48	21.58	40.00	-18.42	QP	Vertical

1GHz to 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	65.45	-11.12	54.33	74.00	-19.67	Peak	Vertical
xxx	xxx	63.00	-11.12	51.88	54.00	-2.12	AVG	Vertical

Above 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	68.86	57.66	-11.20	83.54	25.88	peak	Vertical
xxx	xxx	68.89	-11.20	57.69	63.54	5.85	AVG	Vertical

Frequency (MHz) = Emission frequency in MHz

Ant.Pol. (H/V) = Antenna polarization

Reading (dBuV) = Uncorrected Analyzer / Receiver reading

Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain

Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Remark Result (dBuV/m) – Limit (dBuV/m)

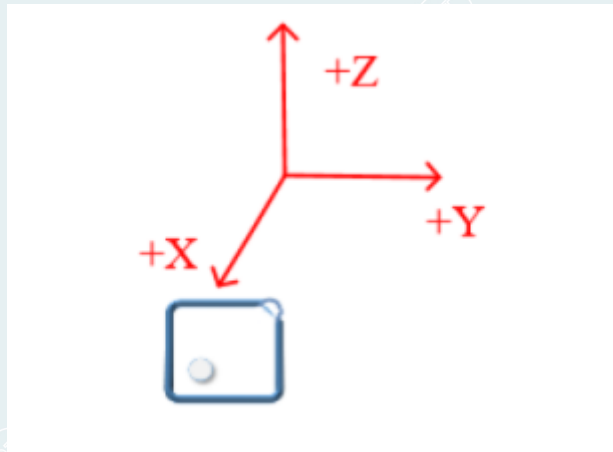
Peak = Peak Reading

QP = Quasi-peak Reading

AVG = Average Reading

6.5 TEST RESULTS

The test are under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown the X position only.



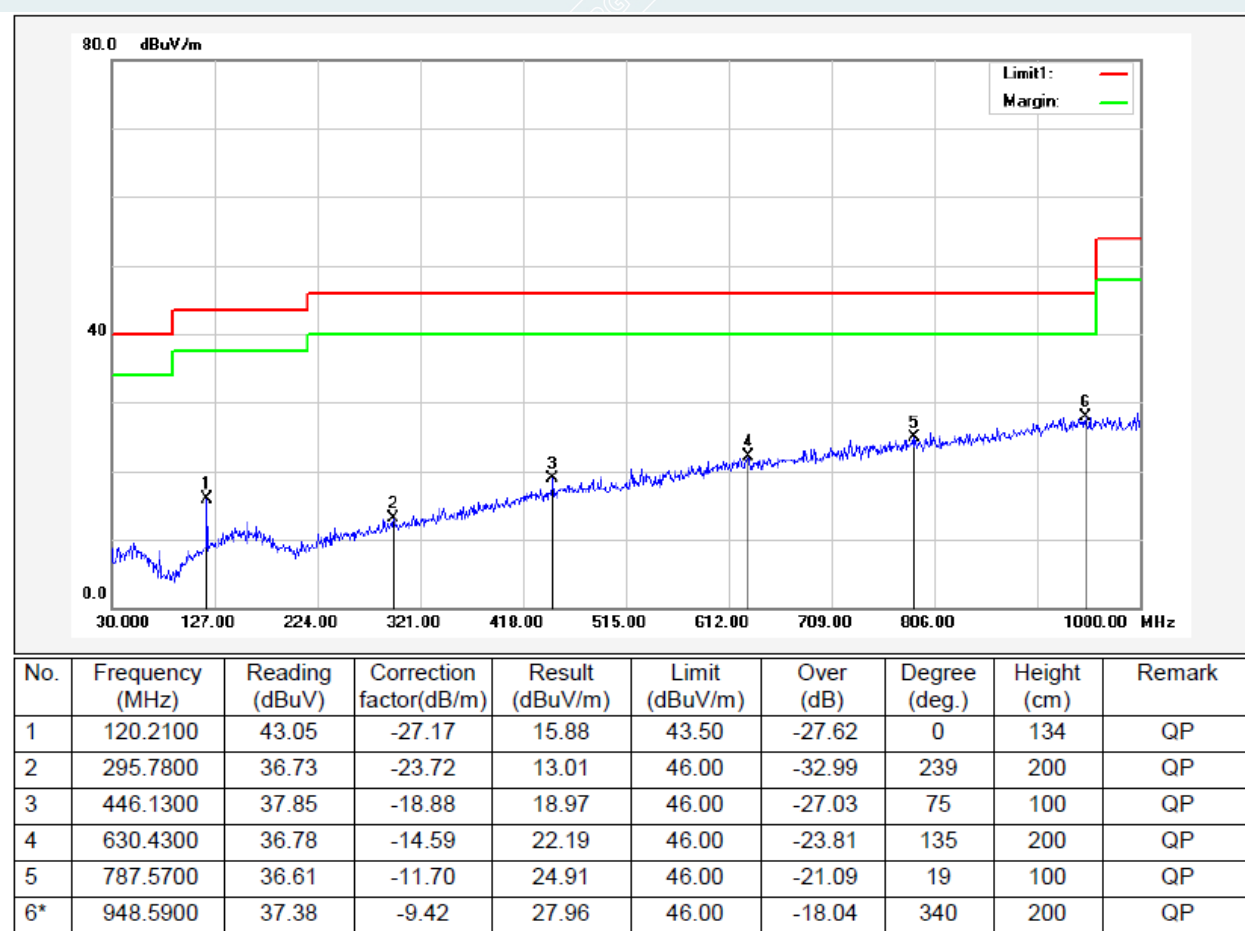
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Below 1GHz

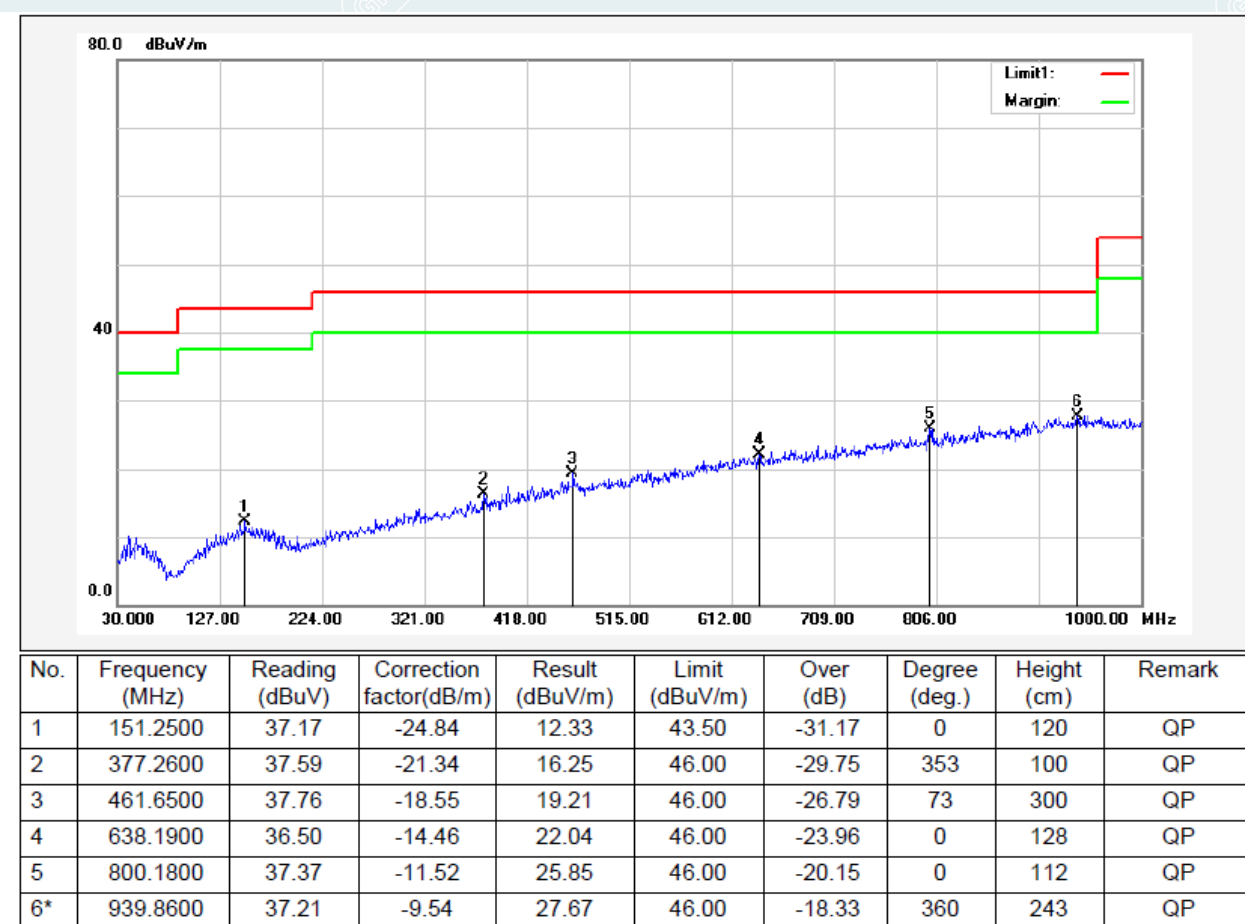
Pre-test all test mode and recorded the worst case BLE 1M 2402MHz test results in the report.

Antenna 1

EUT Name	Blueiot RTLS Tag	Model	BT1000-d
Environmental Conditions	25.0°C/51%RH/101.0kPa	Test Voltage	DC 3V
Test Mode	TX/ BLE_1M (2402MHz)	Polarity	Vertical
Tested By	Tang Shenghui	Tested Date	2022-09-19

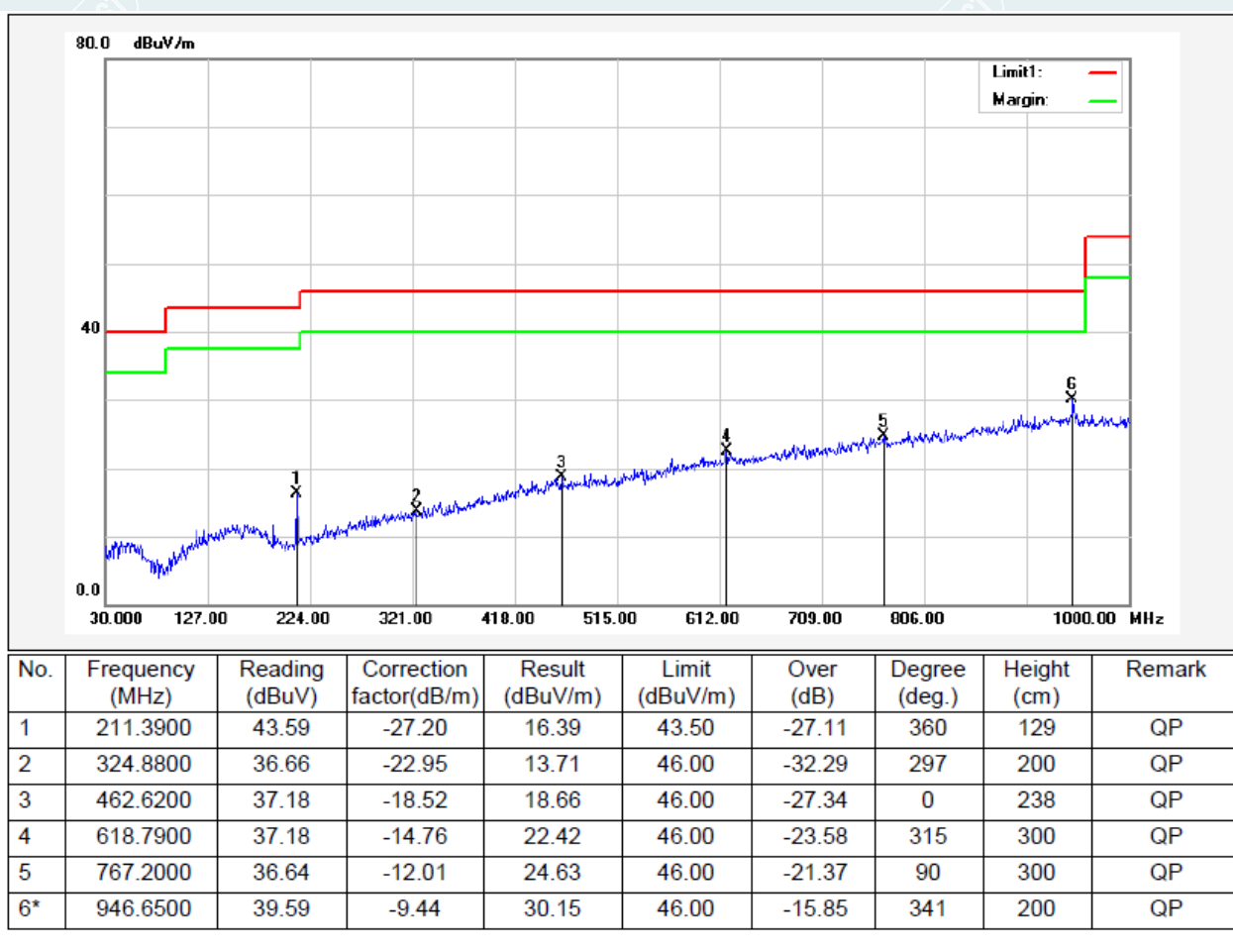


EUT Name	Blueiot RTLS Tag	Model	BT1000-d
Environmental Conditions	25.0°C/51%RH/101.0kPa	Test Voltage	DC 3V
Test Mode	TX/ BLE_1M (2402MHz)	Polarity	Horizontal
Tested By	Tang Shenghui	Tested Date	2022-09-19

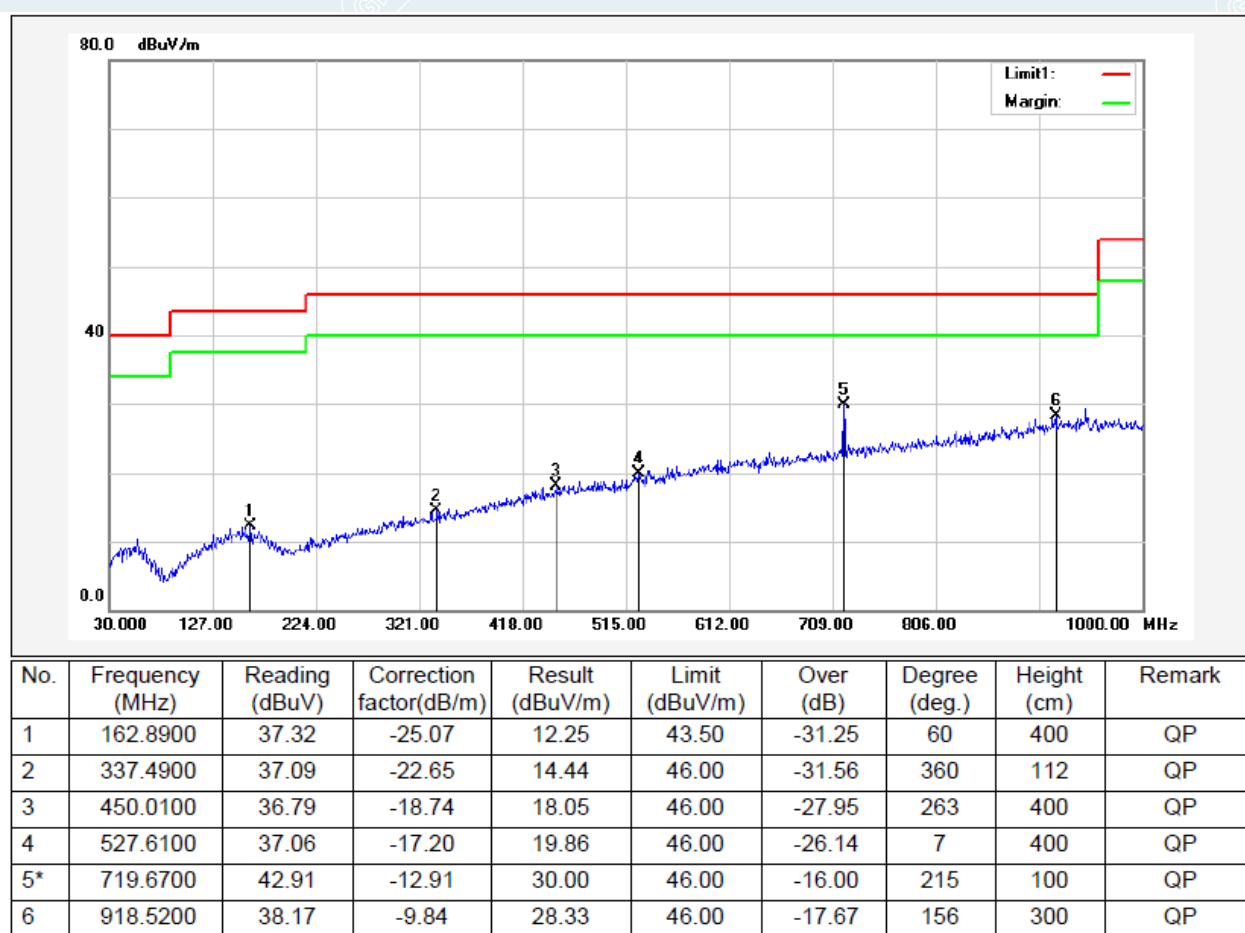


Antenna 2

EUT Name	Blueiot RTLS Tag	Model	BT1000-d
Environmental Conditions	23.5°C/43%RH/101.0kPa	Test Voltage	DC 3V
Test Mode	TX/ BLE_1M (2402MHz)	Polarity	Vertical
Tested By	Tang Shenghui	Tested Date	2022-10-20



EUT Name	Blueiot RTLS Tag	Model	BT1000-d
Environmental Conditions	23.5°C/43%RH/101.0kPa	Test Voltage	DC 3V
Test Mode	TX/ BLE_1M (2402MHz)	Polarity	Horizontal
Tested By	Tang Shenghui	Tested Date	2022-10-20

**Remark:**

- 1 No emission found between lowest internal used/generated frequency to 30MHz.
- 2 Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using Quasi-peak detector mode.
- 3 The IF bandwidth of Receiver between 30MHz to 1GHz was 120kHz.

