

Test Report

Verified code: 312427

Report No.: E20230224734401-2

Customer: OnePlus Technology (Shenzhen) Co., Ltd.

Address: 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, China

Sample Name: OnePlus Stylo

Sample Model: OPN2202

Receive Sample Date: Feb.27,2023

Test Date: Mar.06,2023 ~ Mar.17,2023

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

Test Result: Pass

Prepared by: *Huang Lifang*

Reviewed by: *Jimmy Tan*

Approved by: *Xiao Liang*

GRG METROLOGY & TEST GROUP CO., LTD.

Issued Date: 2023-04-04

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20230224734401-2	Original Issue	2023-03-20

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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 ¹⁾
§15.207(a)	Conducted Emission	Not Applicable ²⁾
§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⁾ The antenna is FPC antenna. The max gain of antenna is 1.2dBi, which accordance 15.203 is considered sufficient to comply with the provisions of this section.

²⁾ Test is not applicable to this Equipment. This EUT is no AC mains power ports.

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2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name: OnePlus Technology (Shenzhen) Co., Ltd.
Address: 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue
North, Futian District, Shenzhen, China

2.2 MANUFACTURER

Name: OnePlus Technology (Shenzhen) Co., Ltd.
Address: 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue
North, Futian District, Shenzhen, China

2.3 FACTORY

Name: Shenzhen Qianfenyi Intelligent Technology Co., Ltd.
Address: Room 2101, Building 3, Nanshan i Park Chongwen, No. 3370 Liuxian Avenue,
Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen City,
Guangdong Province P.R.China

2.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: OnePlus Stylo
Model No.: OPN2202
Adding Model: /
Trade Name: ONEPLUS
FCC ID: 2ABZ2-OPN2202
Power supply: DC 3.82V power supplied by battery
DC 5V power supplied by ONEPLUS Pad OPD2203
Model name:BLB001;
Battery Specification: Nominal voltage:3.82V;
Rated capacity:82mAh/0.31Wh
Frequency Band: 2402-2480MHz
Transmit Power: GFSK for 1Mbps:0.77dBm
Modulation type: Bluetooth LE with 1M:GFSK
Channel space: 2MHz
Antenna Specification: FPC antenna with 1.2dBi gain (Max.)
Temperature Range: 0℃~+35℃
Hardware Version: V5.4
Software Version: V4D45.02.01.19
Sample No: E20230224734401-0003,E20230224734401-0004
Note: /

2.5 CHANNELIST

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

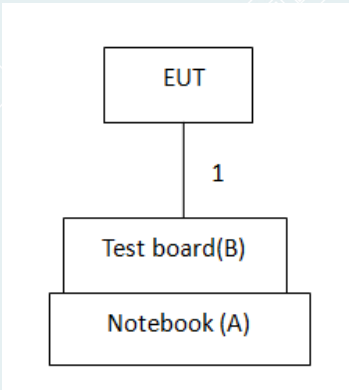
2.7 LOCAL SUPPORTIVE

No.	Name of equipment	Manufacturer	Model	Serial number	Note
A	Notebook	LENOVO	TianYi 310-14ISK	MP18DLC6	/
B	Test board	/	/	/	/

No.	Cable Type	Qty.	Shielded Type	Ferrite Core(Qty.)	Length
1	DC cable	1	No	0	0.2m

2.8 CONFIGURATION OF SYSTEM UNDER TEST

For Conducted Emission, 6dB bandwidth, Maximum Peak Output Power, Power Spectral Density, Conducted band edges and Spurious Emission



For Radiated Spurious Emission, Restricted bands of operation



Test software:

Software version	Test level
DTM	0

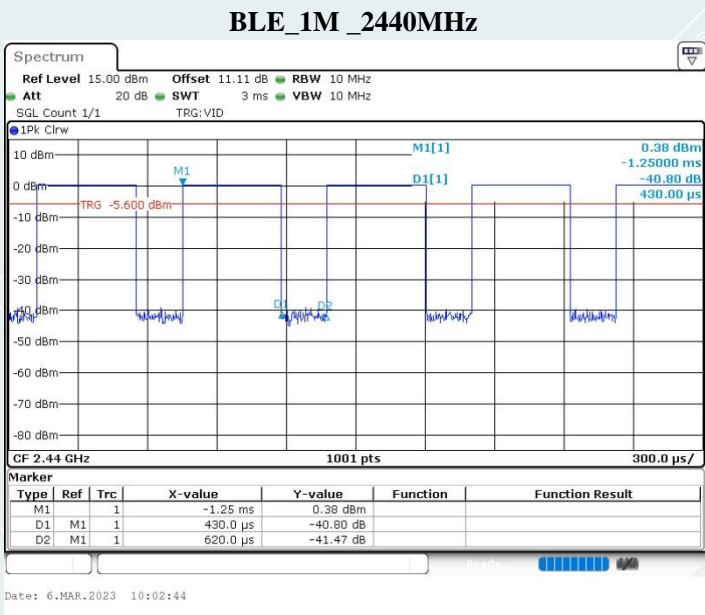
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2.9 DUTY CYCLE

Environment: 21.4℃/39%RH/101.0kPa
Tested By: Huang Tianmei

Voltage: DC 3.82V
Date: 2023-03-06

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	DC [%]	T [s]
BLE_1M	Ant1	2440	0.43	0.62	69.35	0.00043



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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 GRG METROLOGY & TEST GROUP CO., LTD.

Add : No.1301 Guangang Road Xinlan Community, Guanlan Street, Longhua District
Shenzhen, 518110, People's Republic of China

P.C. : 518110

Tel : 0755-61180008

Fax : 0755-61180008

3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to GB/T 27025(ISO/IEC 17025:2017)

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 ¹⁾
		30MHz~200MHz	4.5dB ¹⁾
		200MHz~1000MHz	4.4dB ¹⁾
		1GHz~18GHz	5.6dB ¹⁾
		18GHz~26.5GHz	3.7dB ¹⁾
	Vertical	9kHz~30MHz	5.1dB ¹⁾
		30MHz~200MHz	4.4dB ¹⁾
		200MHz~1000MHz	4.5dB ¹⁾
		1GHz~18GHz	5.6dB ¹⁾
		18GHz~26.5GHz	3.7dB ¹⁾

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

Note:

¹⁾ This uncertainty represents an expanded uncertainty expressed at approximately the 95%.
This uncertainty represents an expanded uncertainty factor of $k=2$.

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	2024-02-06
Bi-log Antenna	Schwarzbeck	CBL6143A	26039	2024-10-23
Loop Antenna	Schwarzbeck	FMZB 1513-60	1513-60-56	2023-08-06
Spectrum Analyzer	R&S	ESR26	101758	2023-10-27
Horn Antenna	Schwarzbeck	BBHA9120D	02143	2023-10-15
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170-497	2023-10-14
Amplifier	Tonscend	TAP01018048	AP20E8060075	2023-05-05
Amplifier	Tonscend	TAP184050	AP20E806071	2023-05-05
Amplifier	SHIRONG ELECTRONIC	DLNA-1G18G-G40	20200928005	2023-05-08
Test S/W	Tonscend	JS32-RE		
6dB Bandwidth&Conducted band edges and Spurious Emission&Power Spectral Density				
Spectrum Analyzer	R&S	FSV30	104381	2023-11-17
Automatic power measuring unit	TONSCEND	JS0806-2	21B8060365	2023-11-17
BT/WIFI System	Tonscend	JS1120-3		
Maximum Peak Output Power				
Pulse power sensor	Anritsu	MA2411B	1126150	2024-02-12
Power meter	Anritsu	ML2495A	1204003	2024-02-12

Note: The calibration cycle of the above instruments is 12 months except for the Bi-log Antenna which is 24 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 fixed frequency transmitting conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- 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 fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- 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 fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- 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 fixed frequency transmitting conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

Pre measurement:

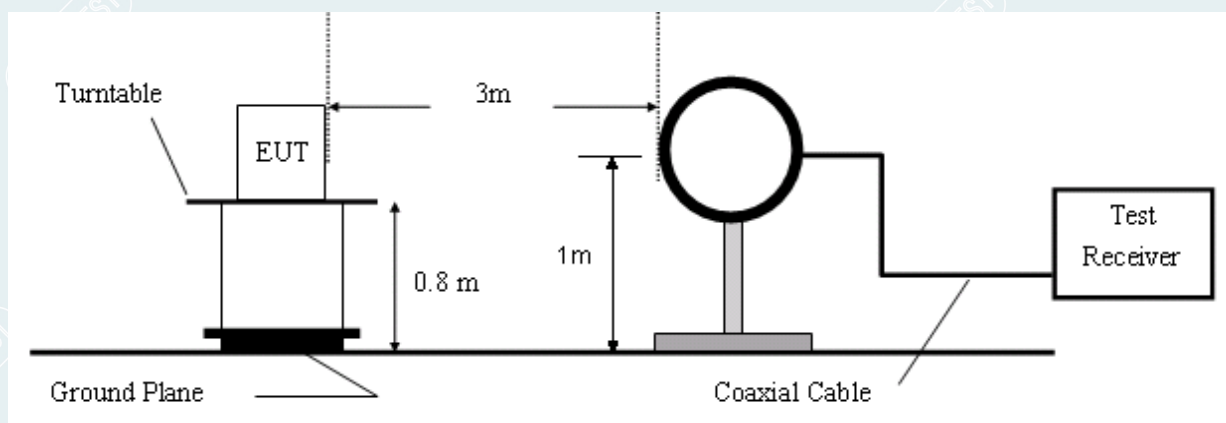
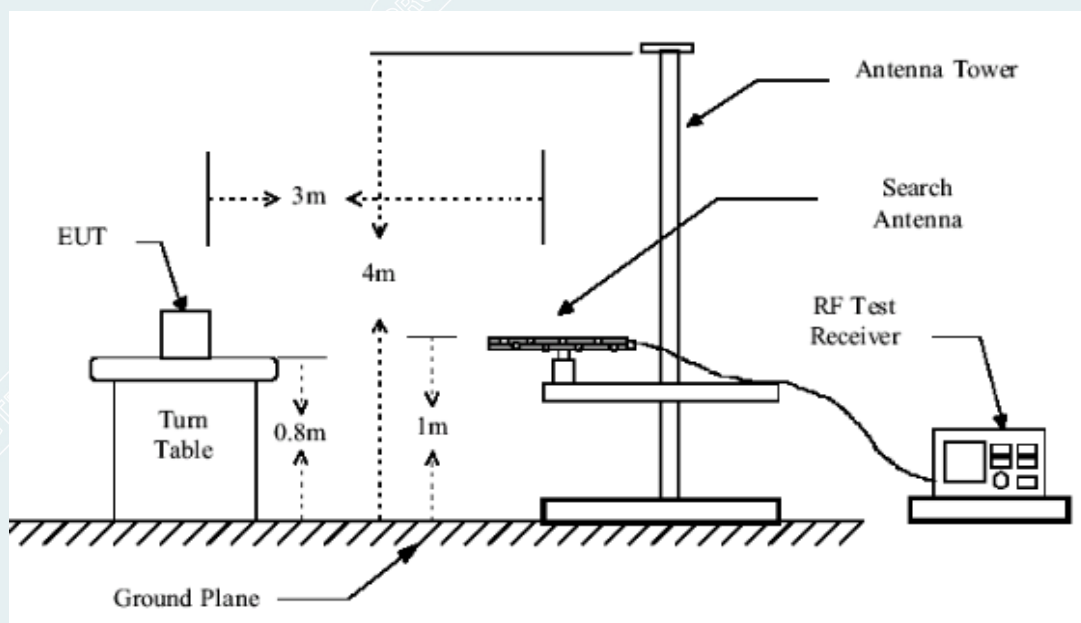
- The turntable rotates from 0 ° to 360 °.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 4 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

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.

