



FCC CERTIFICATION TEST REPORT

Applicant	:	Hannto Technology Co., Ltd.
Address	:	Room 704, Building 1, No.88, Shengrong Road, Pudong, Shanghai, China.
Equipment under Test	:	Photo Printer
Model No.	:	DHP515, DHP514
Trade Mark	:	Liene [®] / Liene / Optional
FCC ID	:	2AZHDDHP515
Manufacturer	:	Hannto Technology Co., Ltd.
Address	:	Room 704, Building 1, No.88, Shengrong Road, Pudong, Shanghai, China.

Issued By: Suzhou Dongdian Testing Service Co.,Ltd.

Address: Phase II, No.16 Runsheng Road, Suzhou Industrial Park, Suzhou, People's Republic of China.

Tel: +86-0512-62531270, E-mail: ddt@dgddt.com, http://www.ddttest.com



REPORT

Table of Contents

1.	Summary of Test Results.....	6
2.	General Test Information	6
2.1.	Description of EUT	6
2.2.	Accessories of EUT.....	7
2.3.	Assistant equipment used for test.....	7
2.4.	Block diagram of EUT configuration for test	7
2.5.	Test environment conditions	8
2.6.	Deviations of test standard.....	8
2.7.	Test laboratory	8
2.8.	Measurement uncertainty.....	9
3.	Equipment Used During Test.....	10
4.	6 dB Bandwidth and 99% Bandwidth.....	11
4.1.	Block diagram of test setup.....	11
4.2.	Limits	11
4.3.	Test procedure	11
4.4.	Test result.....	12
4.5.	Original test data	12
5.	Maximum Peak Output Power	15
5.1.	Block diagram of test setup.....	15
5.2.	Limits	15
5.3.	Test procedure	15
5.4.	Test result.....	15
5.5.	Original test data	16
6.	Power Spectral Density.....	18
6.1.	Block diagram of test setup.....	18
6.2.	Limits	18
6.3.	Test procedure	18
6.4.	Test result.....	18
6.5.	Original test data	19
7.	Band Edge Compliance (Conducted Method)	21
7.1.	Block diagram of test setup.....	21
7.2.	Limits	21
7.3.	Test procedure	21
7.4.	Test result.....	21
7.5.	Original test data	21
8.	RF Conducted Spurious Emissions	23
8.1.	Block diagram of test setup.....	23

8.2.	Limits	23
8.3.	Test procedure	23
8.4.	Test result.....	24
8.5.	Original test data	24
9.	Radiated Emission	28
9.1.	Block diagram of test setup.....	28
9.2.	Limit.....	29
9.3.	Test Procedure.....	30
9.4.	Test result.....	32
10.	Emissions in Restricted Frequency Bands	44
10.1.	Block diagram of test setup.....	44
10.2.	Limit.....	44
10.3.	Test Procedure.....	44
10.4.	Test result.....	44
11.	Power Line Conducted Emission	49
11.1.	Block diagram of test setup.....	49
11.2.	Power line conducted emission limits	49
11.3.	Test procedure	49
11.4.	Test result.....	50
12.	Antenna Requirements	53
12.1.	Limit	53
12.2.	Result	53
13.	Test Setup Photograph	54
14.	Photos of the EUT	54

Test Report Declare

Applicant	:	Hannuo Technology Co., Ltd.
Address	:	Room 704, Building 1, No.88, Shengrong Road, Pudong, Shanghai, China.
Equipment under Test	:	Photo Printer
Model No.	:	DHP515, DHP514
Trade Mark	:	Liene [®] / Liene / Optional
Manufacturer	:	Hannuo Technology Co., Ltd.
Address	:	Room 704, Building 1, No.88, Shengrong Road, Pudong, Shanghai, China.

Test Standard Used:

47 CFR FCC Part 15 Subpart C (Section 15.247)

Test Procedure Used:

ANSI C63.10:2020+Corr.1:2023

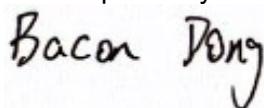
We Declare:

The equipment described above is tested by Suzhou Dongdian Testing Service Co.,Ltd and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Suzhou Dongdian Testing Service Co.,Ltd is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC&ISED standards.

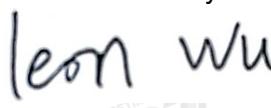
Report No:	DDT-B24120205-3E02	
Sample No:	Y24120205-05	
Date of Receipt:	Dec. 06, 2024	Date of Test: Dec. 06, 2024~ Dec. 18, 2024

Prepared By:



Bacon Dong/Engineer

Reviewed By:



Leon Wu/Director

Authorized By:



Chris Zhong/EMC Manager

Note:

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Suzhou Dongdian Testing Service Co., Ltd.