Antenna 1**1GHz-18GHz:**

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Mode: TX/ BLE_1M

Lowest Frequency (2402MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-09-20

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1341.7927	60.64	37.44	-23.20	74.00	36.56	100	106	Horizontal
2	1461.8077	60.37	37.40	-22.97	74.00	36.60	200	55	Horizontal
3	2882.4853	59.68	42.20	-17.48	74.00	31.80	200	65	Horizontal
4	3999.0999	61.40	45.17	-16.23	74.00	28.83	100	334	Horizontal
5	4804.6805	63.95	51.89	-12.06	74.00	22.11	100	315	Horizontal
6	7204.9205	59.53	55.60	-3.93	74.00	18.40	100	44	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4803.8637	-12.06	53.33	41.27	54.00	12.73	156	87.1	Horizontal
2	7205.3528	-3.93	46.01	42.08	54.00	11.92	109	62.5	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1379.0474	59.39	37.68	-21.71	74.00	36.32	100	26	Vertical
2	1675.8345	59.42	37.35	-22.07	74.00	36.65	100	156	Vertical
3	3322.5323	61.29	43.72	-17.57	74.00	30.28	100	86	Vertical
4	3996.0996	65.73	49.81	-15.92	74.00	24.19	100	262	Vertical
5	4803.1803	64.00	51.66	-12.34	74.00	22.34	200	124	Vertical
6	7204.9205	56.71	53.66	-3.05	74.00	20.34	100	335	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4803.9488	-12.34	56.03	43.69	54.00	10.31	187	115.9	Vertical
2	7205.2807	-3.05	45.90	42.85	54.00	11.15	100	315.4	Vertical

Mode: TX/ BLE_1M
 Middle Frequency (2440MHz)
 Environment: 25°C/51%RH/101.0kPa
 Tested By: Zhang Zishan

Voltage: DC 3.0V
 Date: 2022-09-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1252.7816	59.55	37.61	-21.94	74.00	36.39	100	56	Horizontal
2	1754.5943	60.51	37.59	-22.92	74.00	36.41	200	154	Horizontal
3	2222.1528	58.69	40.48	-18.21	74.00	33.52	100	196	Horizontal
4	2849.2312	58.56	42.26	-16.30	74.00	31.74	100	116	Horizontal
5	4879.688	63.91	50.79	-13.12	74.00	23.21	200	314	Horizontal
6	7320.432	56.63	53.51	-3.12	74.00	20.49	100	53	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/ m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4879.932	-13.12	55.90	42.78	54.00	11.22	144	310.9	Horizontal
2	7319.4071	-3.12	44.47	41.35	54.00	12.65	120	68	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1390.7988	60.02	38.41	-21.61	74.00	35.59	200	267	Vertical
2	2255.1569	60.00	40.85	-19.15	74.00	33.15	200	218	Vertical
3	3330.033	62.31	44.54	-17.77	74.00	29.46	100	35	Vertical
4	3988.5989	64.16	48.30	-15.86	74.00	25.70	100	345	Vertical
5	4879.688	63.28	50.20	-13.08	74.00	23.80	200	125	Vertical
6	7320.432	56.95	53.84	-3.11	74.00	20.16	100	345	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/ m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4879.9808	-13.08	55.40	42.32	54.00	11.68	171	120	Vertical
2	7319.4071	-3.11	45.74	42.63	54.00	11.37	107	352.1	Vertical

Mode: TX/ BLE_1M

Highest Frequency (2480MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-09-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1254.5318	58.91	36.94	-21.97	74.00	37.06	200	147	Horizontal
2	2179.8975	59.02	40.12	-18.90	74.00	33.88	100	335	Horizontal
3	2849.9812	58.19	41.91	-16.28	74.00	32.09	100	344	Horizontal
4	3984.0984	59.57	43.43	-16.14	74.00	30.57	100	343	Horizontal
5	4960.6961	62.92	51.08	-11.84	74.00	22.92	100	314	Horizontal
6	7440.444	57.09	53.55	-3.54	74.00	20.45	200	225	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4960.0016	-11.84	56.31	44.47	54.00	9.53	156	327.3	Horizontal
2	7439.4023	-3.54	46.24	42.70	54.00	11.30	200	47	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1382.7978	59.16	37.49	-21.67	74.00	36.51	100	232	Vertical
2	3328.5329	62.51	44.77	-17.74	74.00	29.23	200	35	Vertical
3	3994.5995	64.77	48.87	-15.90	74.00	25.13	200	109	Vertical
4	4645.6646	60.82	48.74	-12.08	74.00	25.26	100	234	Vertical
5	4960.6961	63.43	51.91	-11.52	74.00	22.09	200	109	Vertical
6	7440.444	60.14	56.75	-3.39	74.00	17.25	100	328	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4959.952	-11.52	54.37	42.85	54.00	11.15	172	99.5	Vertical
2	7439.3279	-3.39	47.78	44.39	54.00	9.61	100	328.7	Vertical

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3 Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4 Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Antenna 2**1GHz-18GHz:**

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Mode: TX/ BLE_1M

Lowest Frequency (2402MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-10-26

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1166.0208	65.82	41.21	-24.61	74.00	32.79	100	225	Horizontal
2	1664.083	68.39	45.28	-23.11	74.00	28.72	200	243	Horizontal
3	2654.7068	60.56	42.12	-18.44	74.00	31.88	100	66	Horizontal
4	3984.4981	60.66	44.52	-16.14	74.00	29.48	200	235	Horizontal
5	4803.9755	62.98	50.93	-12.05	74.00	23.07	100	147	Horizontal
6	7204.2755	62.37	58.43	-3.94	74.00	15.57	100	127	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4803.9275	-12.05	53.55	41.50	54.00	12.50	121	190.7	Horizontal
2	7205.5723	-3.94	49.53	45.59	54.00	8.41	121	131.7	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1167.0209	67.73	43.43	-24.30	74.00	30.57	200	214	Vertical
2	2286.9109	64.65	45.97	-18.68	74.00	28.03	200	183	Vertical
3	3322.5403	62.39	44.82	-17.57	74.00	29.18	100	88	Vertical
4	3993.8742	61.80	45.90	-15.90	74.00	28.10	100	157	Vertical
5	4803.9755	63.67	51.33	-12.34	74.00	22.67	200	235	Vertical
6	7206.1508	57.99	54.93	-3.06	74.00	19.07	100	206	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4803.9275	-12.34	57.22	44.88	54.00	9.12	199	258.6	Vertical
2	7205.4302	-3.06	45.64	42.58	54.00	11.42	106	78.6	Vertical

Mode: TX/ BLE_1M
 Middle Frequency (2440MHz)
 Environment: 25°C/51%RH/101.0kPa
 Tested By: Zhang Zishan

Voltage: DC 3.0V
 Date: 2022-10-26

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1166.7708	72.12	47.53	-24.59	74.00	26.47	200	186	Horizontal
2	1470.8089	65.89	42.98	-22.91	74.00	31.02	200	216	Horizontal
3	2367.671	66.39	46.21	-20.18	74.00	27.79	200	146	Horizontal
4	2665.9582	63.86	45.44	-18.42	74.00	28.56	200	295	Horizontal
5	4880.8601	64.47	51.33	-13.14	74.00	22.67	100	185	Horizontal
6	7318.6648	58.76	55.67	-3.09	74.00	18.33	100	125	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4879.9327	-13.14	55.22	42.08	54.00	11.92	114	187.8	Horizontal
2	7319.3235	-3.09	47.13	44.04	54.00	9.96	106	125.8	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1164.0205	67.55	43.31	-24.24	74.00	30.69	200	196	Vertical
2	1467.8085	68.74	46.30	-22.44	74.00	27.70	200	145	Vertical
3	2368.4211	63.62	44.89	-18.73	74.00	29.11	200	245	Vertical
4	3320.6651	63.01	45.48	-17.53	74.00	28.52	100	229	Vertical
5	4878.9849	64.82	51.74	-13.08	74.00	22.26	200	256	Vertical
6	7320.5401	56.28	53.17	-3.11	74.00	20.83	100	50	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4880.0095	-13.08	56.20	43.12	54.00	10.88	173	258.9	Vertical
2	7319.3688	-3.11	45.51	42.40	54.00	11.60	101	84.1	Vertical

Mode: TX/ BLE_1M

Highest Frequency (2480MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-10-26

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1333.0416	67.36	44.26	-23.10	74.00	29.74	200	56	Horizontal
2	1661.5827	68.46	45.33	-23.13	74.00	28.67	200	294	Horizontal
3	1992.374	64.85	43.68	-21.17	74.00	30.32	200	155	Horizontal
4	2526.1908	64.76	46.18	-18.58	74.00	27.82	200	204	Horizontal
5	4959.62	66.35	54.53	-11.82	74.00	19.47	200	137	Horizontal
6	7440.5551	58.25	54.71	-3.54	74.00	19.29	200	137	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4959.9672	-11.82	59.19	47.37	54.00	6.63	158	132.2	Horizontal
2	7439.2902	-3.54	46.35	42.81	54.00	11.19	200	156.8	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1164.5206	68.07	43.82	-24.25	74.00	30.18	200	233	Vertical
2	1333.2917	66.60	44.09	-22.51	74.00	29.91	200	185	Vertical
3	1499.5624	68.67	45.20	-23.47	74.00	28.80	200	233	Vertical
4	1993.6242	66.72	46.05	-20.67	74.00	27.95	200	195	Vertical
5	4959.62	64.64	53.14	-11.50	74.00	20.86	200	114	Vertical
6	7440.5551	58.99	55.60	-3.39	74.00	18.40	100	0	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4960.0664	-11.50	56.75	45.25	54.00	8.75	179	259.1	Vertical
2	7439.2902	-3.39	45.02	41.63	54.00	12.37	100	342.6	Vertical

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3 Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4 Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Antenna 1**18GHz to 26.5GHz**

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Pre-test all test mode and recorded the worst case 2402MHz test results in the report.

Mode: TX/ BLE_1M

Lowest Frequency (2402MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-09-20

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18466.225	51.92	39.68	-12.24	83.54	43.86	150	113	Horizontal
2	18994.925	52.04	40.24	-11.80	83.54	43.30	150	243	Horizontal
3	19504.925	52.54	41.12	-11.42	83.54	42.42	150	309	Horizontal
4	20225.3	51.64	40.80	-10.84	83.54	42.74	150	32	Horizontal
5	21139.05	49.91	39.84	-10.07	83.54	43.70	150	359	Horizontal
6	22597.65	47.25	38.23	-9.02	83.54	45.31	150	294	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18572.475	53.78	41.71	-12.07	83.54	41.83	150	51	Vertical
2	19042.95	52.45	40.68	-11.77	83.54	42.86	150	84	Vertical
3	19709.775	51.03	39.87	-11.16	83.54	43.67	150	34	Vertical
4	20167.075	51.80	41.00	-10.80	83.54	42.54	150	101	Vertical
5	21155.2	49.94	39.97	-9.97	83.54	43.57	150	197	Vertical
6	21960.575	47.06	37.39	-9.67	83.54	46.15	150	245	Vertical

----- The following blanks -----

Antenna 2**18GHz to 26.5GHz**

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Pre-test all test mode and recorded the worst case BLE 1M 2402MHz test results in the report.

Mode: TX/ BLE_1M

Lowest Frequency (2402MHz)

Environment: 25°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.0V

Date: 2022-10-26

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18482.375	52.67	40.43	-12.24	83.54	43.11	100	161	Horizontal
2	19555.925	52.54	41.18	-11.36	83.54	42.36	100	128	Horizontal
3	21121.2	50.16	40.08	-10.08	83.54	43.46	100	273	Horizontal
4	21872.6	47.90	38.13	-9.77	83.54	45.41	100	289	Horizontal
5	22811	46.08	37.35	-8.73	83.54	46.19	100	226	Horizontal
6	23965.3	43.43	34.95	-8.48	83.54	48.59	100	289	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18530.825	52.85	40.75	-12.10	83.54	42.79	100	282	Vertical
2	19548.7	52.21	40.86	-11.35	83.54	42.68	100	266	Vertical
3	20355.35	51.13	40.56	-10.57	83.54	42.98	100	23	Vertical
4	21210.025	50.53	40.58	-9.95	83.54	42.96	100	134	Vertical
5	22597.65	46.77	37.75	-9.02	83.54	45.79	100	201	Vertical
6	23912.175	43.82	35.41	-8.41	83.54	48.13	100	56	Vertical

----- The following blanks -----

7. 6dB BANDWIDTH

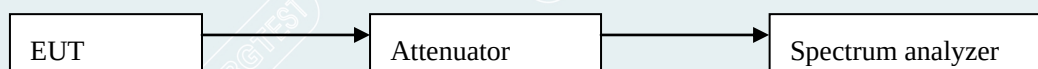
7.1 LIMITS

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

7.2 TEST PROCEDURES

- 1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
- 2) Set resolution bandwidth (RBW) = 100kHz. Set the video bandwidth (VBW) $\geq 3 \times$ RBW. Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize, record 6dB bandwidth value.
- 3) Repeat above procedures until all frequencies measured were complete.

7.3 TEST SETUP



7.4 TEST RESULTS

Environment: 25.8°C/60%RH/101.0kPa
 Tested By: Qin Tingting

Voltage: DC 3V
 Date: 2022-10-18

Antenna 1

BLE_1M

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Lowest	2402	692.0	≥ 500	PASS
Middle	2440	704.0		PASS
Highest	2480	696.0		PASS

Antenna 2

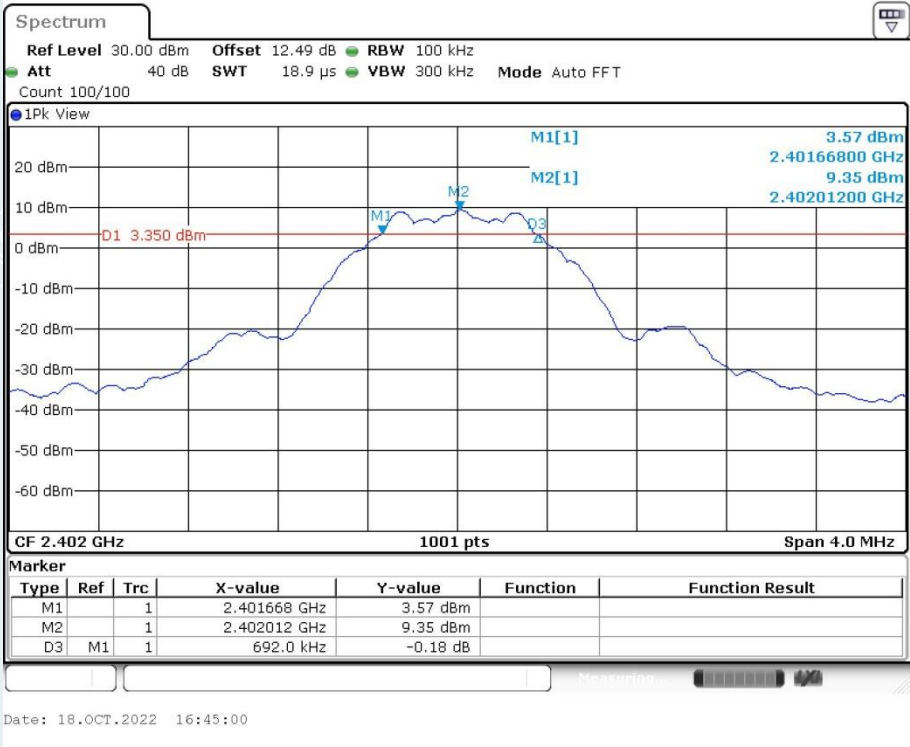
BLE_1M

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Lowest	2402	696.0	≥ 500	PASS
Middle	2440	704.0		PASS
Highest	2480	704.0		PASS