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**

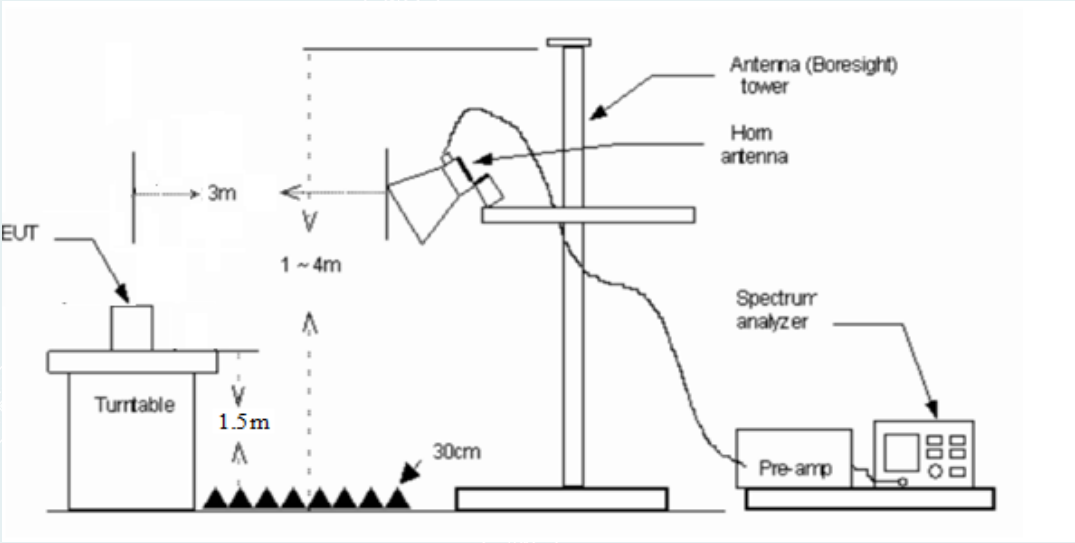


Figure 3. 1GHz to 18GHz radiated emissions test configuration

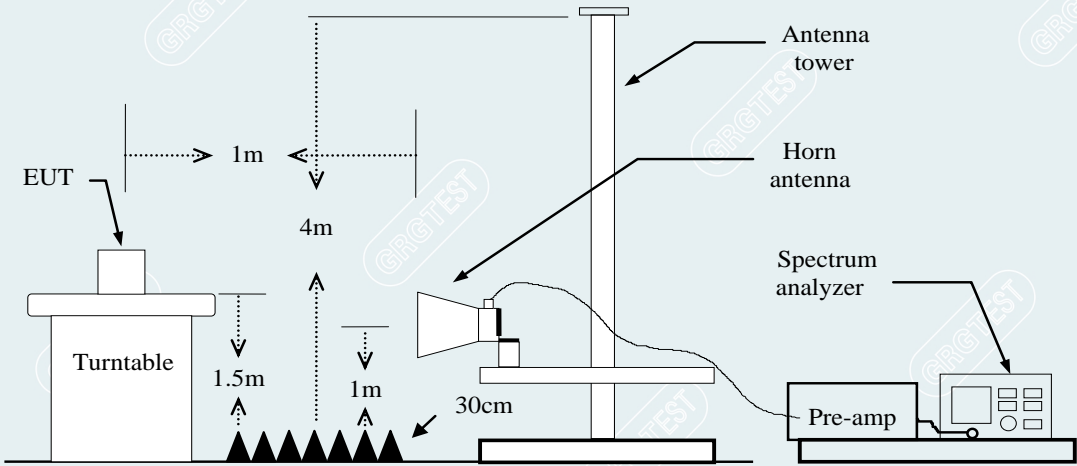


Figure 4. 18GHz to 26.5GHz radiated emissions test configuration

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

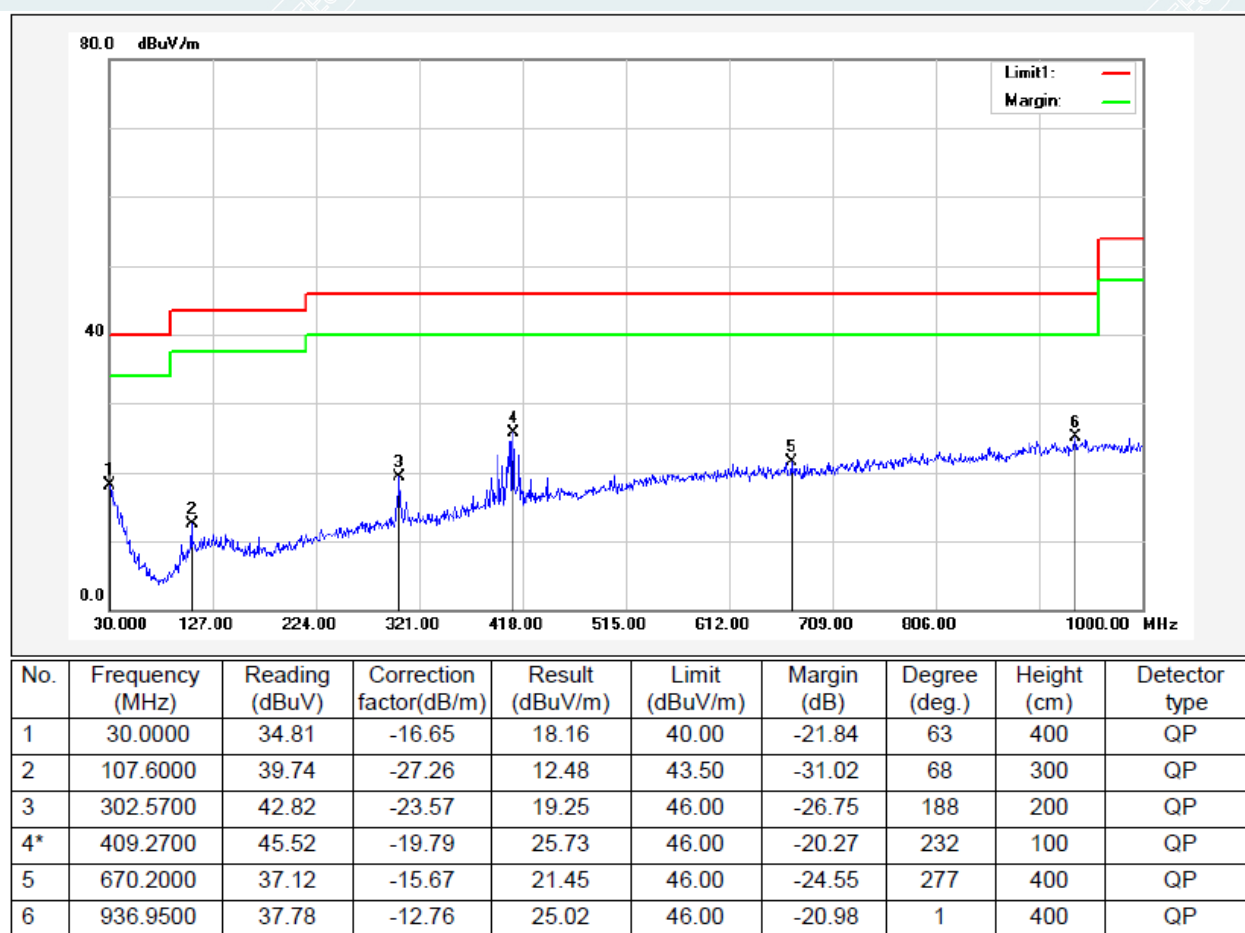
6.5 TEST RESULTS

Pre-scanned in three orthogonal panels,X,Y,Z.The worst cases mode (Z plane) were recorded in this report.

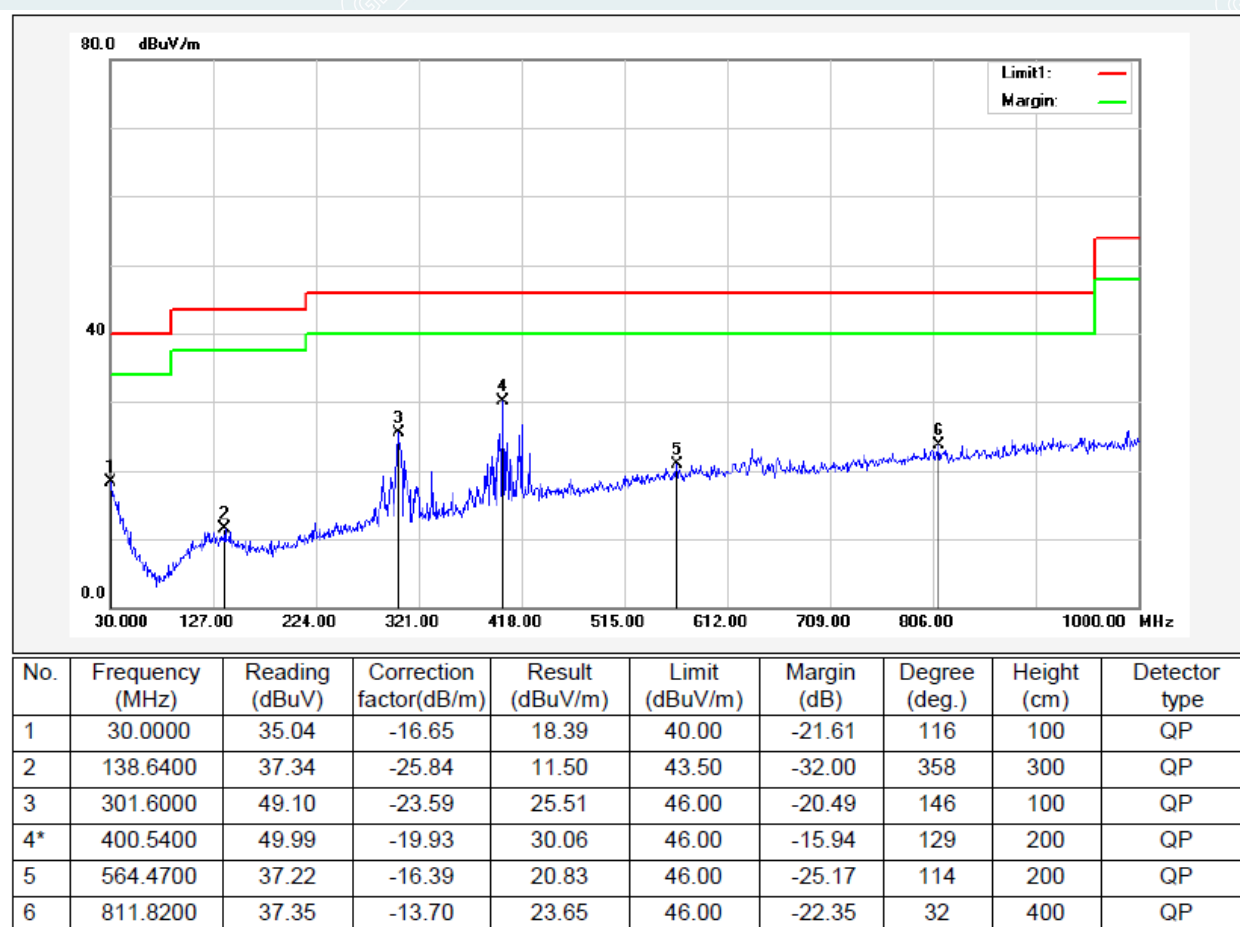
Below 1GHz

Pre-scan all modes and recorded the worst case results in this report. (BLE_1M_2480MHz)

EUT Name	OnePlus Stylo	Model	OPN2202
Environmental Conditions	20.0℃/44%RH/101.0kPa	Test Voltage	DC 3.82V
Test Mode	Mode 1	Polarity	Vertical
Tested By	Wang Xinyuan	Tested Date	2023-03-17



EUT Name	OnePlus Stylo	Model	OPN2202
Environmental Conditions	20.0°C/44%RH/101.0kPa	Test Voltage	DC 3.82V
Test Mode	Mode 1	Polarity	Horizontal
Tested By	Wang Xinyuan	Tested Date	2023-03-17

**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.

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: Mode 1

Lowest Frequency (2402MHz)

Environment: 23.2°C/51%RH/101.0kPa

Tested By:Zhang Zishan

Voltage: DC 3.82V

Date: 2023-03-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1242.0303	58.60	36.37	-22.23	74.00	37.63	150	293	Horizontal
2	2249.9062	57.90	39.28	-18.62	74.00	34.72	150	5	Horizontal
3	3243.7805	56.12	40.15	-15.97	74.00	33.85	150	57	Horizontal
4	4802.1003	60.93	48.32	-12.61	74.00	25.68	150	98	Horizontal
5	7206.1508	57.21	54.08	-3.13	74.00	19.92	150	273	Horizontal
6	17829.3537	44.53	53.54	9.01	74.00	20.46	150	151	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	4803.9768	-12.61	46.67	34.06	54.00	19.94	200	70.8	Horizontal
2	7205.63	-3.13	45.15	42.02	54.00	11.98	181	275.3	Horizontal
3	17829.3537	9.01	33.58	42.59	54.00	11.41	150	151	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	1073.5092	59.37	36.72	-22.65	74.00	37.28	150	256	Vertical
2	1673.8342	59.27	37.14	-22.13	74.00	36.86	150	102	Vertical
3	2370.6713	58.98	40.22	-18.76	74.00	33.78	150	129	Vertical
4	4802.1003	62.24	49.34	-12.90	74.00	24.66	150	83	Vertical
5	7204.2755	56.62	54.37	-2.25	74.00	19.63	150	83	Vertical
6	17846.2308	43.89	54.74	10.85	74.00	19.26	150	15	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	4803.9768	-12.90	55.34	42.44	54.00	11.56	100	87.6	Vertical
2	7205.9441	-2.25	48.05	45.80	54.00	8.20	120	86.6	Vertical
3	17846.2308	10.85	34.15	45.00	54.00	9.00	150	15	Vertical

Mode: Mode 1
Middle Frequency (2440MHz)
Environment: 23.2°C/51%RH/101.0kPa
Tested By:Zhang Zishan

Voltage: DC 3.82V
Date: 2023-03-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1248.7811	58.03	36.08	-21.95	74.00	37.92	150	90	Horizontal
2	2189.1486	58.24	39.80	-18.44	74.00	34.20	150	220	Horizontal
3	3120.015	56.84	40.58	-16.26	74.00	33.42	150	282	Horizontal
4	4920.24	54.97	43.76	-11.21	74.00	30.24	150	331	Horizontal
5	7318.6648	55.23	52.21	-3.02	74.00	21.79	150	16	Horizontal
6	9882.1103	48.23	52.36	4.13	74.00	21.64	150	311	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	7319.9315	-3.02	48.43	45.41	54.00	8.59	183	342.7	Horizontal
2	9882.1103	4.13	42.58	46.71	54.00	7.29	150	311	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	1435.0544	57.94	36.18	-21.76	74.00	37.82	150	122	Vertical
2	2089.8862	58.21	37.83	-20.38	74.00	36.17	150	150	Vertical
3	2997.9998	55.48	39.11	-16.37	74.00	34.89	150	111	Vertical
4	4878.9849	57.42	45.81	-11.61	74.00	28.19	150	360	Vertical
5	7318.6648	54.19	51.21	-2.98	74.00	22.79	150	193	Vertical
6	10746.5933	48.03	53.19	5.16	74.00	20.81	150	350	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	7319.8315	-2.98	46.86	43.88	54.00	10.12	177	190.1	Vertical
2	10746.5933	5.16	41.05	46.21	54.00	7.79	150	350	Vertical

Mode: Mode 1

Highest Frequency (2480MHz)

Environment: 23.2°C/51%RH/101.0kPa

Tested By:Zhang Zishan

Voltage: DC 3.82V

Date: 2023-03-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1245.7807	58.42	36.34	-22.08	74.00	37.66	150	283	Horizontal
2	2213.6517	58.72	40.62	-18.10	74.00	33.38	150	302	Horizontal
3	4959.62	56.26	44.73	-11.53	74.00	29.27	150	85	Horizontal
4	7440.5551	58.55	55.52	-3.03	74.00	18.48	150	153	Horizontal
5	9876.4846	47.70	51.90	4.20	74.00	22.10	150	273	Horizontal
6	17551.819	45.13	53.90	8.77	74.00	20.10	150	193	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	7440.0123	-3.03	50.27	47.24	54.00	6.76	196	117.7	Horizontal
2	9876.4846	4.20	41.12	45.32	54.00	8.68	150	273	Horizontal
3	17551.819	8.77	34.15	42.92	54.00	11.08	150	193	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	1106.7633	58.52	36.04	-22.48	74.00	37.96	150	62	Vertical
2	1722.8404	57.93	36.39	-21.54	74.00	37.61	150	194	Vertical
3	2495.937	61.57	42.01	-19.56	74.00	31.99	150	184	Vertical
4	4959.62	57.45	46.24	-11.21	74.00	27.76	150	104	Vertical
5	7440.5551	56.32	53.44	-2.88	74.00	20.56	150	338	Vertical
6	17887.4859	44.70	55.28	10.58	74.00	18.72	150	270	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	7439.9123	-2.88	48.83	45.95	54.00	8.05	181	301.5	Vertical
2	17887.4859	10.58	32.14	42.72	54.00	11.28	150	270	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.

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.

Only the worst mode and channel were recorded in this report. (BLE_1M 2480MHz)

Mode: Mode 1

Highest Frequency (2480MHz)

Environment: 23.2°C/51%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 3.82V

Date: 2023-03-16

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18399.075	53.01	40.72	-12.29	83.54	42.82	150	32	Horizontal
2	19473.475	52.35	40.91	-11.44	83.54	42.63	150	281	Horizontal
3	20213.825	51.86	41.01	-10.85	83.54	42.53	150	313	Horizontal
4	21332.85	51.46	41.50	-9.96	83.54	42.04	150	172	Horizontal
5	22804.625	49.85	41.12	-8.73	83.54	42.42	150	46	Horizontal
6	25099.2	49.12	41.93	-7.19	83.54	41.61	150	298	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	18590.75	52.33	40.28	-12.05	83.54	43.26	150	236	Vertical
2	20220.2	52.32	41.57	-10.75	83.54	41.97	150	299	Vertical
3	21002.625	51.67	41.67	-10.00	83.54	41.87	150	143	Vertical
4	21660.525	50.91	41.25	-9.66	83.54	42.29	150	49	Vertical
5	22196.45	49.81	40.34	-9.47	83.54	43.20	150	112	Vertical
6	25192.275	48.00	41.00	-7.00	83.54	42.54	150	81	Vertical

Remark:

- 1 Measuring frequencies from 18GHz to 26.5GHz.
- 2 Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Above 18G test distance is 1m, so the Peak Limit=74+20*log(3/1)=83.54 (dBμV/m), The limits are relaxed.