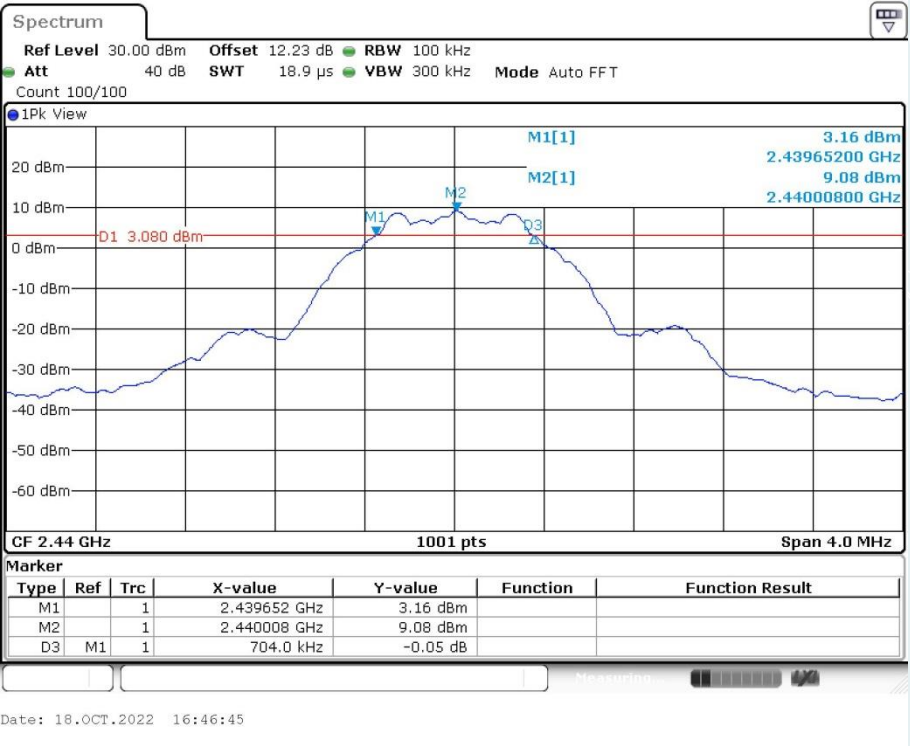
Antenna 1

BLE_1M

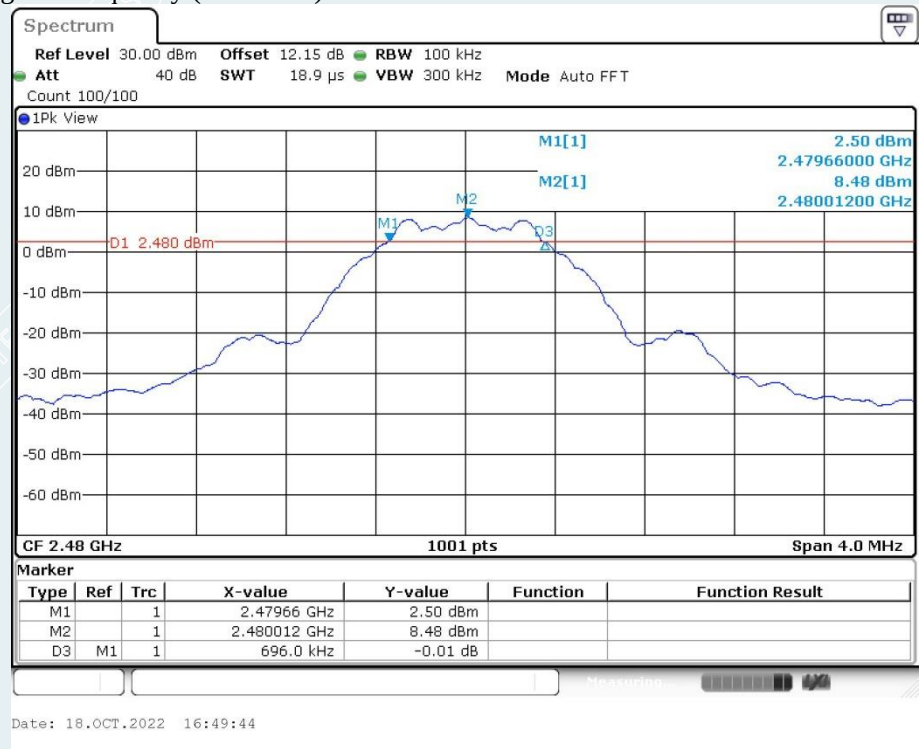
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)



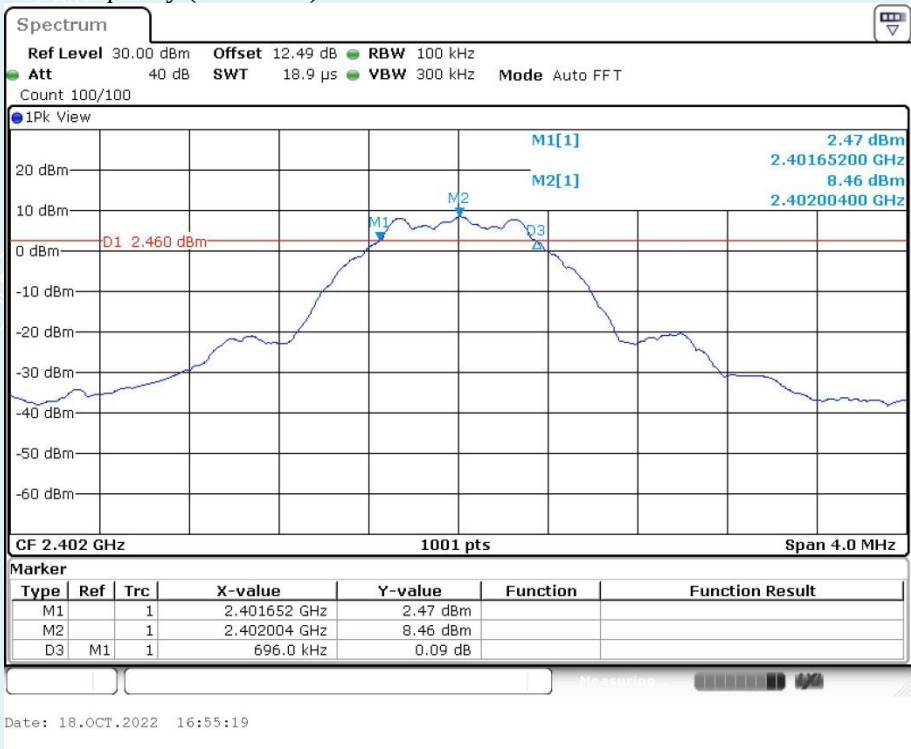
Highest Frequency (2480MHz)



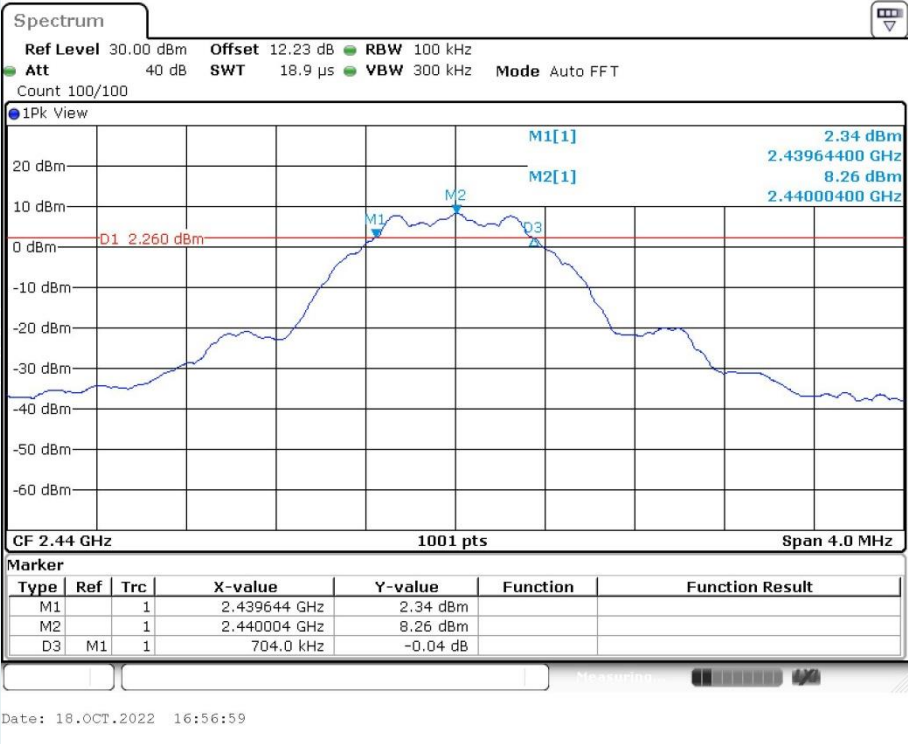
Antenna 2

BLE_1M

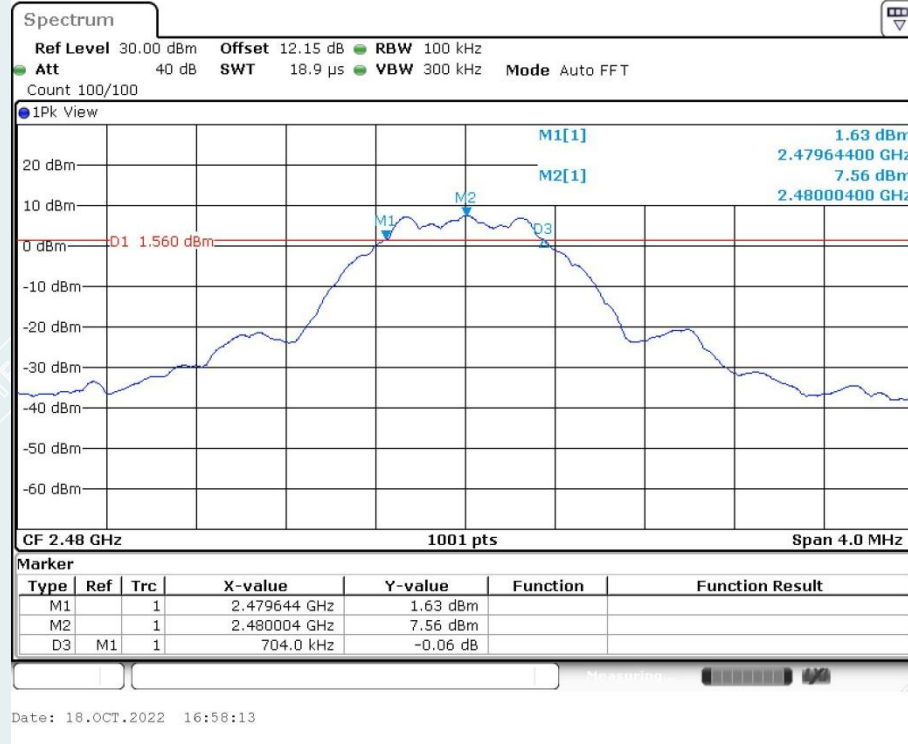
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)



Highest Frequency (2480MHz)



8. MAXIMUM PEAK OUTPUT POWER

8.1 LIMITS

The maximum Peak output power measurement is 1W

8.2 TEST PROCEDURES

- 1) RF output of EUT was connected to the broadband peak RF power meter by RF cable. The path loss was compensated to the results for each measurement.
- 2) Set to the maximum power setting and enable the EUT transmit continuously.
- 3) Measure the conducted output power and record the results in the test report.

8.3 TEST SETUP



8.4 TEST RESULTS

Antenna 1

Environment: 25.8°C/60%RH/101.0kPa
Tested By: Qin Tingting

Voltage: DC 3V
Date: 2022-08-31

BLE_1M

Channel	Frequency (MHz)	Maximum conducted peak output power (dBm)	Maximum conducted average output power (dBm)	Limit	Peak/Average	Result
Lowest	2402	8.93	3.45	1W (30dBm)	Peak	Pass
Middle	2440	8.69	3.21			Pass
Highest	2480	8.28	3.05			Pass

Antenna 2

BLE_1M

Channel	Frequency (MHz)	Maximum conducted peak output power (dBm)	Maximum conducted average output power (dBm)	Limit	Peak/Average	Result
Lowest	2402	8.09	2.93	1W (30dBm)	Peak	Pass
Middle	2440	7.75	2.56			Pass
Highest	2480	7.26	2.10			Pass

9. POWER SPECTRAL DENSITY

9.1 LIMITS

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

9.2 TEST PROCEDURES

- 1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
- 2) Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- 3) Set the analyzer span to 1.5 times the DTS bandwidth. Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. Set the VBW $\geq [3 \times \text{RBW}]$. 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 requirement, then reduce RBW (but no less than 3kHz) and repeat.
- 4) Repeat above procedures until all frequencies measured were complete.

9.3 TEST SETUP



----- The following blanks -----

9.4 TEST RESULTS

Environment: 25.8°C/60%RH/101.0kPa

Tested By: Qin Tingting

Voltage: DC 3V

Date: 2022-10-18

Antenna 1

BLE_1M

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
Lowest	2402	-7.89	8.00	PASS
Middle	2440	-8.11		PASS
Highest	2480	-8.80		PASS

Antenna 2

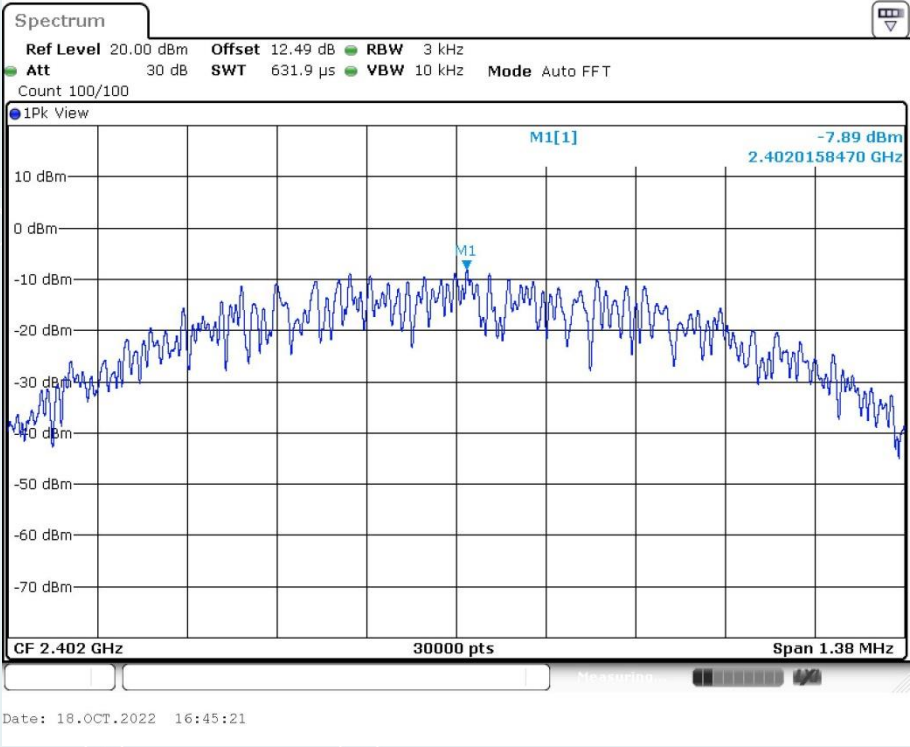
BLE_1M

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
Lowest	2402	-9.05	8.00	PASS
Middle	2440	-9.14		PASS
Highest	2480	-9.83		PASS

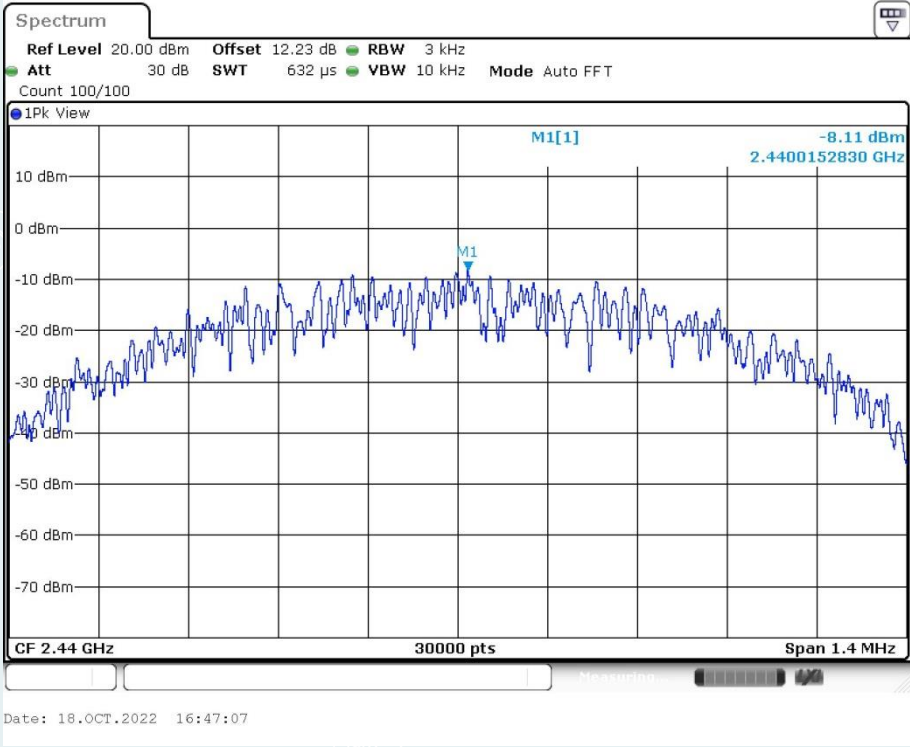
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Antenna 1
BLE_1M