7. 6dB BANDWIDTH

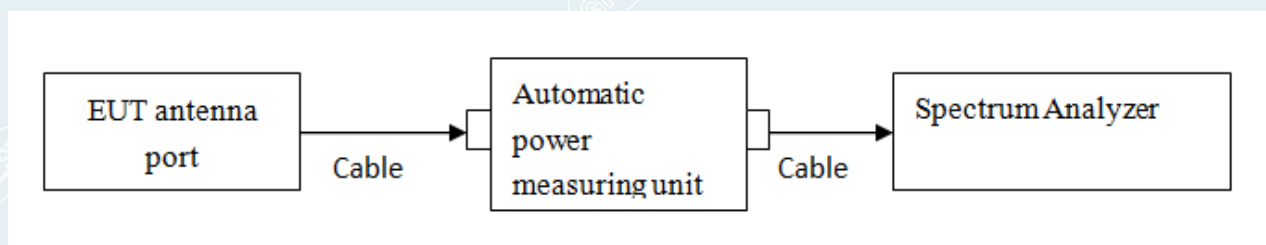
7.1 LIMITS

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: 21.4°C/39%RH/101.0kPa

Tested By: Huang Tianmei

Voltage: DC 3.82V

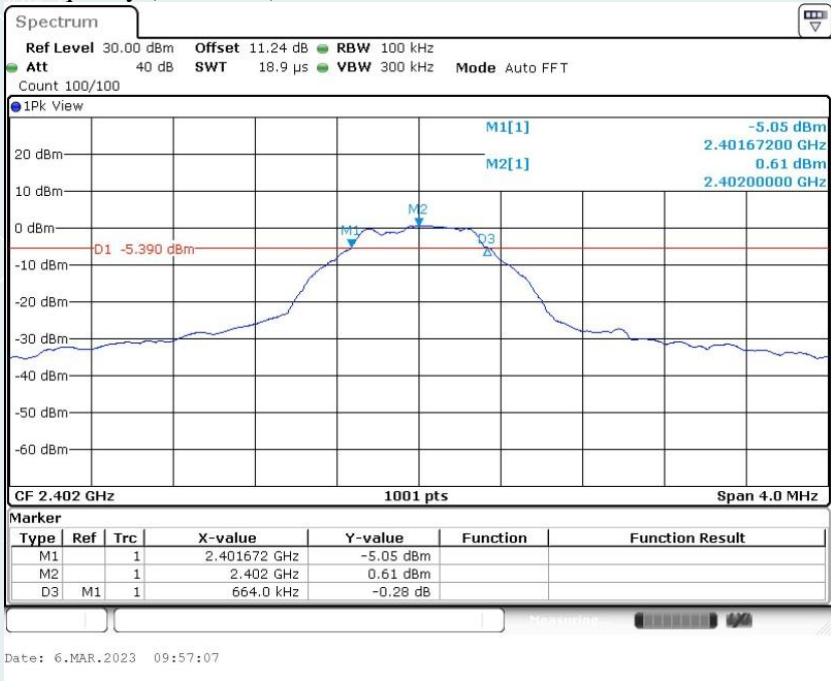
Date: 2023-03-06

BLE_1M

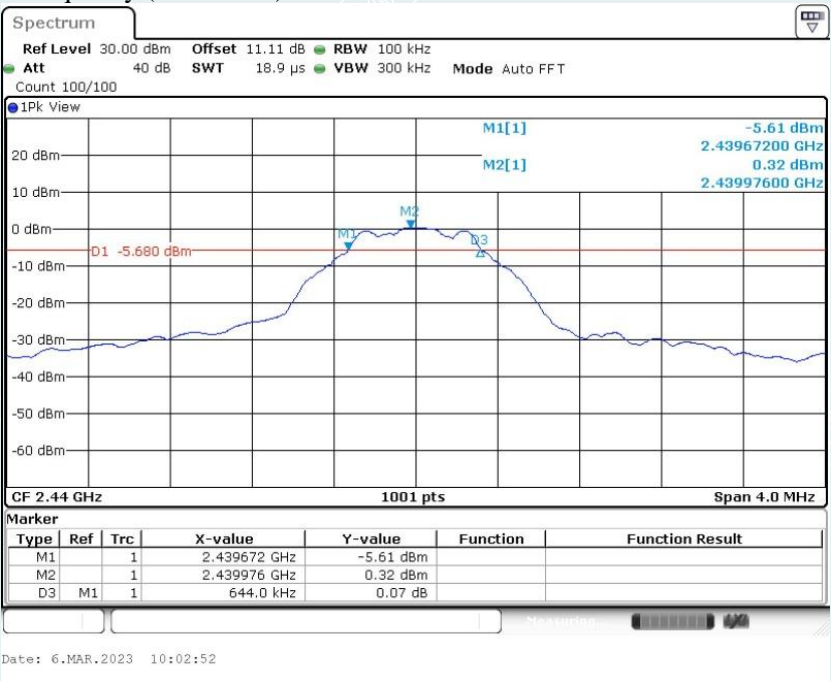
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Lowest	2402	664	≥ 500	PASS
Middle	2440	644		PASS
Highest	2480	664		PASS

BLE_1M

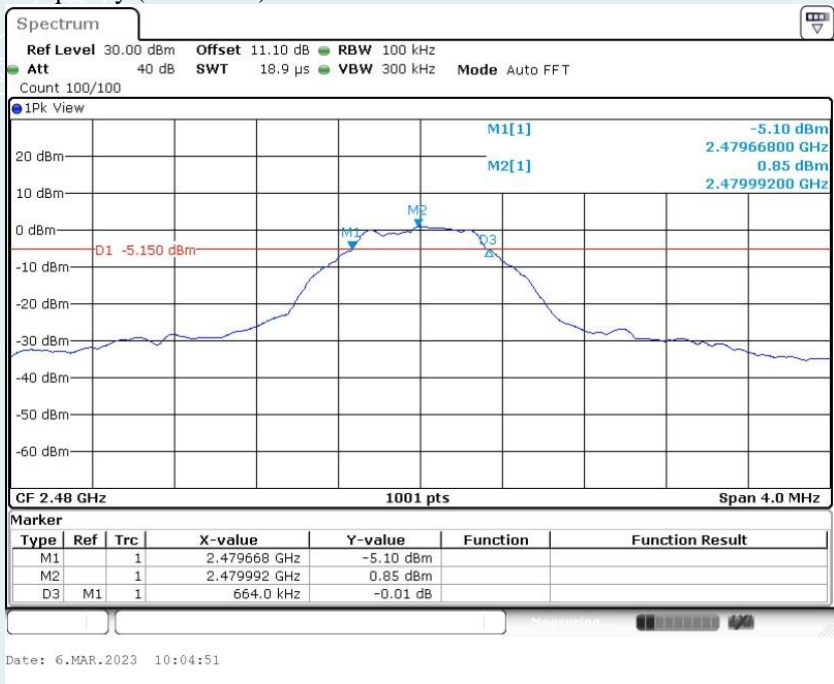
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)



Highest Frequency (2480MHz)



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

8. MAXIMUM PEAK OUTPUT POWER

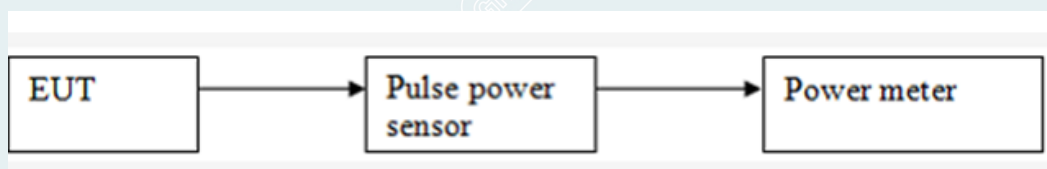
8.1 LIMITS

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

Environment: 21.4°C/39%RH/101.0kPa

Tested By: Huang Tianmei

Voltage: DC 3.82V

Date: 2023-03-06

BLE_1M

Channel	Frequency (MHz)	Measured Channel Power (dBm)	Limit	Peak/Average	Result
Lowest	2402	0.09	1W (30dBm)	Peak	Pass
Middle	2440	0.36			Pass
Highest	2480	0.77			Pass

9. POWER SPECTRAL DENSITY

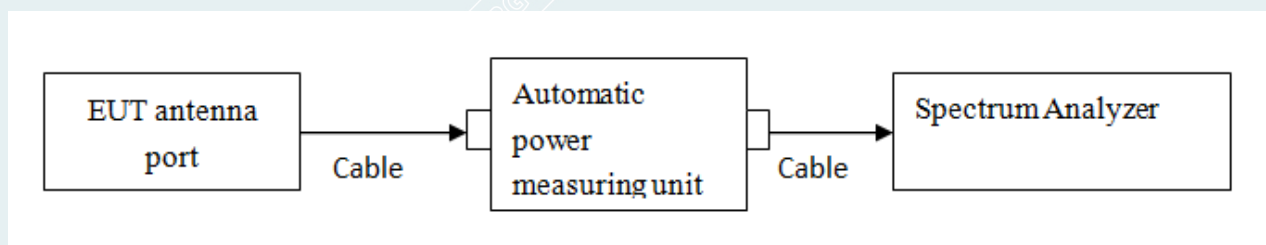
9.1 LIMITS

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



9.4 TEST RESULTS

Environment: 21.4°C/39%RH/101.0kPa
 Tested By: Huang Tianmei

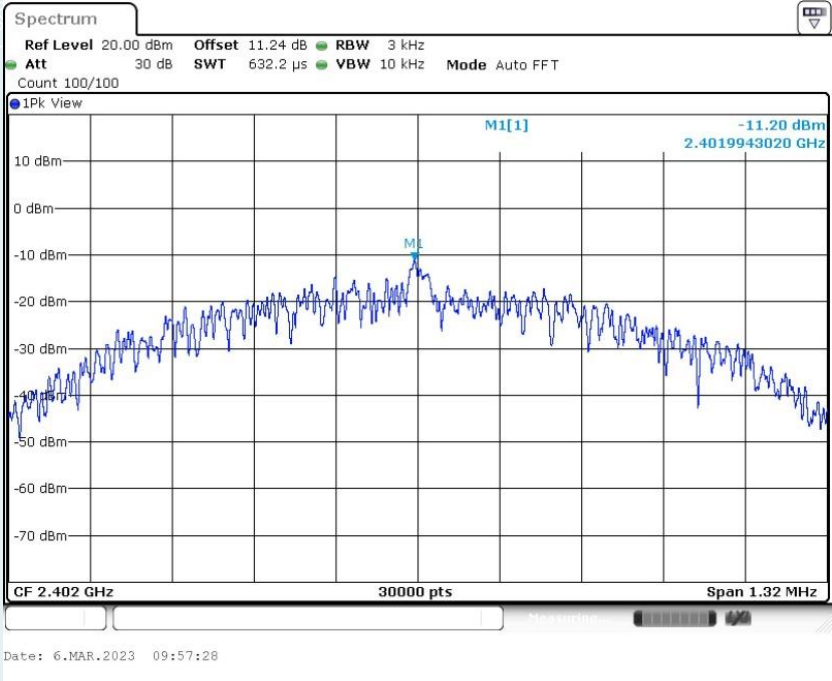
Voltage: DC 3.82V
 Date: 2023-03-06

BLE_1M

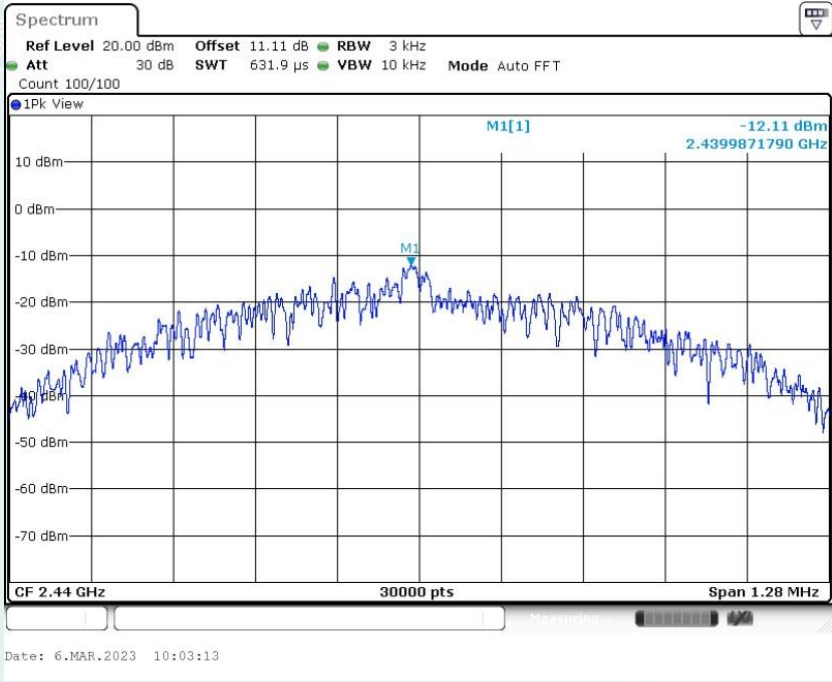
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
Lowest	2402	-11.20	8.00	PASS
Middle	2440	-12.11		PASS
Highest	2480	-11.02		PASS

BLE_1M

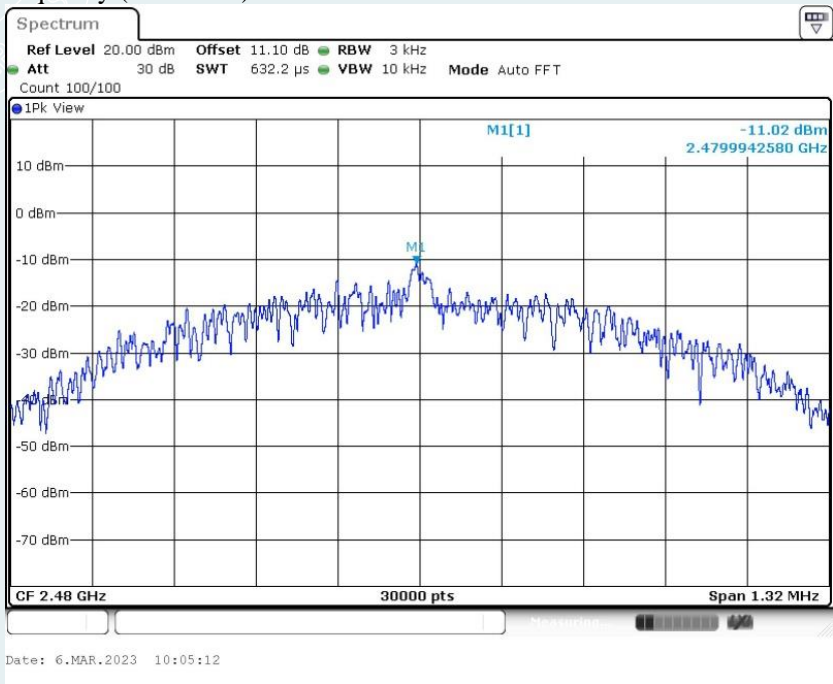
Lowest Frequency (2402MHz)



Middle Frequency (2440 MHz)



Highest Frequency (2480MHz)



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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.