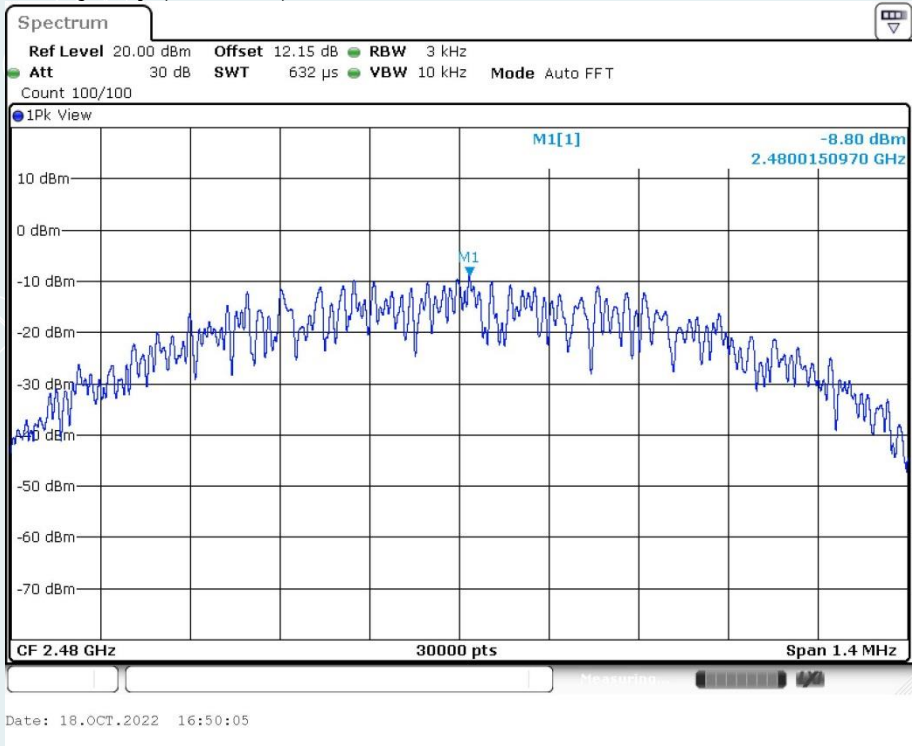
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)

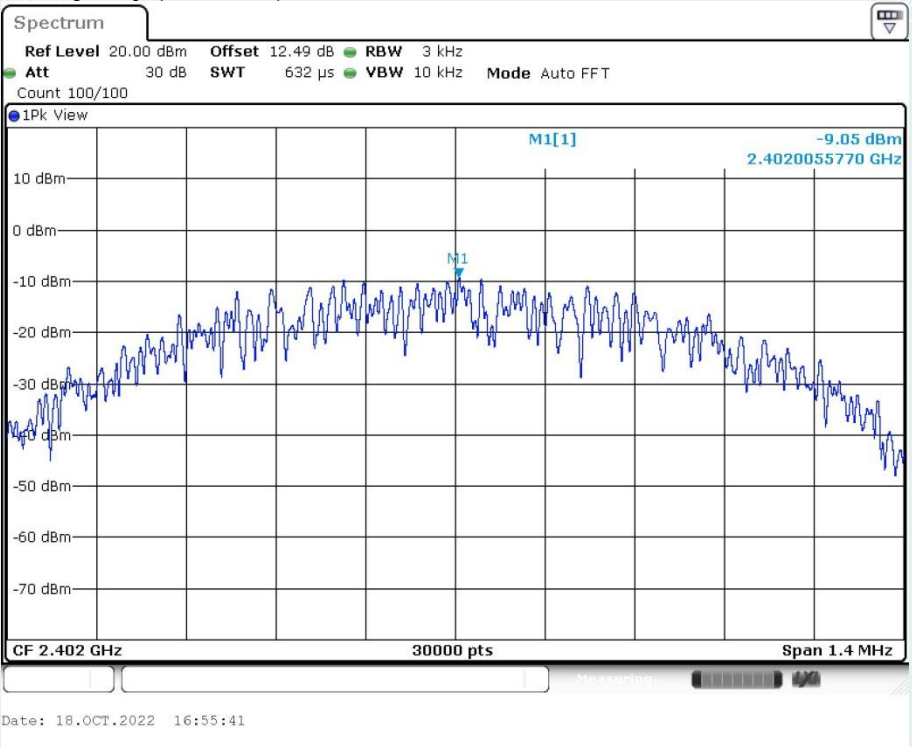


Highest Frequency (2480MHz)

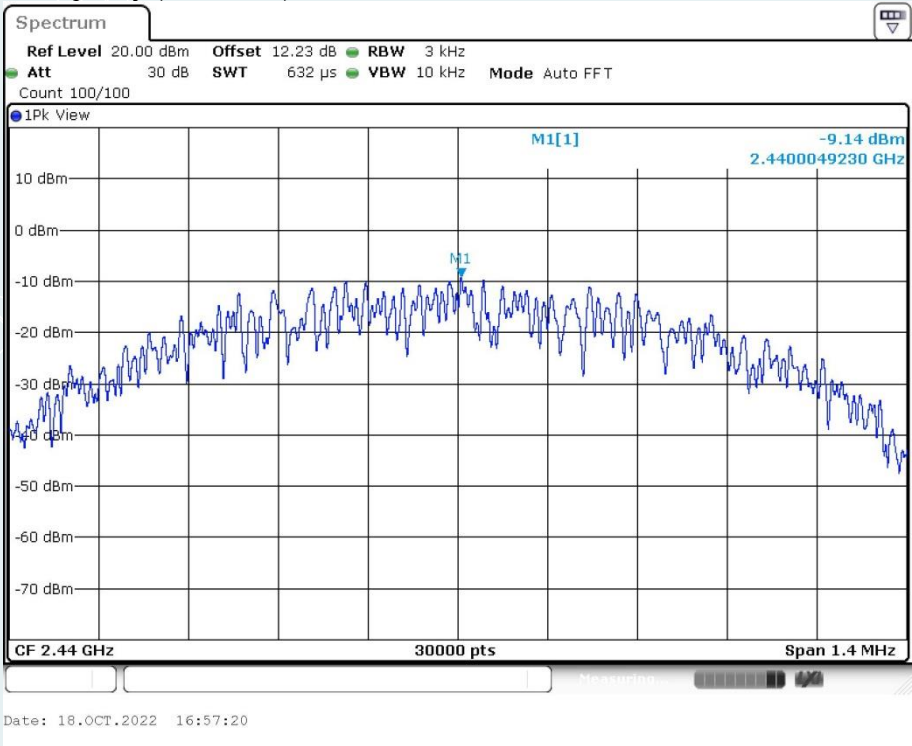


Antenna 2
BLE_1M

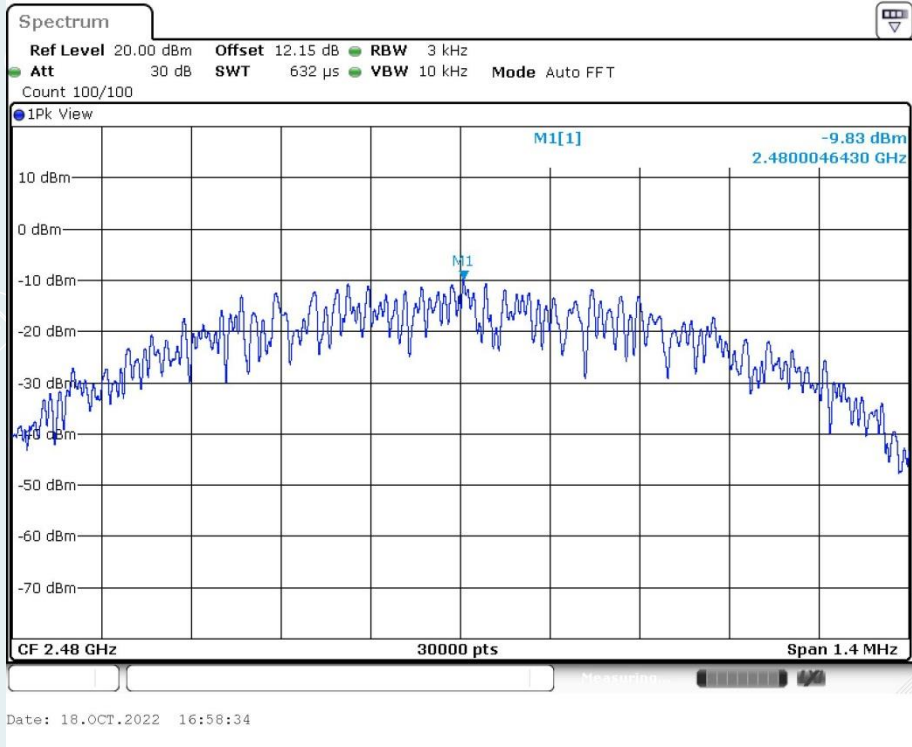
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)



Highest Frequency (2480MHz)



10. CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS

10.1 LIMITS

In any 100kHz 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 20dB below that in the 100kHz 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.

10.2 TEST PROCEDURES

Test procedures follow KDB 558074 D01 15.247 Measurement Guidance v05r02.

Remove the antenna from the EUT and then connect a low attenuation cable from the antenna port to the spectrum.

- 1) Remove the antenna from the EUT and then connect a low attenuation cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer: RBW =100kHz; VBW =300kHz, Frequency range = 30MHz to 26.5GHz; Sweep = auto; Detector Function = Peak. Trace = Max, hold.
- 3) Measure and record the results in the test report.
- 4) The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

10.3 TEST SETUP



----- The following blanks -----

10.4 TEST RESULTS

Antenna 1

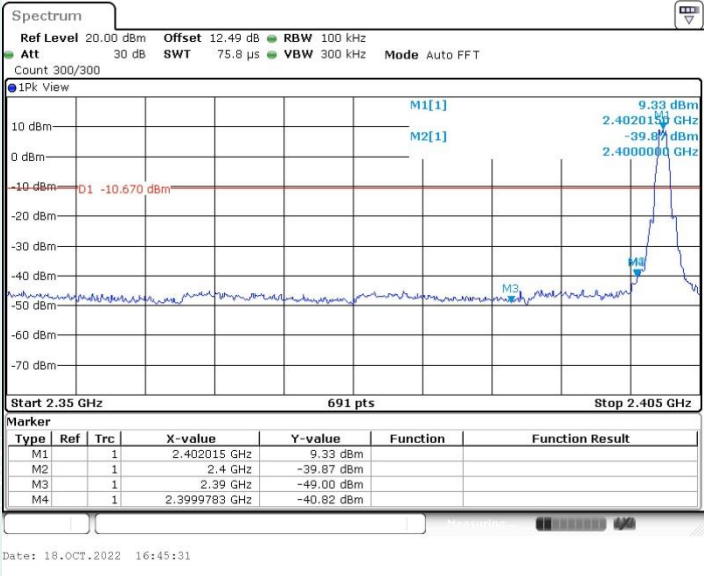
Environment: 25.8°C/60%RH/101.0kPa
Tested By: Qin Tingting

Voltage: DC 3V
Date: 2022-10-18

Band edge measurements

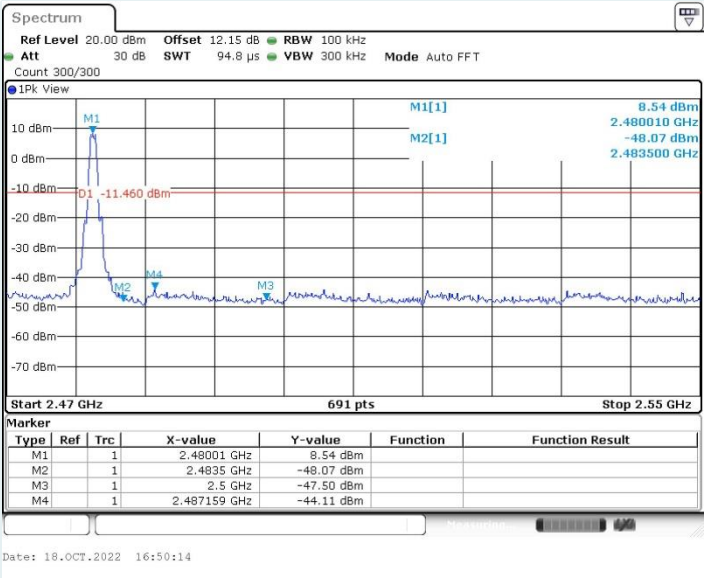
BLE_1M

Lowest Frequency (2402MHz)
2.35GHz-2.405GHz



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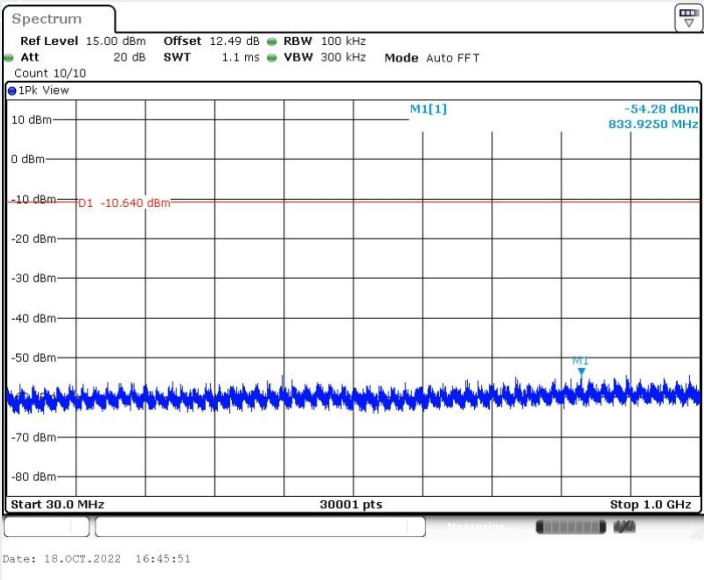
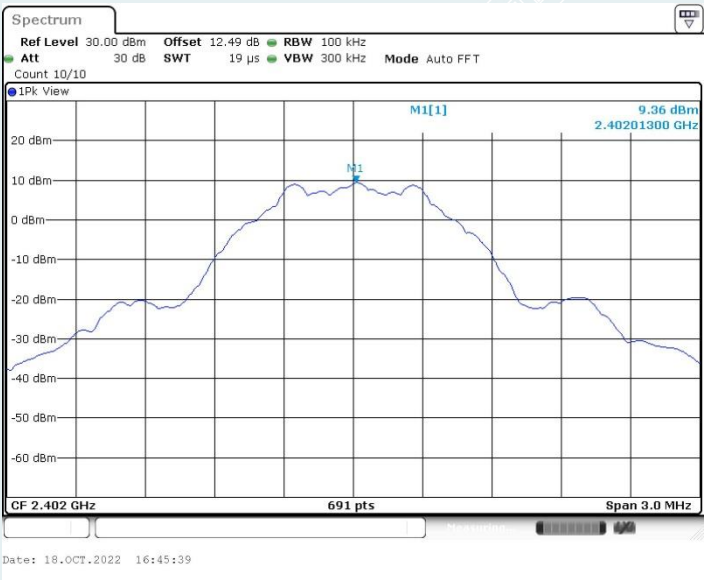
Highest Frequency (2480MHz)
2.47GHz-2.55GHz

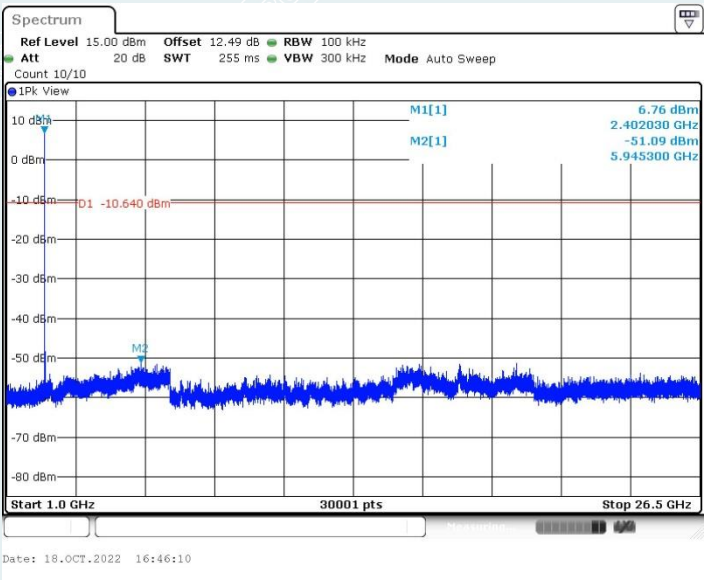


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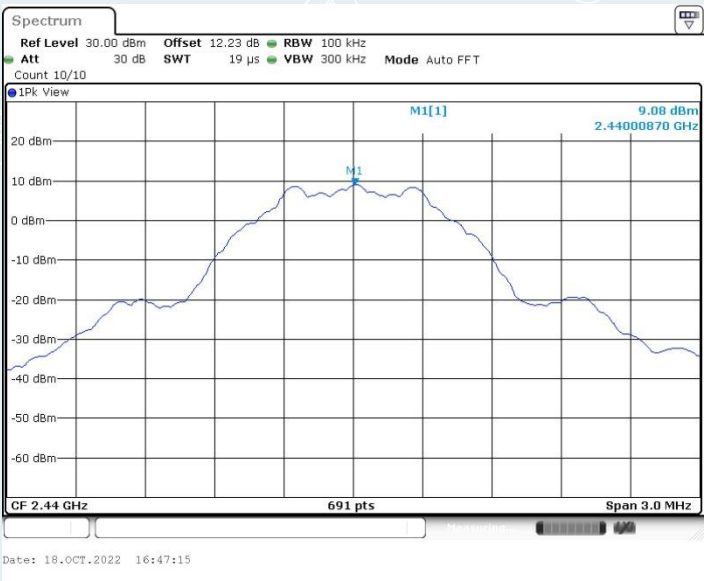
Conducted Spurious Emission
BLE_1M