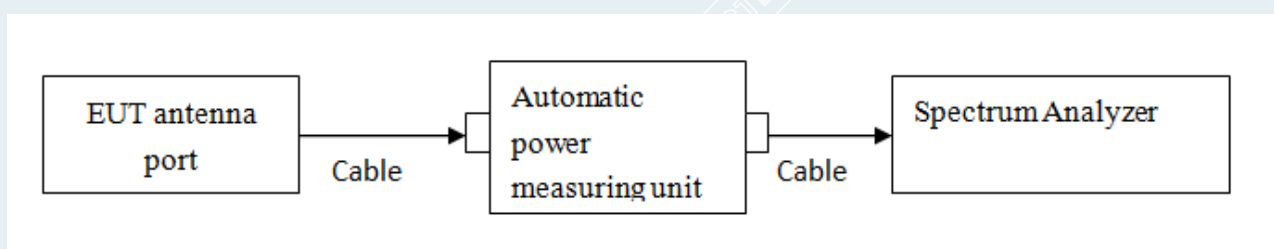
10.2 TEST PROCEDURES

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



10.4 TEST RESULTS

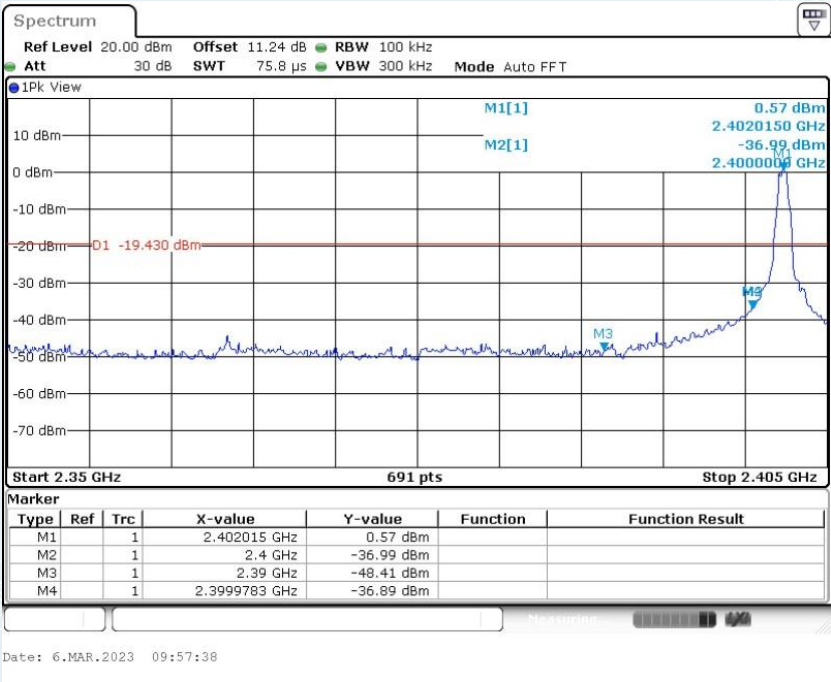
Environment: 21.4℃/39%RH/101.0kPa
Tested By: Huang Tianmei

Voltage: DC 3.82V
Date: 2023-03-06

Band edge measurements

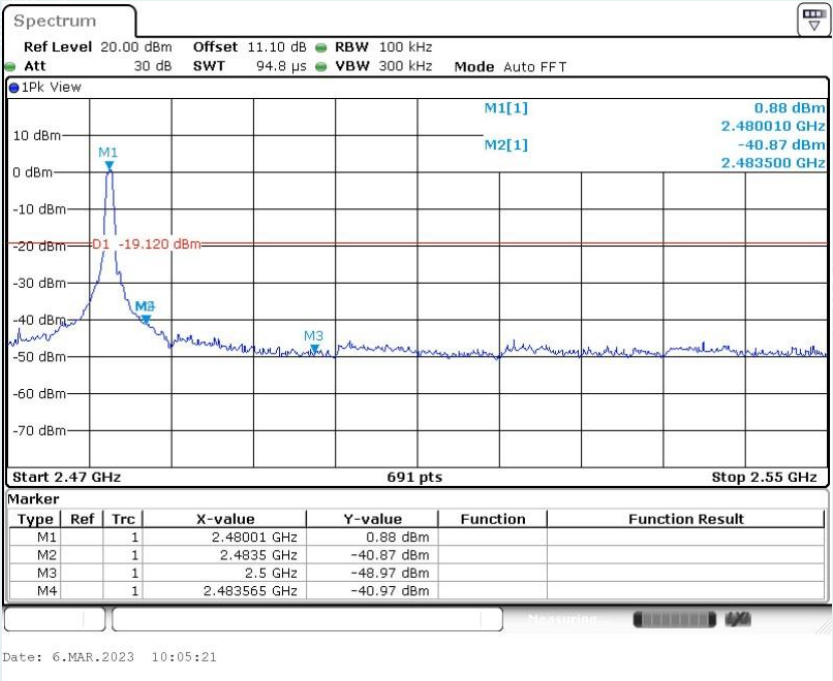
BLE_1M

Lowest Frequency (2402MHz)
2.35GHz-2.405GHz



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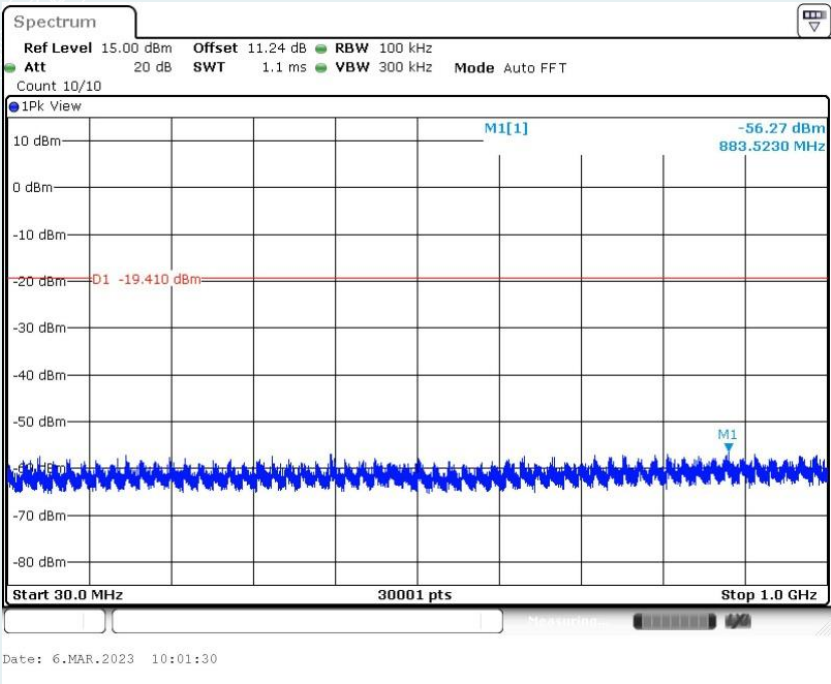
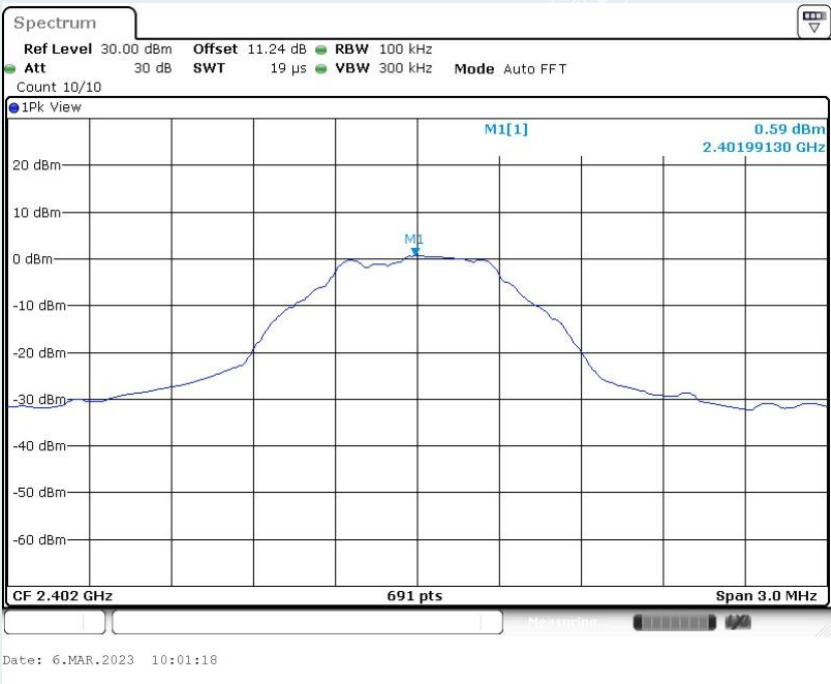
Highest Frequency (2480MHz)
2.47GHz-2.55GHz