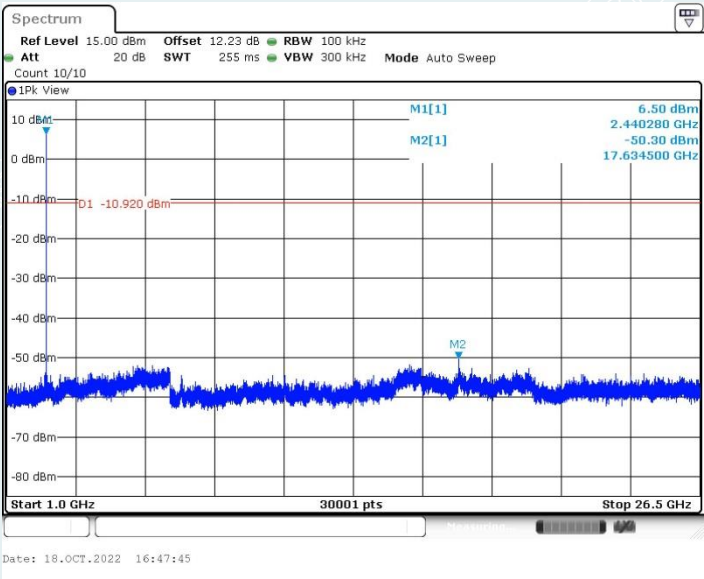
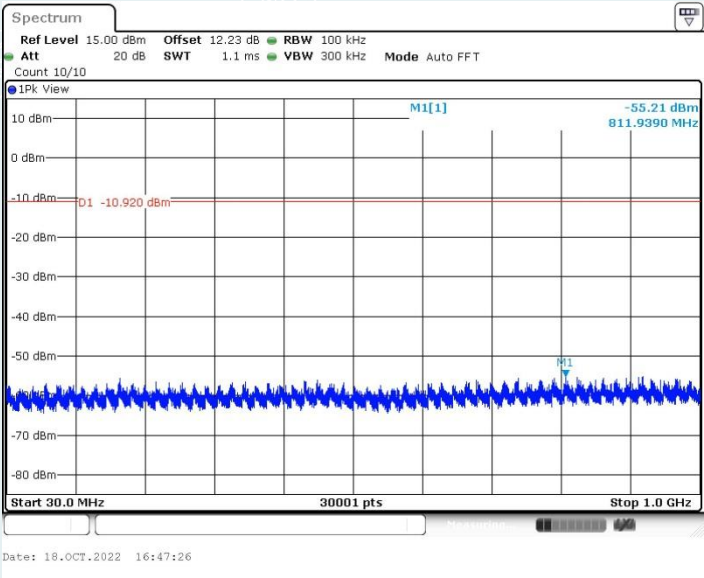
Lowest Frequency (2402MHz)



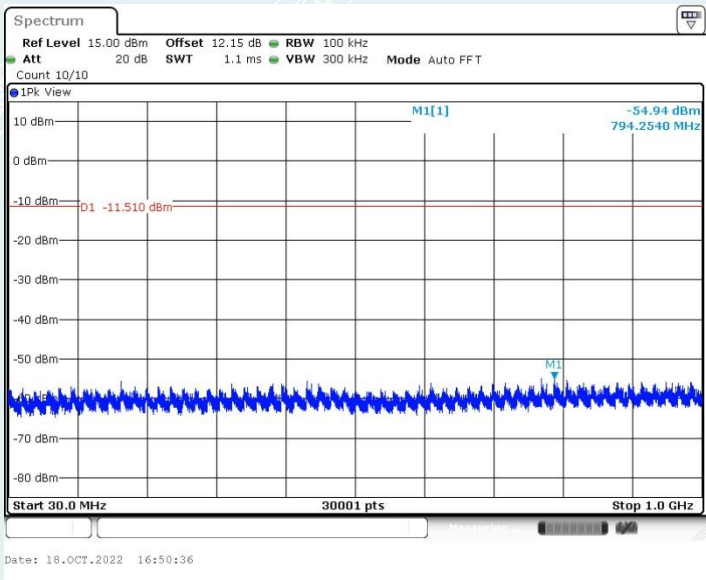


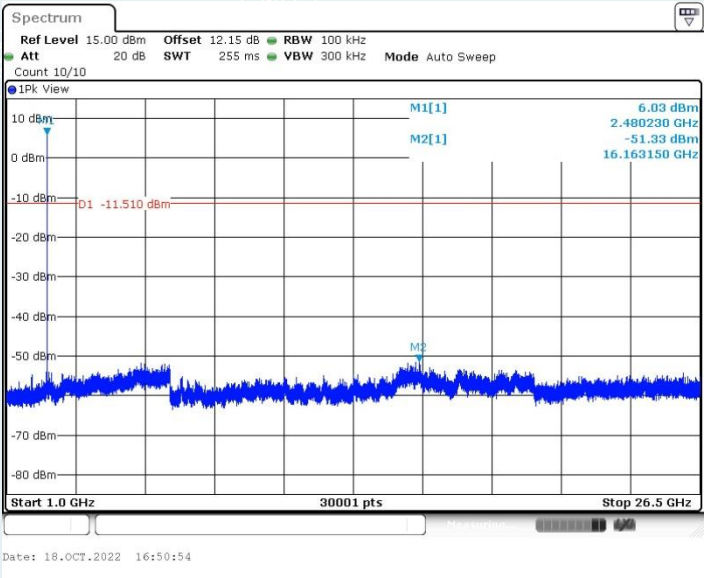
Middle Frequency (2440MHz)





Highest Frequency (2480MHz)





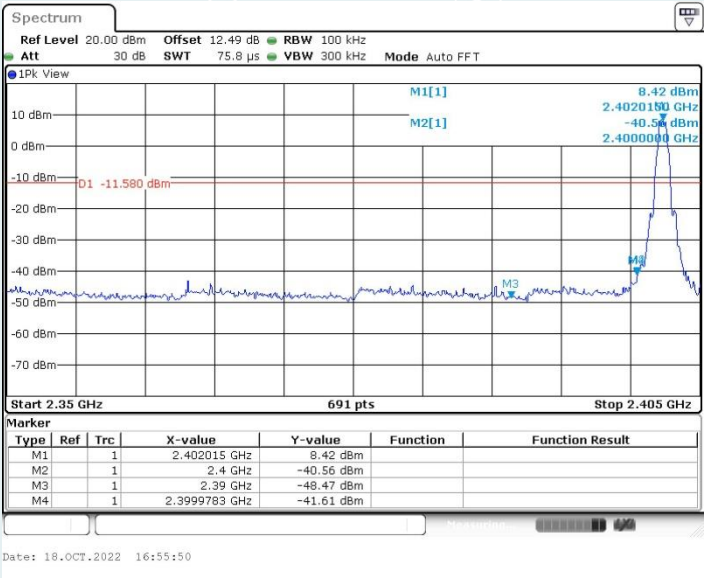
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Antenna 2

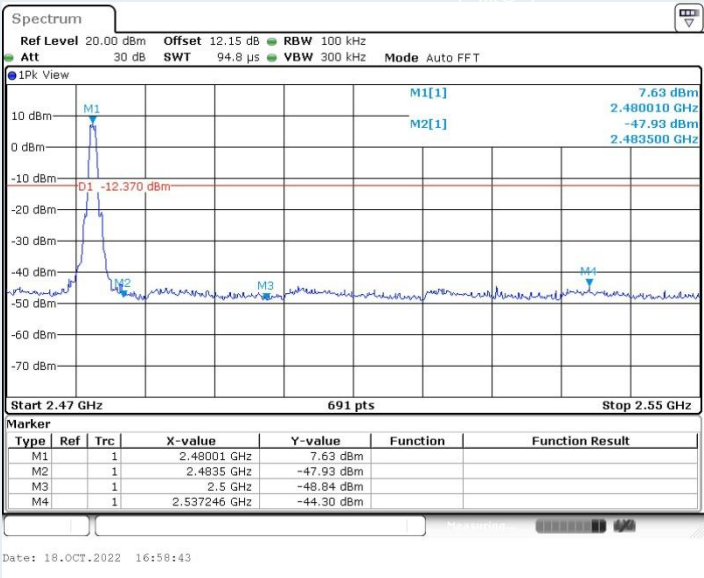
Band edge measurements

BLE_1M

Lowest Frequency (2402MHz)
2.35GHz-2.405GHz

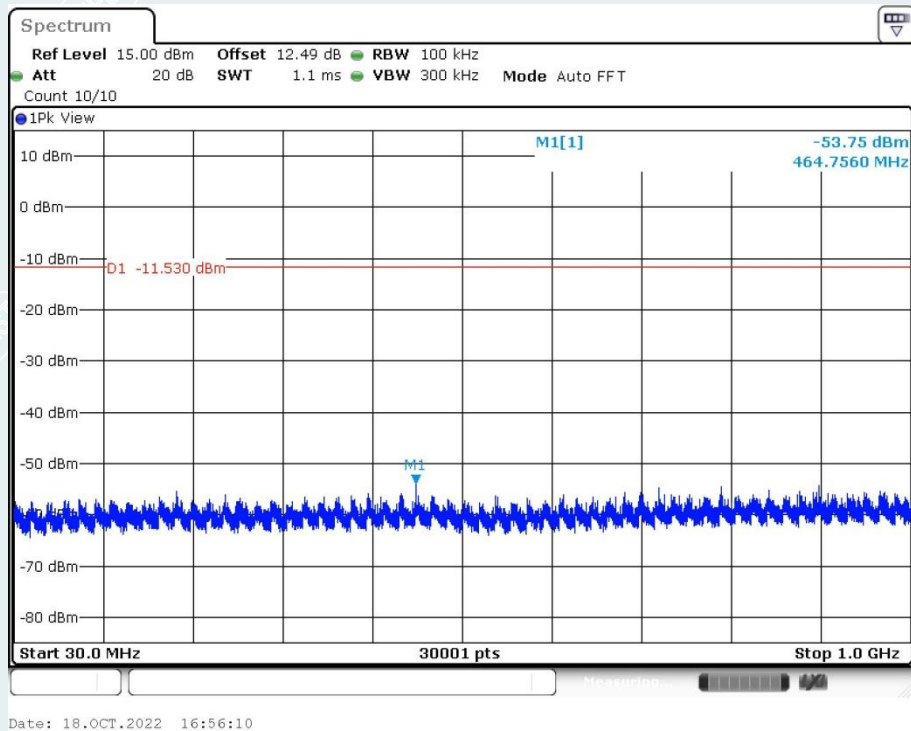
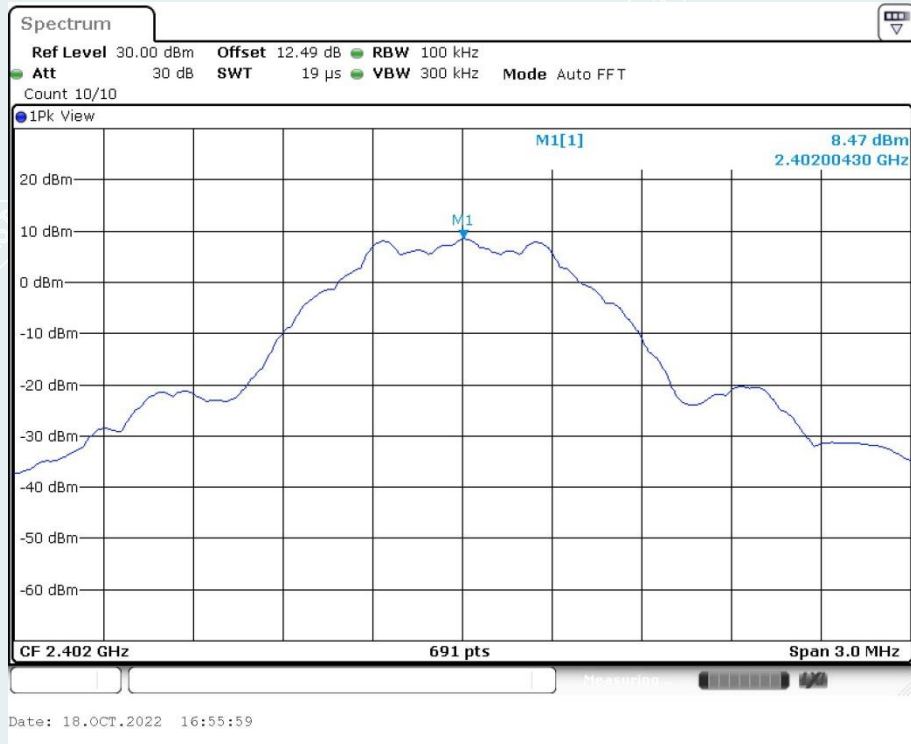


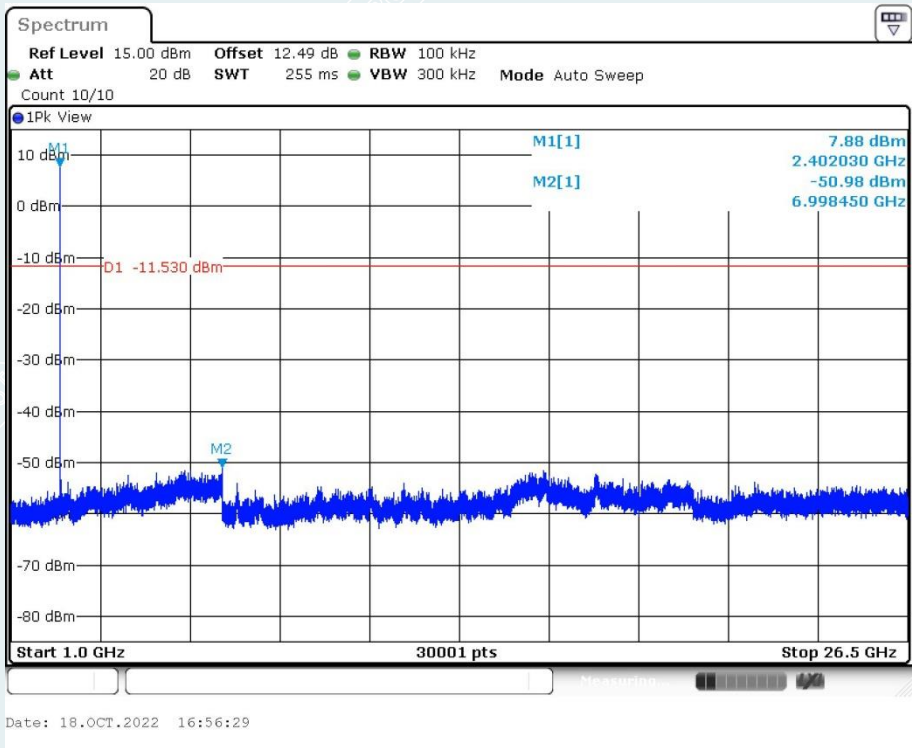
Highest Frequency (2480MHz)
2.47GHz-2.55GHz



Conducted Spurious Emission BLE_1M

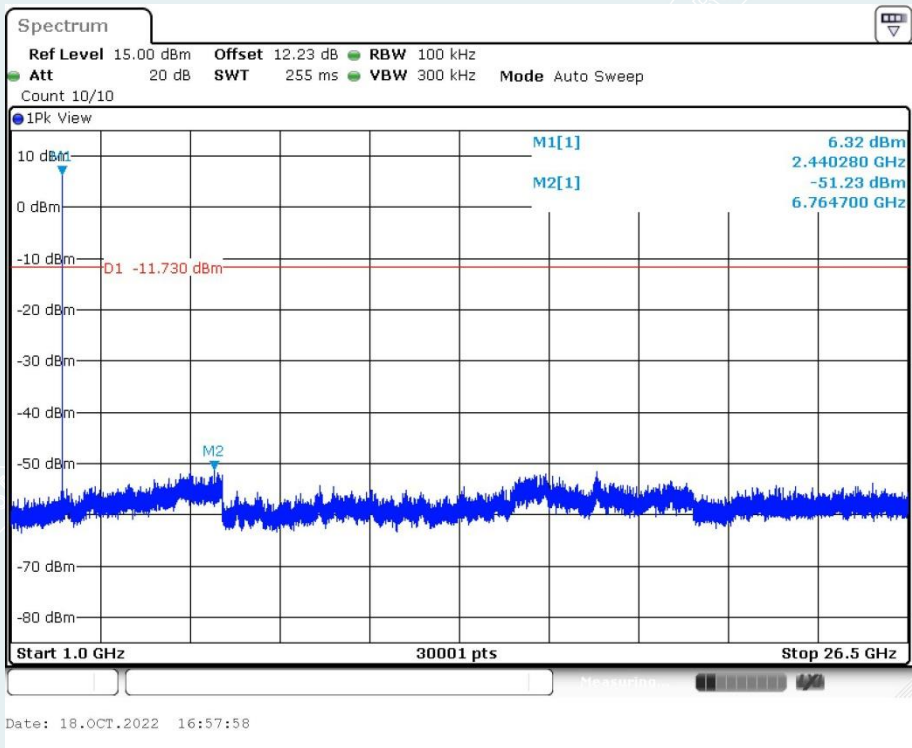
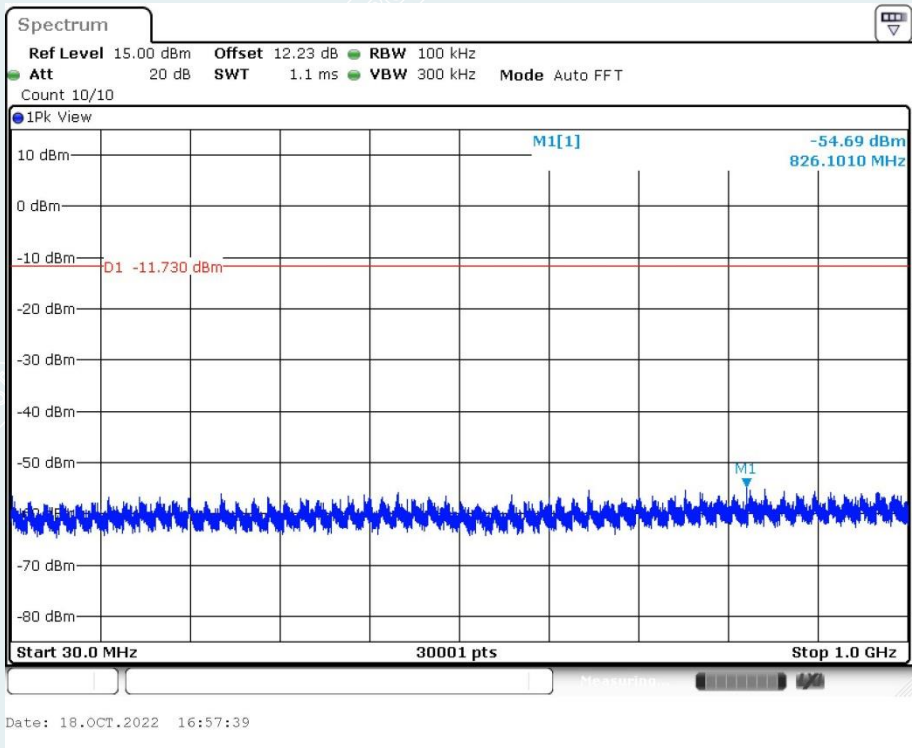
Lowest Frequency (2402MHz)