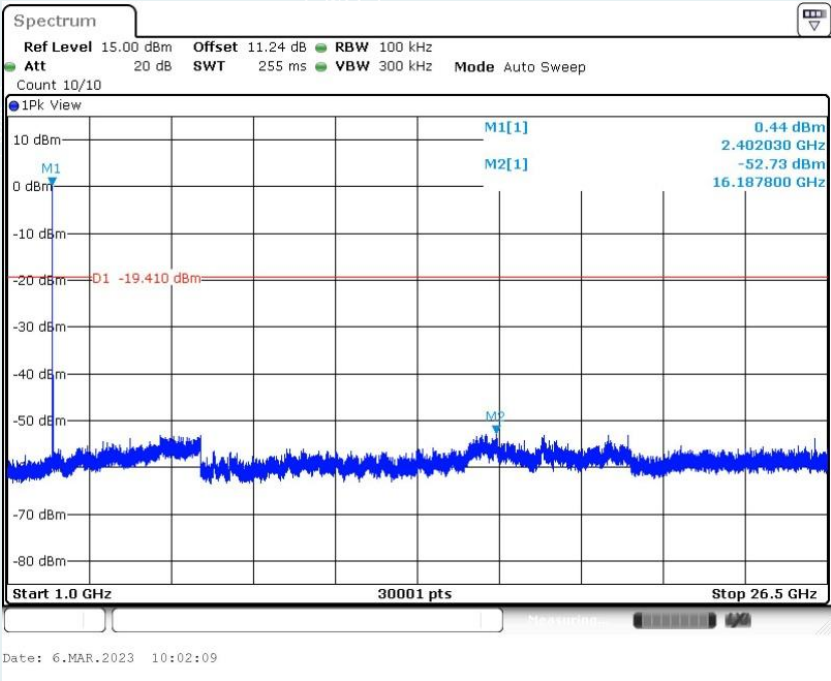


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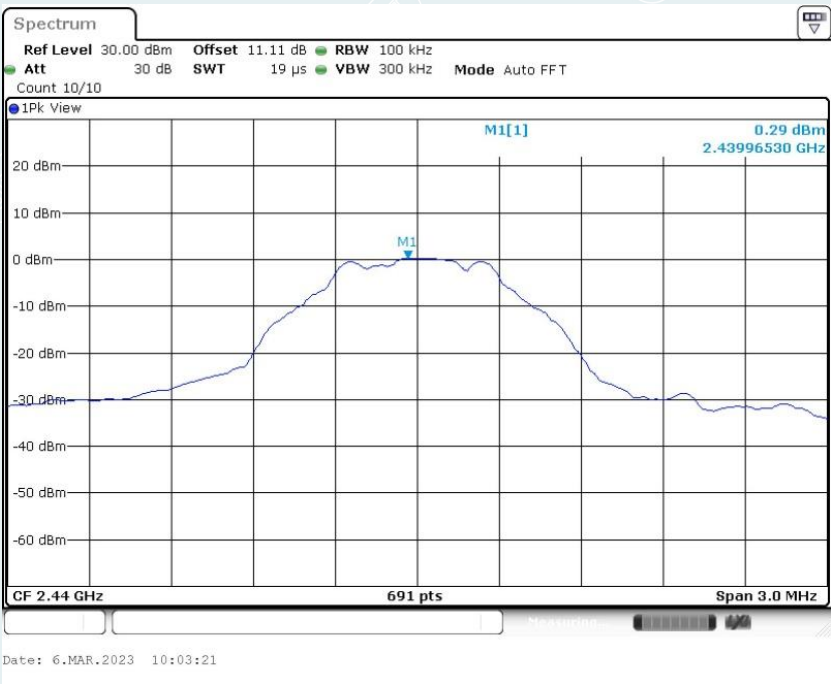
Conducted Spurious Emission
BLE_1M

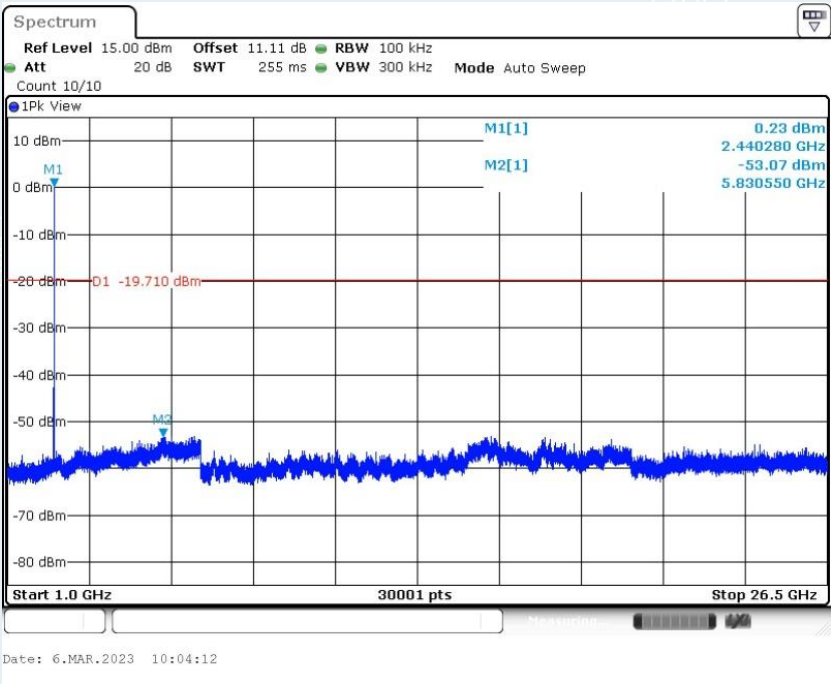
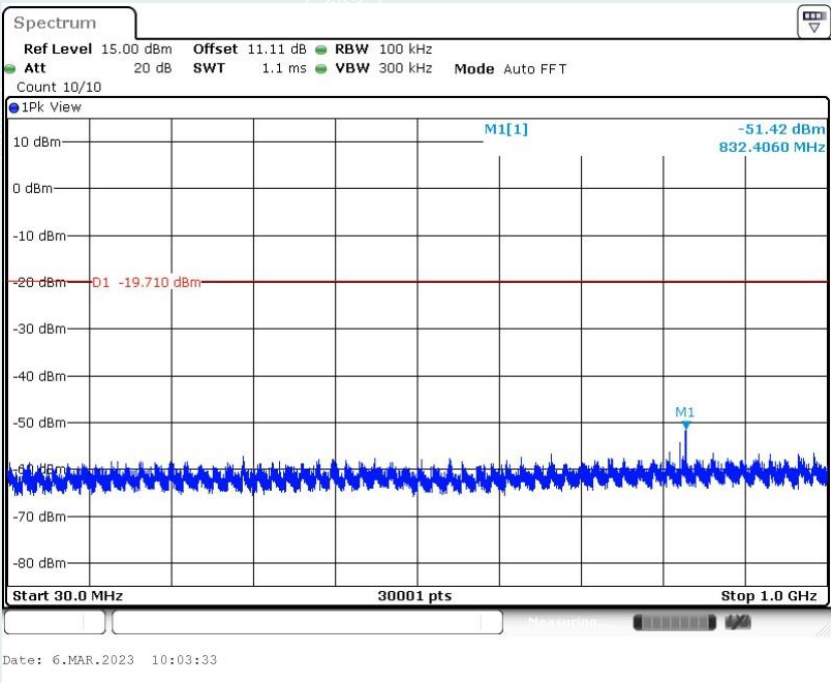
Lowest Frequency (2402MHz)



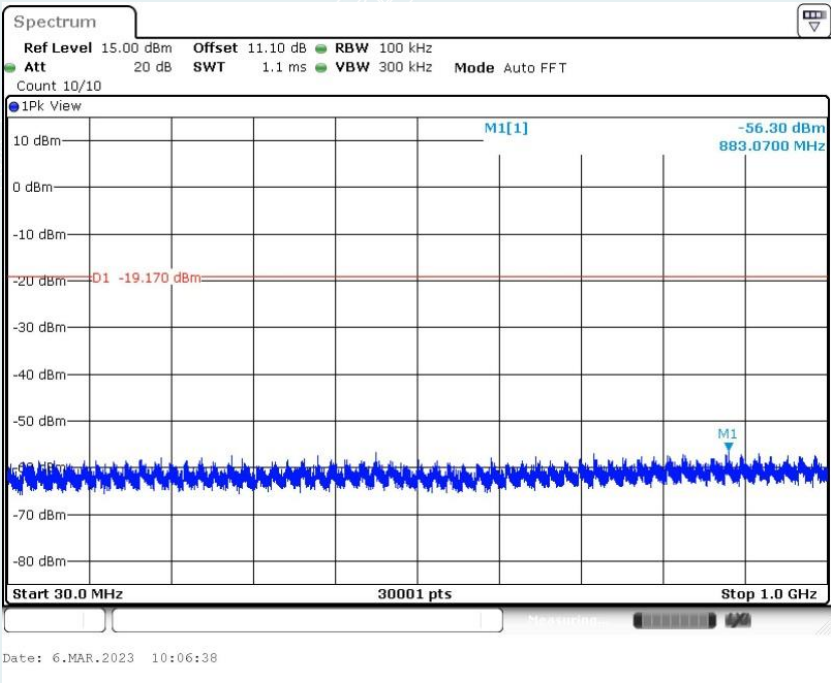
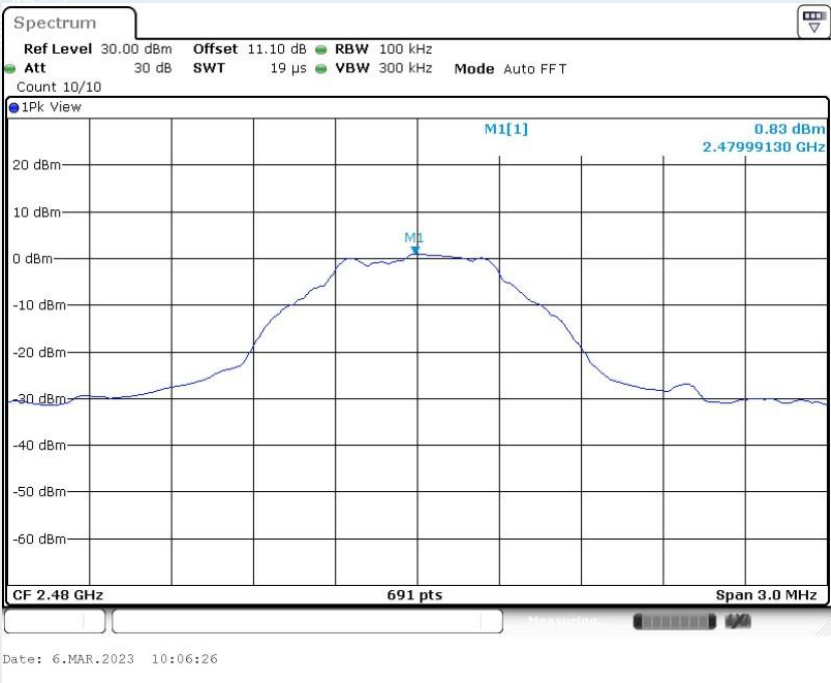


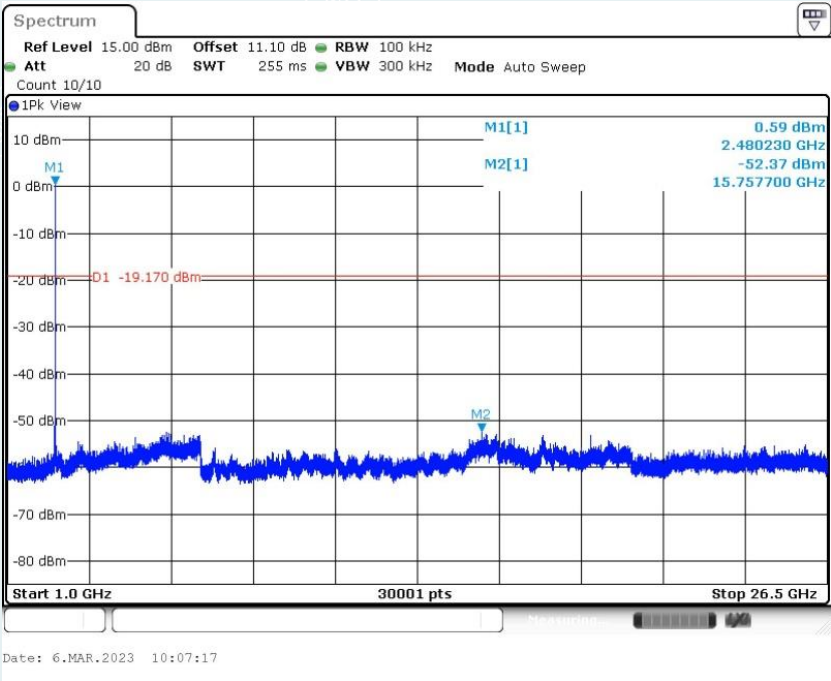
Middle Frequency (2440MHz)





Highest Frequency (2480MHz)





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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($\mu\text{V}/\text{m}$)	Measurement distance(m)	Quasi-peak(dB $\mu\text{V}/\text{m}$)@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

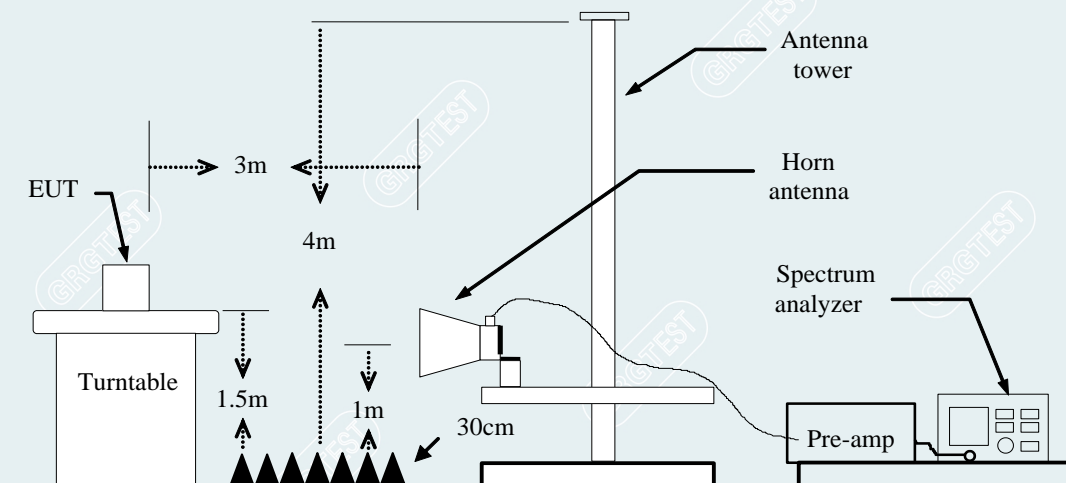
11.2 TEST PROCEDURES

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



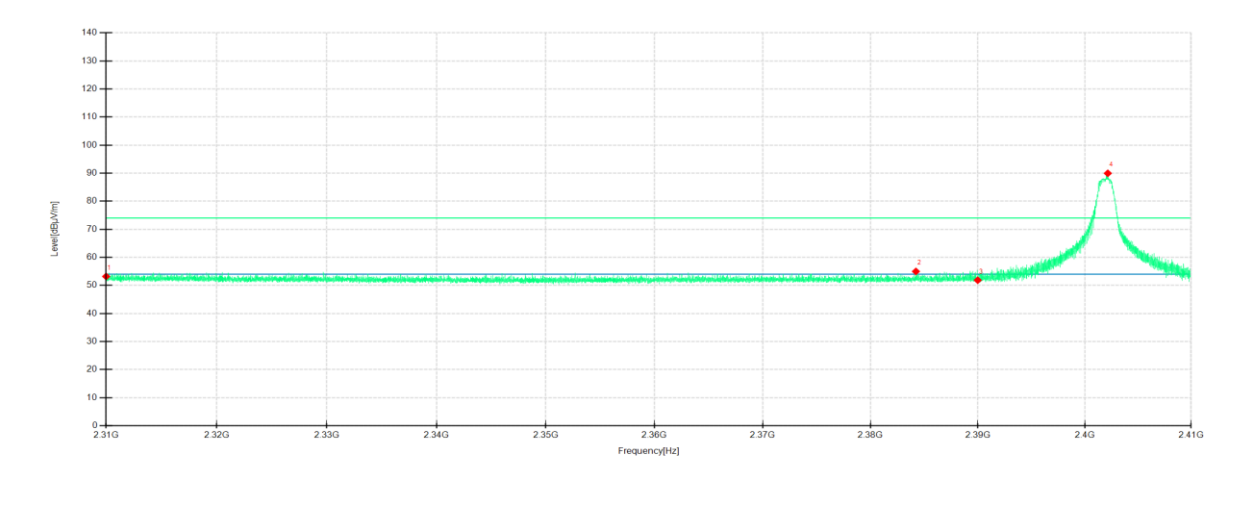
11.4 TEST RESULTS

Pre-scanned in three orthogonal panels,X,Y,Z.The worst cases mode (Z plane) were recorded in this report.

Equipment:	OnePlus Stylo	Test Date	2023-03-06
Model No.:	OPN2202	Test Engineer:	Chen Xiacong
Test Voltage:	DC 3.82V	Environmental Conditions	22.5℃/47%RH/101.0kPa

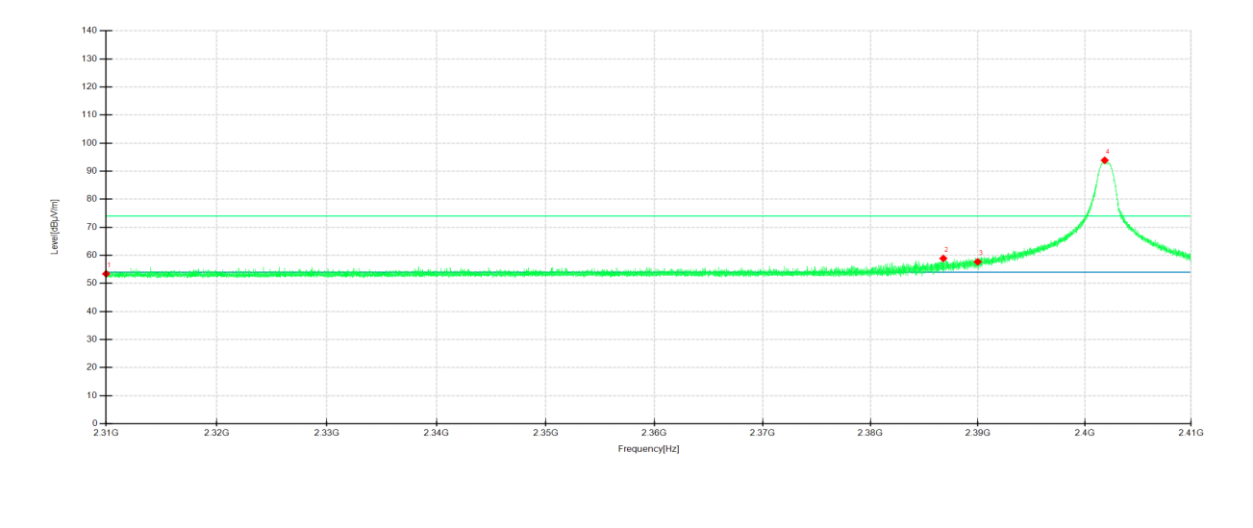
BLE 1M
Lowest Frequency
Frequency 2402MHz
Detector mode: Peak

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	43.84	53.19	9.35	74.00	20.81	100	125	Horizontal	/
2	2384.2383	46.11	54.98	8.87	74.00	19.02	100	130	Horizontal	/
3	2390	42.92	51.85	8.93	74.00	22.15	100	244	Horizontal	/
4	2402.1728	80.90	89.94	9.04	74.00	-15.94	100	187	Horizontal	No limit
1	2310	43.48	53.41	9.93	74.00	20.59	200	249	Vertical	/
2	2386.7918	48.82	58.90	10.08	74.00	15.10	200	36	Vertical	/
3	2390	47.63	57.70	10.07	74.00	16.30	200	75	Vertical	/
4	2401.8861	83.87	93.86	9.99	74.00	-19.86	200	81	Vertical	No limit

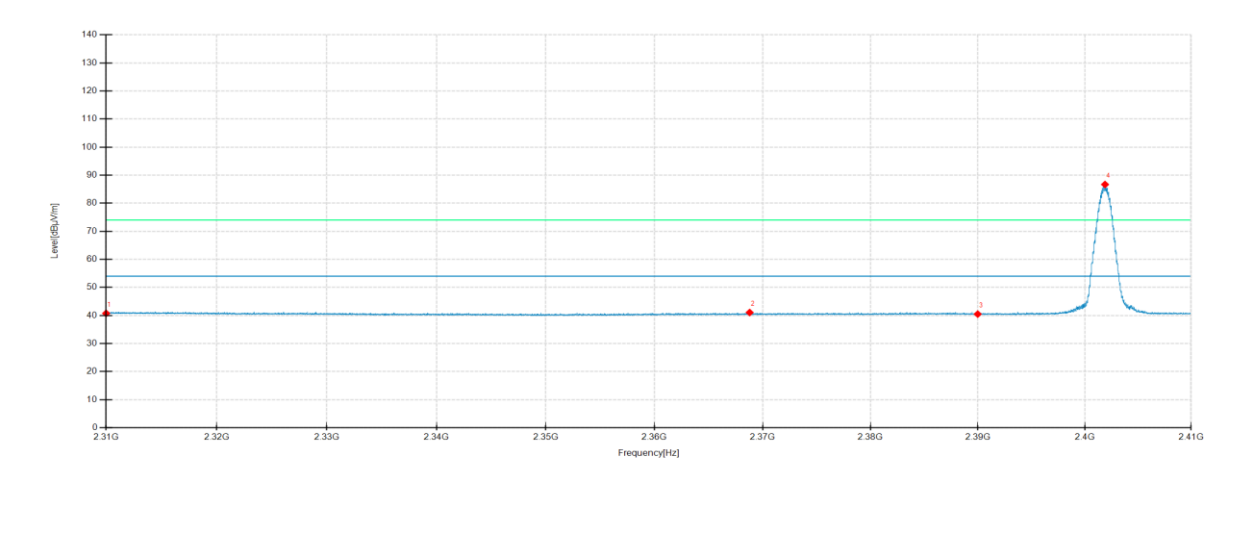
----- The following blanks -----

Lowest Frequency

Frequency 2402MHz

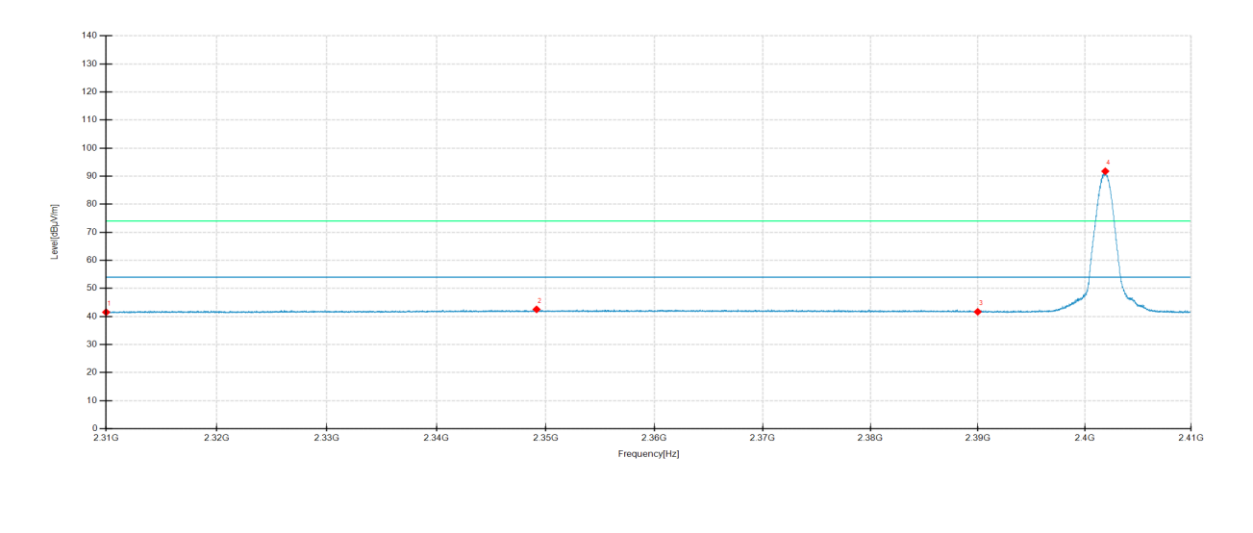
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