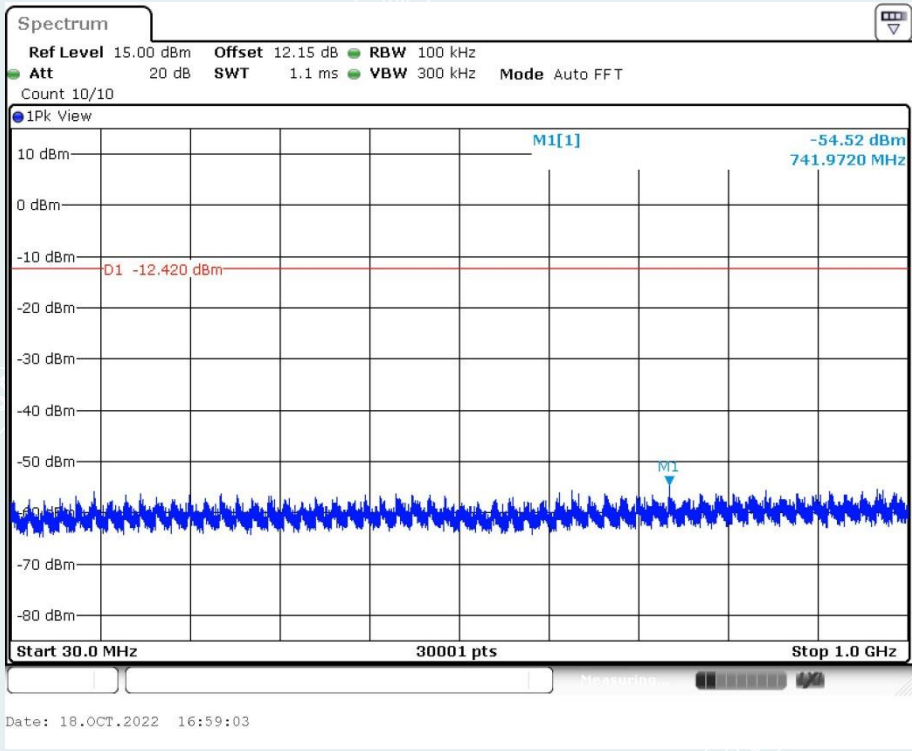
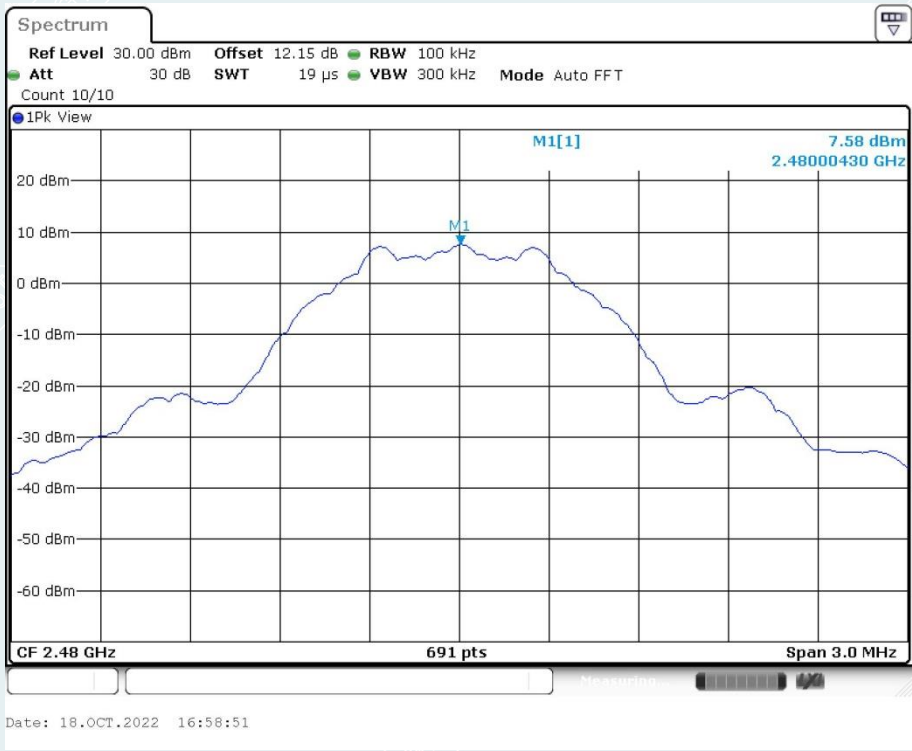


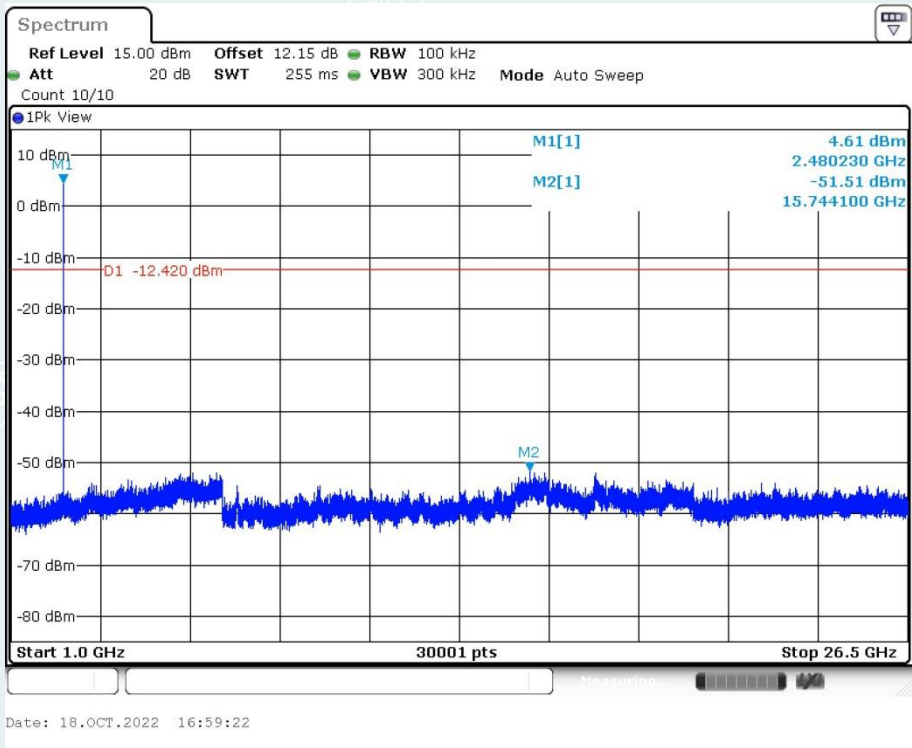
Middle Frequency (2440MHz)





Highest Frequency (2480MHz)





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11. RESTRICTED BANDS OF OPERATION

11.1 LIMITS

Section 15.247(d) 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)).

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	2655 - 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	
13.36 - 13.41			

Frequency (MHz)	Quasi-peak(μ V/m)	Measurement distance(m)	Quasi-peak(dB μ V/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

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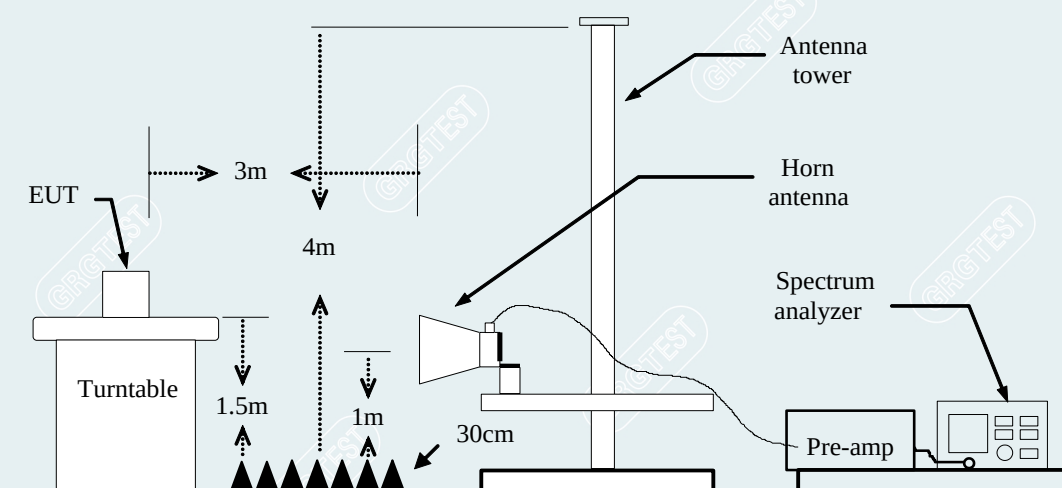
11.2 TEST PROCEDURES

Test procedures follow KDB 558074 D01 15.247 Meas Guidance v05r02.

- 1) The EUT is placed on a turntable, which is 1.5m above the ground plane.
- 2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
- 4) Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - a) PEAK: RBW=1MHz / VBW=1MHz / Sweep=AUTO.
 - b) AVERAGE: RBW=1MHz / VBW=1/T / Sweep=AUTO.

If the EUT is configured to transmit with duty cycle $\geq 98\%$, set $VBW \leq RBW/100$ (i.e., 10kHz) but not less than 10 Hz. If the EUT duty cycle is $< 98\%$, set $VBW \geq 1/T$, Where T is defined in section 2.9.
- 5) Repeat the procedures until all the PEAK and AVERAGE versus polarization are measured.

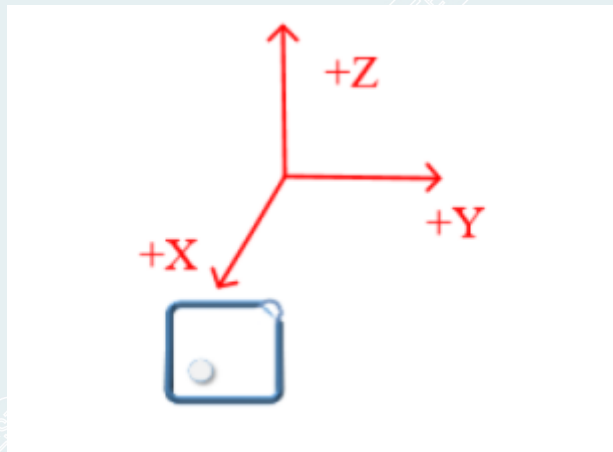
11.3 TEST SETUP



----- The following blanks -----

11.4 TEST RESULTS

The test are under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown the X position only.



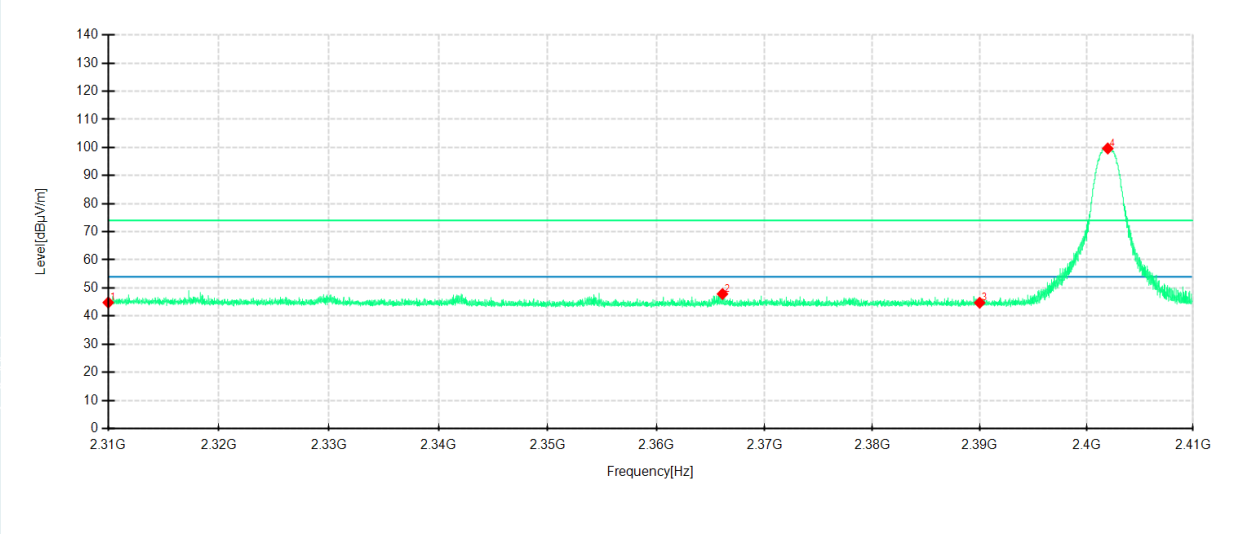
----- The following blanks -----

Antenna 1

Equipment:	Blueiot RTLS Tag	Test Date	2022-10-26
Model No.:	BT1000-d	Test Engineer:	Zhang Qiang
Test Voltage:	DC 3.0V	Environment:	25.0°C/51%RH/101.0kPa

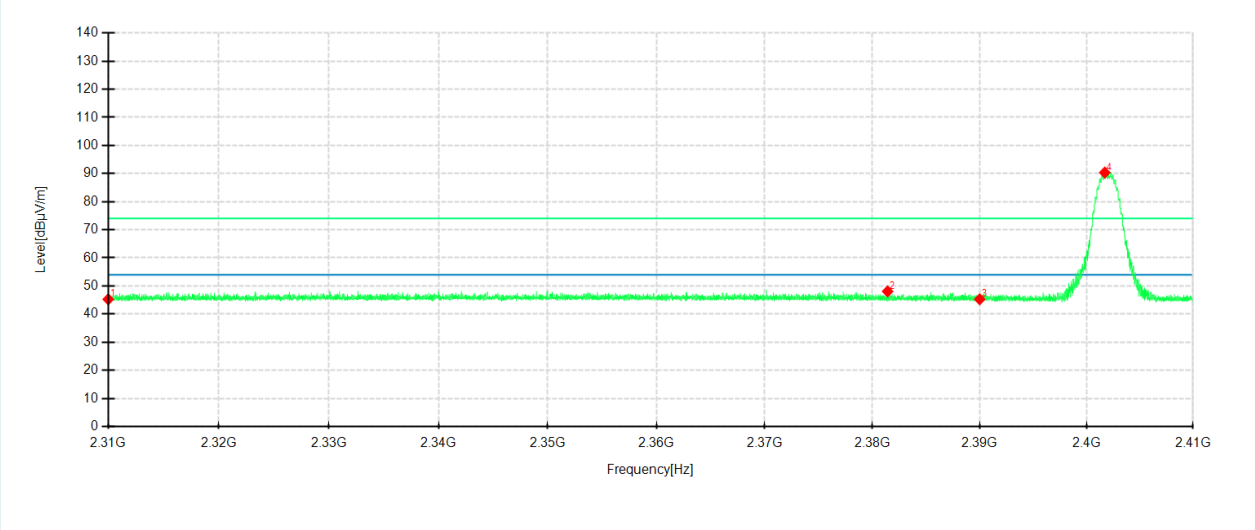
BLE 1M
Lowest Frequency
Frequency 2402MHz
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



No.	Frequency MHz	Reading dB μ V/m	Level dB μ V/m	Factor dB	Limit dB μ V/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310	45.11	44.82	-0.29	74.00	29.18	200	53	Horizontal	/
2	2366.1056	48.90	47.86	-1.04	74.00	26.14	100	174	Horizontal	/
3	2390	45.58	44.73	-0.85	74.00	29.27	200	187	Horizontal	/
4	2401.9892	100.39	99.64	-0.75	74.00	-25.64	100	174	Horizontal	No limit
1	2310	44.98	45.27	0.29	74.00	28.73	100	189	Vertical	/
2	2381.4171	47.72	48.07	0.35	74.00	25.93	100	106	Vertical	/
3	2390	44.98	45.27	0.29	74.00	28.73	100	74	Vertical	/
4	2401.7092	90.14	90.35	0.21	74.00	-16.35	100	189	Vertical	No limit

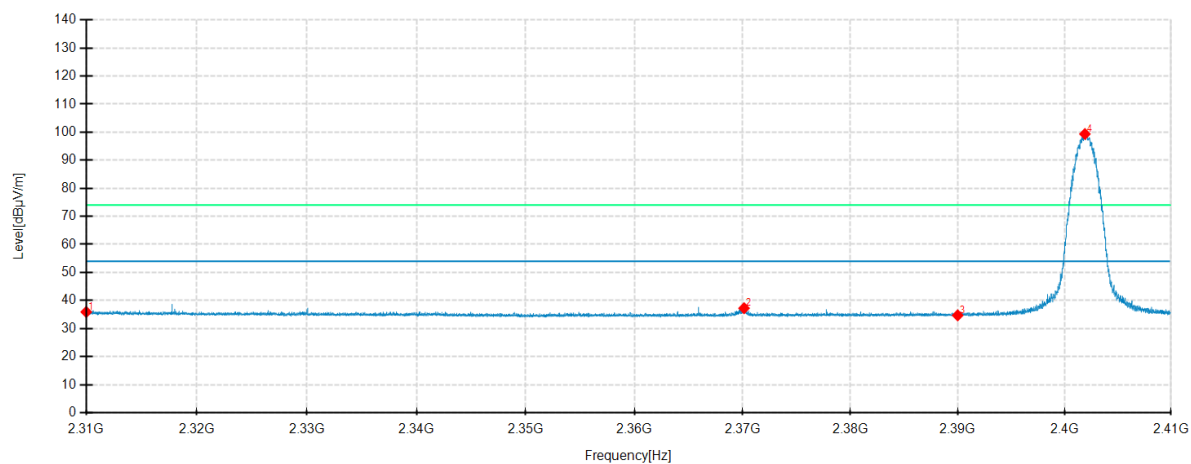
----- The following blanks -----

Lowest Frequency

Frequency 2402MHz

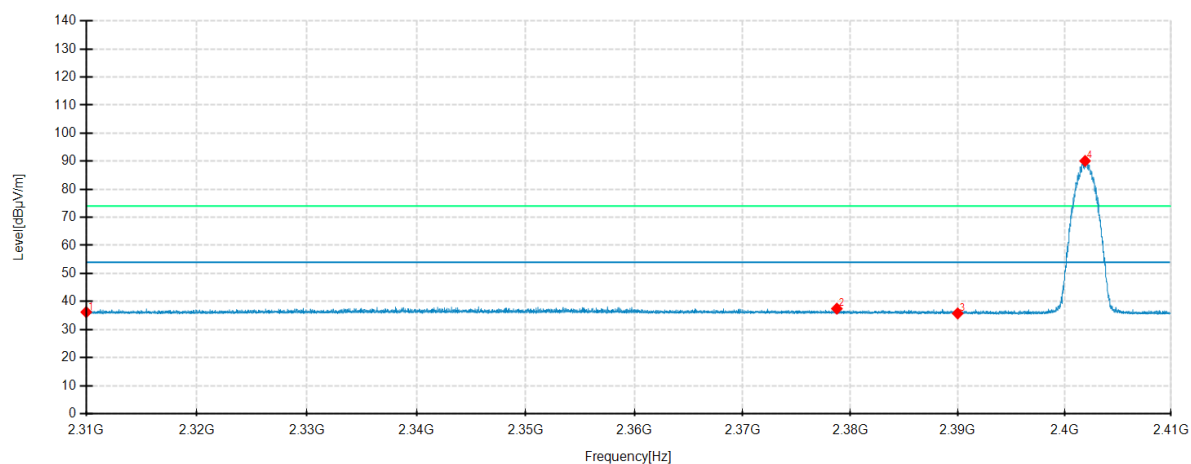
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

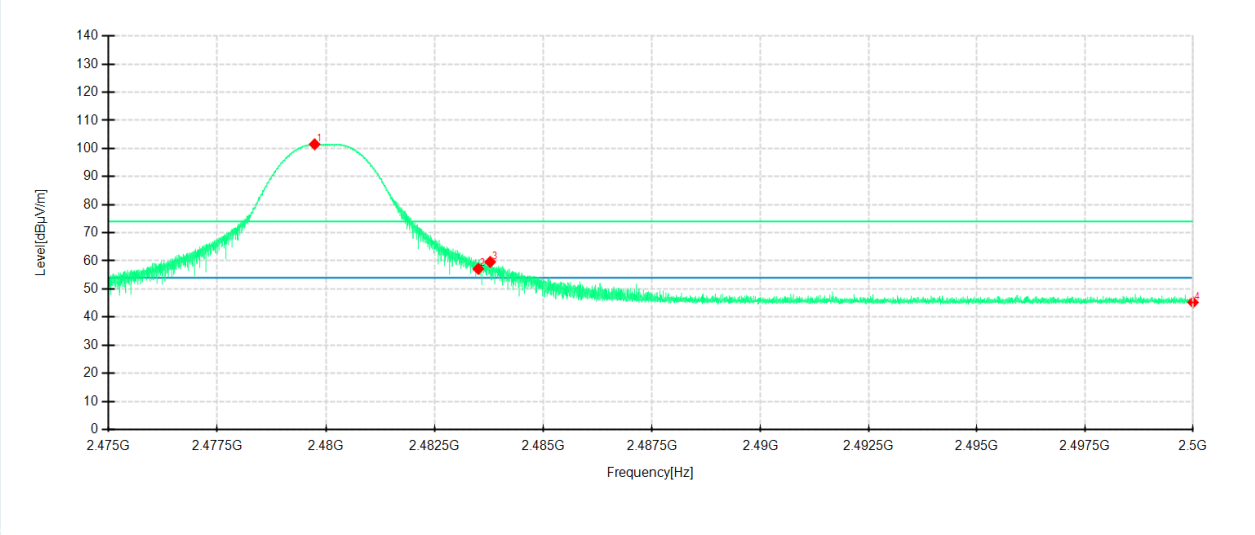
Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310	36.19	35.90	-0.29	54.00	18.10	100	172	Horizontal	/
2	2370.136	38.24	37.24	-1.00	54.00	16.76	100	172	Horizontal	/
3	2390	35.54	34.69	-0.85	54.00	19.31	100	172	Horizontal	/
4	2401.9092	100.09	99.34	-0.75	54.00	-45.34	100	172	Horizontal	No limit
1	2310	35.91	36.20	0.29	54.00	17.80	100	187	Vertical	/
2	2378.7469	37.08	37.44	0.36	54.00	16.56	200	194	Vertical	/
3	2390	35.45	35.74	0.29	54.00	18.26	100	126	Vertical	/
4	2401.9292	89.91	90.11	0.20	54.00	-36.11	100	187	Vertical	No limit

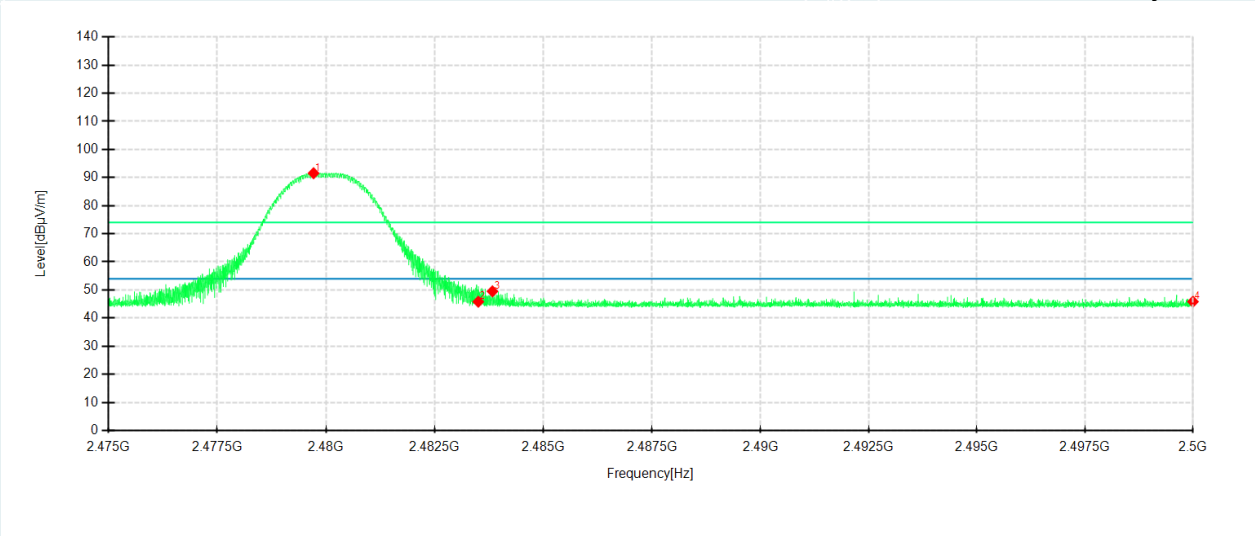
Highest Frequency
Frequency 2480MHz
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



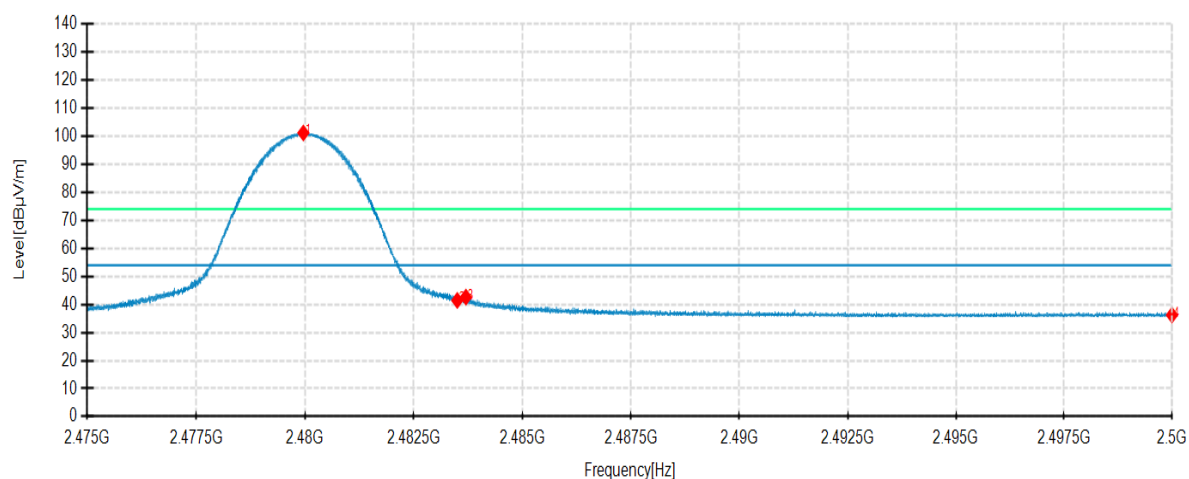
No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2479.738	101.30	101.49	0.19	74.00	-27.49	100	173	Horizontal	No limit
2	2483.5	56.91	57.17	0.26	74.00	16.83	200	44	Horizontal	/
3	2483.7734	59.35	59.61	0.26	74.00	14.39	100	173	Horizontal	/
4	2500	44.64	45.22	0.58	74.00	28.78	200	84	Horizontal	/
1	2479.713	91.94	91.55	-0.39	74.00	-17.55	100	188	Vertical	No limit
2	2483.5	46.21	45.83	-0.38	74.00	28.17	100	188	Vertical	/
3	2483.8259	49.89	49.52	-0.37	74.00	24.48	100	188	Vertical	/
4	2500	46.16	45.84	-0.32	74.00	28.16	200	244	Vertical	/

Highest Frequency

Frequency 2480MHz

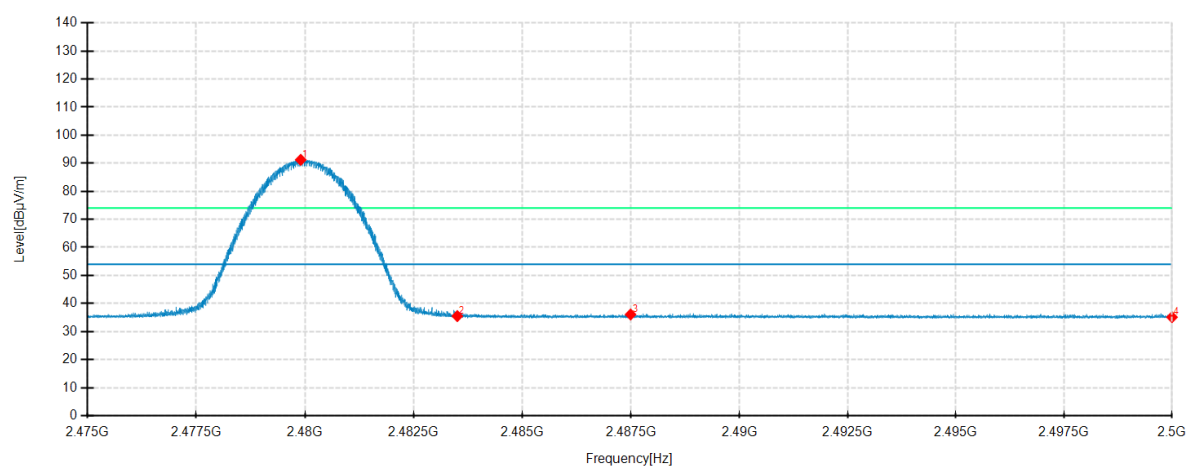
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2479.9605	101.01	101.20	0.19	54.00	-47.20	100	172	Horizontal	No limit
2	2483.5	41.18	41.44	0.26	54.00	12.56	100	172	Horizontal	/
3	2483.6984	42.37	42.63	0.26	54.00	11.37	100	172	Horizontal	/
4	2500	35.66	36.24	0.58	54.00	17.76	100	172	Horizontal	/
1	2479.9005	91.60	91.21	-0.39	54.00	-37.21	100	188	Vertical	No limit
2	2483.5	35.88	35.50	-0.38	54.00	18.50	100	43	Vertical	/
3	2487.4912	36.43	36.07	-0.36	54.00	17.93	100	178	Vertical	/
4	2500	35.45	35.13	-0.32	54.00	18.87	100	53	Vertical	/

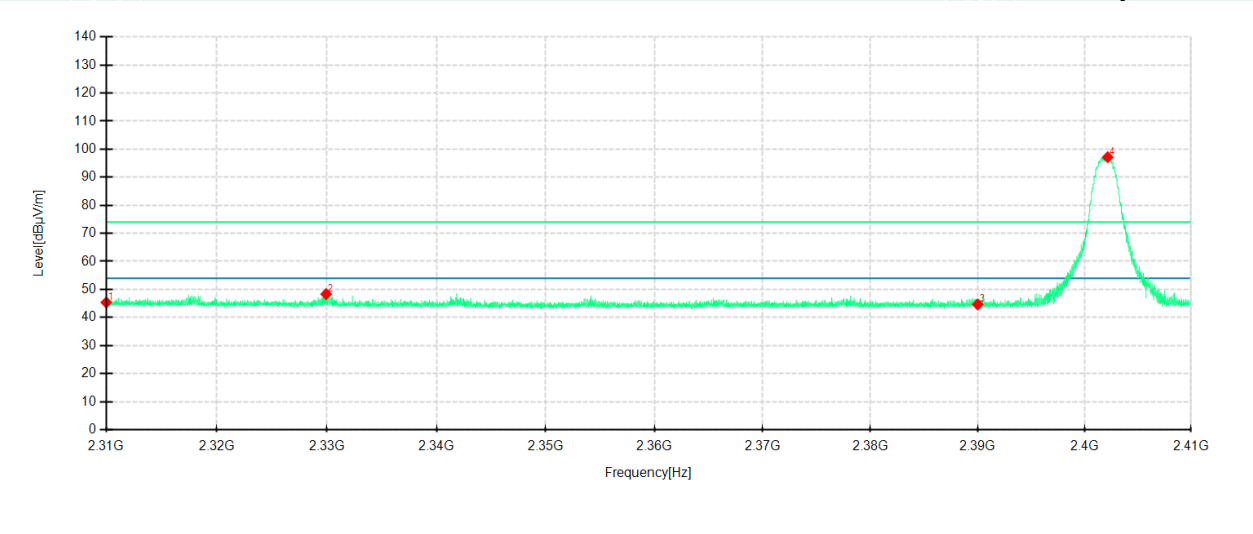
Remark: Max field strength in 3m distance. No any other emission which falls in restricted bands can be found.