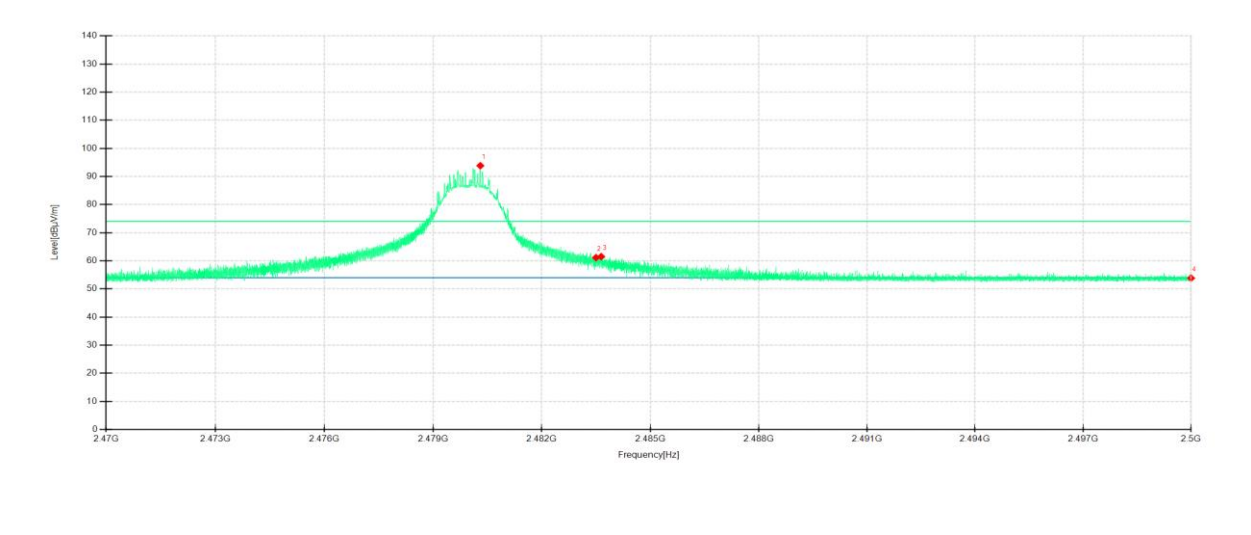
Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310	31.40	40.75	9.35	54.00	13.25	100	355	Horizontal	/
2	2368.8039	32.33	41.05	8.72	54.00	12.95	200	222	Horizontal	/
3	2390	31.56	40.49	8.93	54.00	13.51	200	27	Horizontal	/
4	2401.9128	77.63	86.67	9.04	54.00	-32.67	100	136	Horizontal	No limit
1	2310	31.58	41.51	9.93	54.00	12.49	100	319	Vertical	/
2	2349.1693	32.30	42.52	10.22	54.00	11.48	200	175	Vertical	/
3	2390	31.60	41.67	10.07	54.00	12.33	200	91	Vertical	/
4	2401.9395	81.76	91.75	9.99	54.00	-37.75	200	74	Vertical	No limit

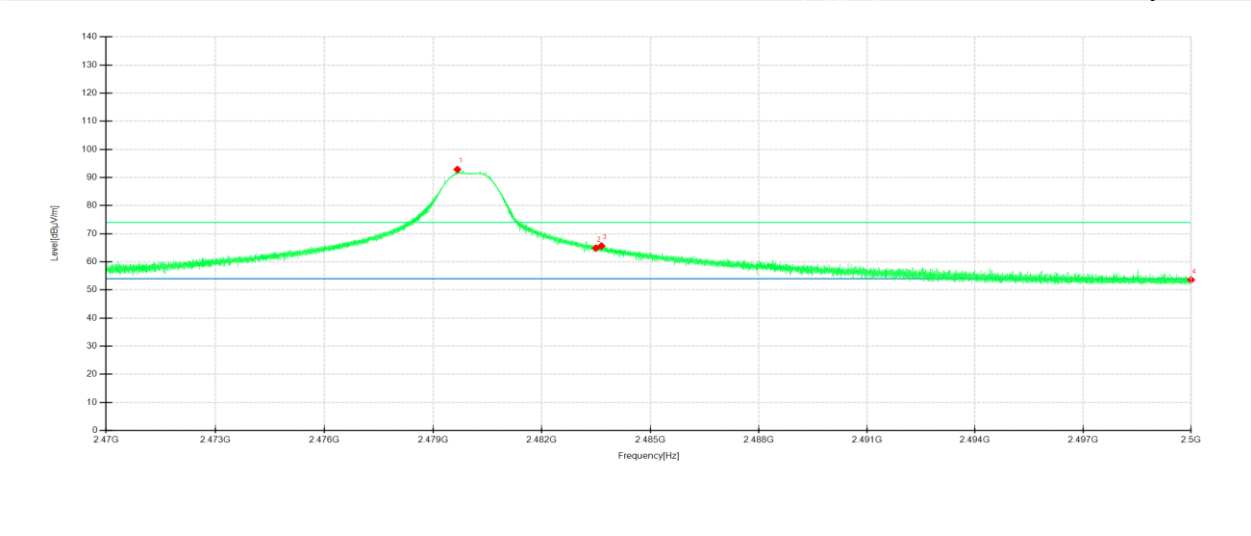
Highest Frequency
Frequency 2480MHz
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



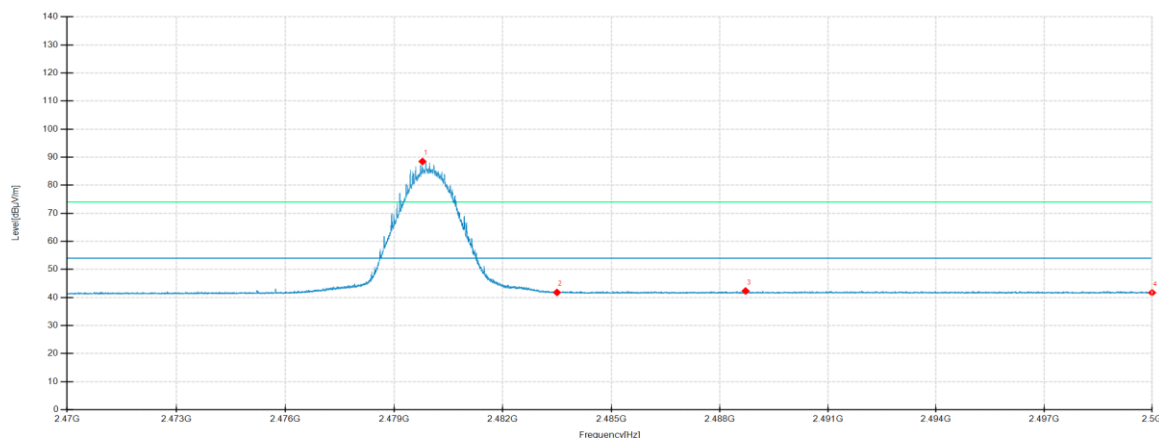
No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2480.3067	83.98	93.83	9.85	74.00	-19.83	100	293	Horizontal	No limit
2	2483.5	51.22	61.14	9.92	74.00	12.86	200	134	Horizontal	/
3	2483.6449	51.57	61.49	9.92	74.00	12.51	100	142	Horizontal	/
4	2500	43.58	53.83	10.25	74.00	20.17	200	313	Horizontal	/
1	2479.6726	83.58	92.84	9.26	74.00	-18.84	100	218	Vertical	No limit
2	2483.5	55.59	64.87	9.28	74.00	9.13	200	298	Vertical	/
3	2483.6509	56.36	65.64	9.28	74.00	8.36	200	58	Vertical	/
4	2500	44.22	53.57	9.35	74.00	20.43	200	304	Vertical	/

Highest Frequency

Frequency 2480MHz

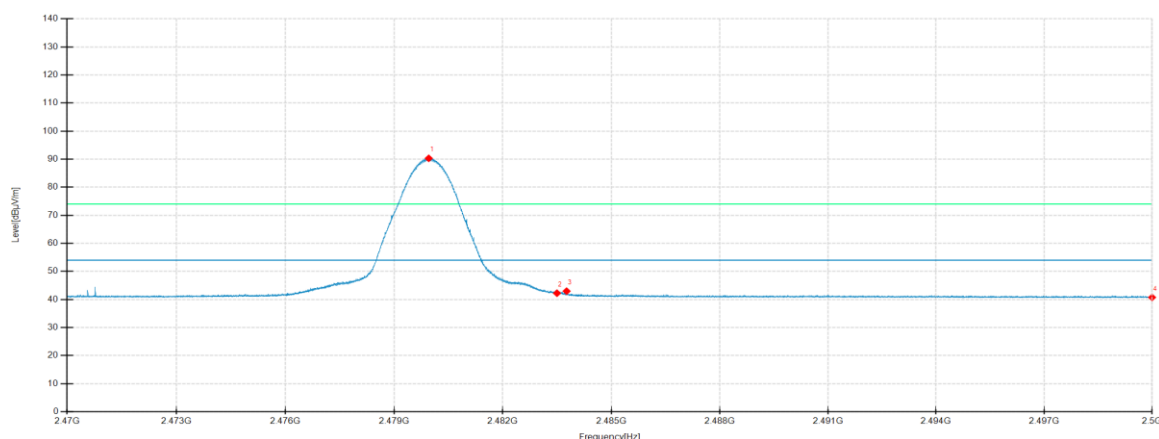
Detector mode: Average

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	2479.7867	78.60	88.45	9.85	54.00	-34.45	100	243	Horizontal	No limit
2	2483.5	31.87	41.79	9.92	54.00	12.21	200	269	Horizontal	/
3	2488.7172	32.29	42.31	10.02	54.00	11.69	100	360	Horizontal	/
4	2500	31.45	41.70	10.25	54.00	12.30	100	270	Horizontal	/
1	2479.9587	81.02	90.29	9.27	54.00	-36.29	200	64	Vertical	No limit
2	2483.5	32.95	42.23	9.28	54.00	11.77	200	226	Vertical	/
3	2483.7669	33.68	42.96	9.28	54.00	11.04	200	58	Vertical	/
4	2500	31.39	40.74	9.35	54.00	13.26	200	248	Vertical	/

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

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E20230224734401-7-Test Photo.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20230224734401-8-EUT Photo.

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