Antenna 2

Equipment:	Blueiot RTLS Tag	Test Date	2022-10-26
Model No.:	BT1000-d	Test Engineer:	Zhang Qiang
Test Voltage:	DC 3.0V	Environment:	25.0℃/51%RH/101.0kPa

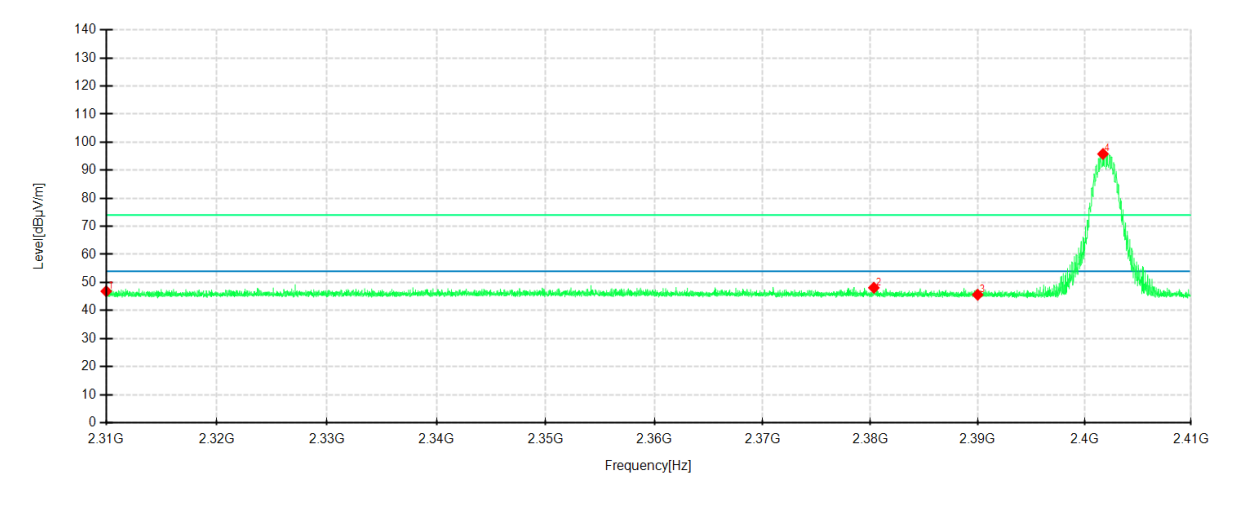
BLE 1M
Lowest Frequency
Frequency 2402MHz
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



No.	Frequency MHz	Reading dB μ V/m	Level dB μ V/m	Factor dB	Limit dB μ V/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310	45.65	45.36	-0.29	74.00	28.64	200	177	Horizontal	/
2	2329.932	49.05	48.33	-0.72	74.00	25.67	100	173	Horizontal	/
3	2390	45.49	44.64	-0.85	74.00	29.36	100	287	Horizontal	/
4	2402.1692	97.90	97.15	-0.75	74.00	-23.15	100	296	Horizontal	No limit
1	2310	46.57	46.86	0.29	74.00	27.14	100	189	Vertical	/
2	2380.327	47.73	48.09	0.36	74.00	25.91	100	96	Vertical	/
3	2390	45.31	45.60	0.29	74.00	28.40	200	275	Vertical	/
4	2401.7292	95.59	95.80	0.21	74.00	-21.80	100	189	Vertical	No limit

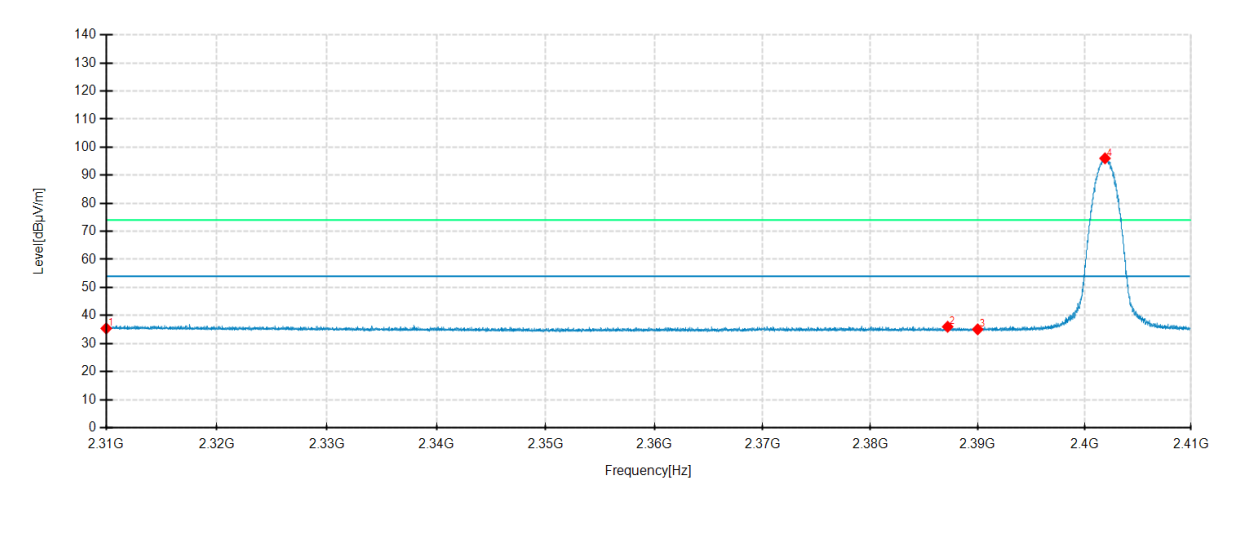
----- The following blanks -----

Lowest Frequency

Frequency 2402MHz

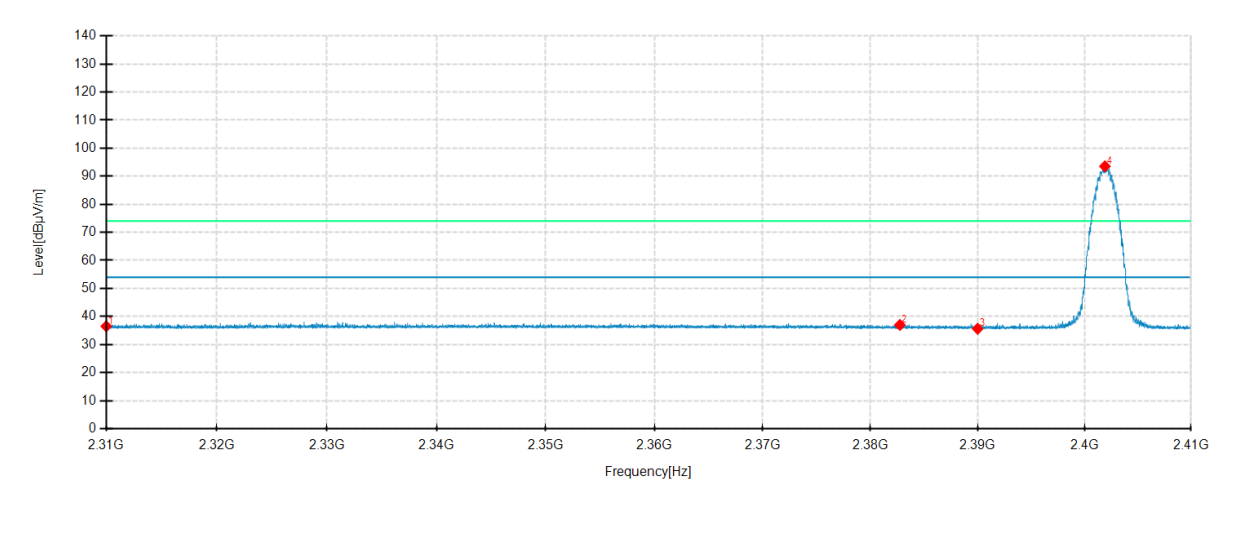
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

Polarity: Vertical



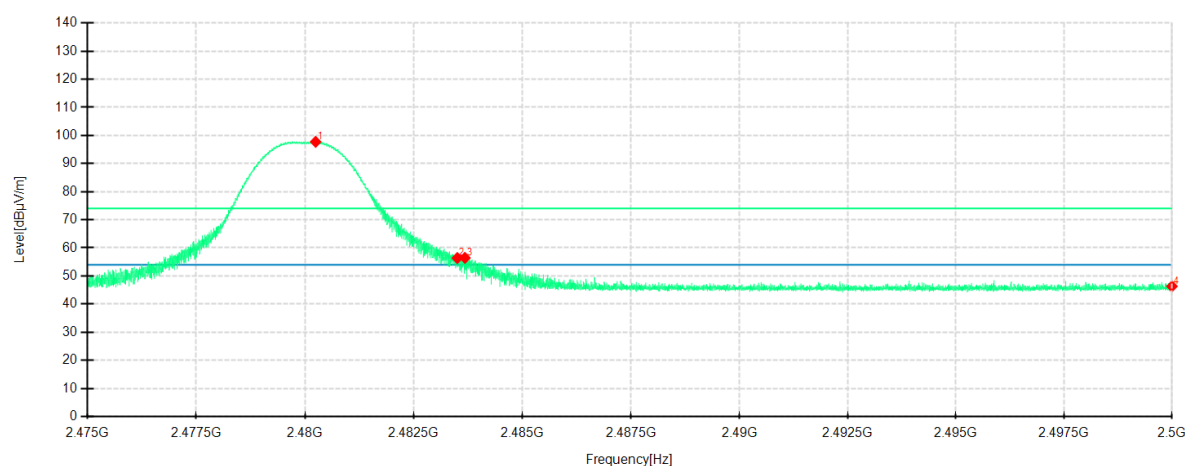
No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310	35.67	35.38	-0.29	54.00	18.62	200	186	Horizontal	/
2	2387.1977	36.84	35.97	-0.87	54.00	18.03	200	124	Horizontal	/
3	2390	35.89	35.04	-0.85	54.00	18.96	200	52	Horizontal	/
4	2401.9192	96.76	96.01	-0.75	54.00	-42.01	100	172	Horizontal	No limit
1	2310	36.21	36.50	0.29	54.00	17.50	100	115	Vertical	/
2	2382.7473	36.65	36.98	0.33	54.00	17.02	100	2	Vertical	/
3	2390	35.34	35.63	0.29	54.00	18.37	100	188	Vertical	/
4	2401.9092	93.33	93.53	0.20	54.00	-39.53	200	285	Vertical	No limit

Highest Frequency

Frequency 2480MHz

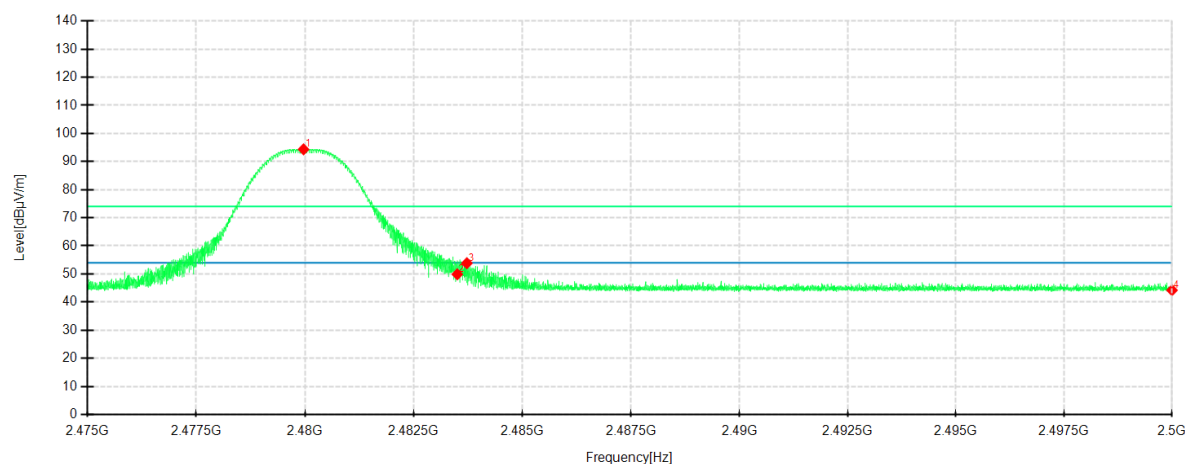
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



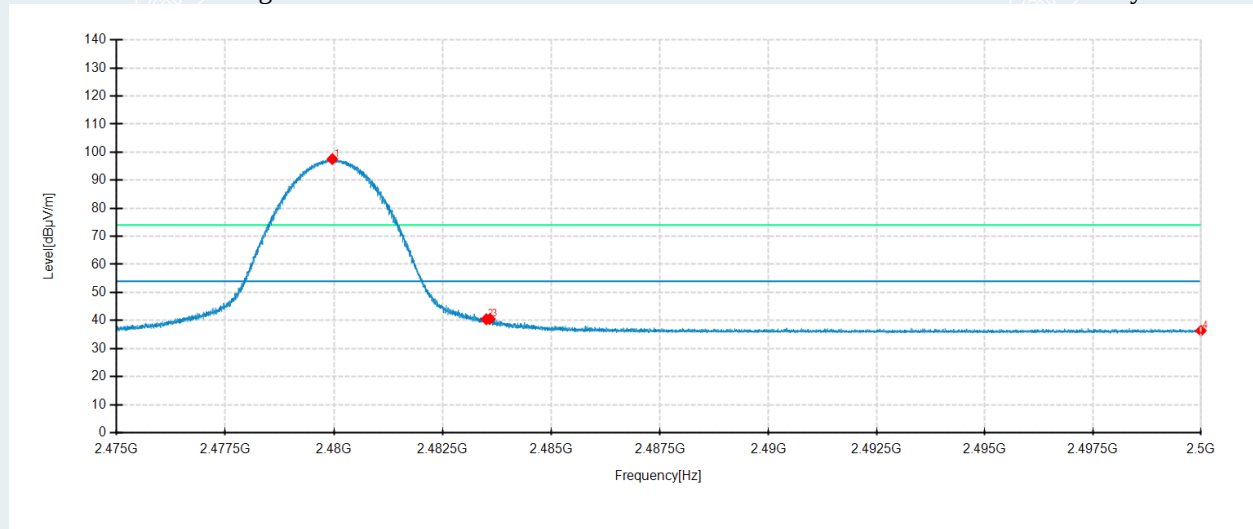
No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2480.243	97.54	97.73	0.19	74.00	-23.73	100	319	Horizontal	No limit
2	2483.5	56.12	56.38	0.26	74.00	17.62	100	319	Horizontal	/
3	2483.6759	56.18	56.44	0.26	74.00	17.56	100	287	Horizontal	/
4	2500	45.74	46.32	0.58	74.00	27.68	200	2	Horizontal	/
1	2479.9655	94.73	94.34	-0.39	74.00	-20.34	200	225	Vertical	No limit
2	2483.5	50.27	49.89	-0.38	74.00	24.11	200	172	Vertical	/
3	2483.7209	54.22	53.84	-0.38	74.00	20.16	200	225	Vertical	/
4	2500	44.54	44.22	-0.32	74.00	29.78	200	276	Vertical	/

Highest Frequency

Frequency 2480MHz

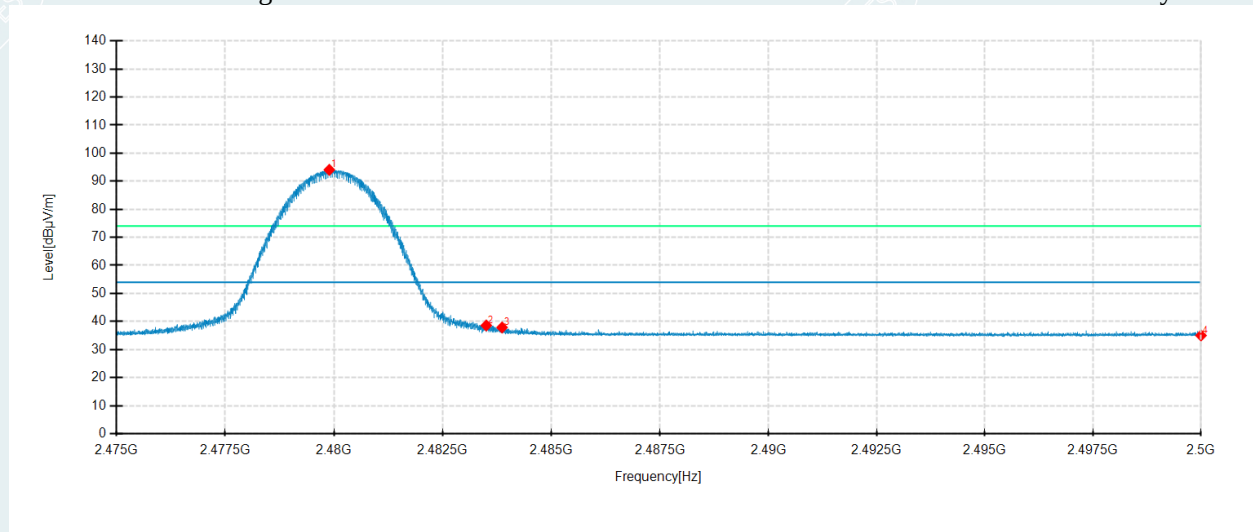
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2479.9605	97.35	97.54	0.19	54.00	-43.54	100	317	Horizontal	No limit
2	2483.5	40.18	40.44	0.26	54.00	13.56	100	317	Horizontal	/
3	2483.5834	40.28	40.54	0.26	54.00	13.46	100	317	Horizontal	/
4	2500	35.76	36.34	0.58	54.00	17.66	200	188	Horizontal	/
1	2479.8905	94.45	94.06	-0.39	54.00	-40.06	200	224	Vertical	No limit
2	2483.5	38.96	38.58	-0.38	54.00	15.42	200	234	Vertical	/
3	2483.8634	38.24	37.87	-0.37	54.00	16.13	200	234	Vertical	/
4	2500	35.33	35.01	-0.32	54.00	18.99	100	82	Vertical	/

Remark: Max field strength in 3m distance. No any other emission which falls in restricted bands can be found.

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E202208181964-4-Test Photo.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E202208181964-5-EUT Photo.

----- End of Report -----