The results reported herein have been performed in accordance with the laboratory's terms of accreditation.

This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report apply to the test sample(s) mentioned above at the time of the testing period only and are not to be used to indicate applicability to other similar products.

This report does not imply that the product(s) has met the criteria for certification.

Revision History

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Dec. 25, 2024	

1. Summary of Test Results

The EUT have been tested according to the applicable standards as referenced below.		
Description of Test Item	Standard	Verdict
6 dB Bandwidth and 99% Bandwidth	FCC 15.247 (a) (2)	Pass
Peak Output Power	FCC 15.247 (b) (3)	Pass
Power Spectral Density	FCC 15.247 (e)	Pass
Band Edge Compliance (conducted method)	FCC 15.247 (d)	Pass
Radiation Emission	FCC 15.247 (d)	Pass
RF Conducted Spurious Emissions	FCC 15.247 (d) FCC 15.209 FCC 15.205	Pass
Emission in Restricted Frequency Bands	FCC 15.247 (d) FCC 15.209 FCC 15.205	Pass
Power Line Conducted Emission	FCC 15.207	Pass
Antenna Requirement	FCC 15.203	Pass

Note: The measurement result for the sample received is <Pass> according to <ANSI C63.10:2020+CORR.1:2023, FCC CFR 47 Part 2, FCC CFR 47 Part 15C> when <Accuracy Method> decision rule is applied.

2. General Test Information

2.1. Description of EUT

EUT* Name	:	Photo Printer
Model Number	:	DHP515, DHP514
Difference of model number	:	The DHP 514 model has one battery, DHP 515 model does not have a battery. The DHP 514 contains all components of the DHP 515.
Test Model	:	DHP514
EUT function description	:	Please reference user manual of this device
Power Supply	:	Input:100-240V~ 50/60Hz 1.0A
Operation Frequency	:	2402MHz-2480MHz
Modulation	:	GFSK
Data Rate	:	1Mbps
Antenna Type	:	PCB Antenna
Antenna Gain	:	-2.55 dBi (Declare by customer and the lab isn't responsible for the value)
Serial Number	:	N/A

Note1: The lab isn't responsible for the value provide by customer(Such as RF cable loss,

antenna gain etc..)

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

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number	Description	Remark
N/A	N/A	N/A	N/A	N/A

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
Laptop	ASUS	FX506LI10750-0DABXHA4X10	FCC/CE	LANRCX04 696543F

2.4. Block diagram of EUT configuration for test



Test software: Airoha.Tool.Kit.EXE

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table:

Tested mode, channel, information			
Mode	Setting Tx Power	Channel	Frequency (MHz)
GFSK	Default	CH0	2402
	Default	CH19	2440
	Default	CH39	2480

2.5. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Environment Parameter	Selected Values During Tests
Relative Humidity	40-75%
Atmospheric Pressure:	86-106 kPa
Temperature	21-25 °C
Voltage:	AC 230V

2.6. Deviations of test standard

No deviation.

2.7. Test laboratory

Lab Information	Company Name: Suzhou Dongdian Testing Service Co.,Ltd. Address: Phase II, No.16 Runsheng Road, Suzhou Industrial Park, Suzhou, People's Republic of China. Tel: +86-0512-62531270, E-mail: ddt@dgddt.com, http://www.ddttest.com
Accreditation Certificate	A2LA (Certificate No.: 7346.01) Suzhou Dongdian Testing Service Co.,Ltd. has been assessed and proved to be in compliance with A2LA. FCC (FCC Designation No.: CN1397) Suzhou Dongdian Testing Service Co.,Ltd. has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules. IC (IC Designation No.: 32952; CAB No.:CN0182) Suzhou Dongdian Testing Service Co.,Ltd. has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.
<p>Note 1: All tests measurement facilities use to collect the measurement data are located at Phase II, No.16 Runsheng Road, Suzhou Industrial Park, Suzhou, China.</p> <p>Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.</p> <p>Note 3: The test anechoic chamber in Suzhou Dongdian Testing Service Co.,Ltd had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.</p>	

2.8. Measurement uncertainty

Test Item	Uncertainty
DTS Bandwidth	±1.9 %
Maximum Conducted Output Power	± 0.69dB
Maximum Power Spectral Density Level	±1.5 dB
Band-edge Compliance	± 1.9%
Conducted Spurious Emissions	30MHz-1GHz:±1.5 dB 1GHz-12.75GHz: ±1.9dB 12.75GHz-26.5GHz: ±2.1dB
Uncertainty for Radiation Emission Test (9kHz - 1 GHz)	9kHz-30MHz: 0.9 dB 30MHz-1000MHz: 1.5dB
Uncertainty for Radiation Emission Test (1 GHz - 40 GHz)	1GHz – 12.75GHz:1.9 dB 12.75GHz – 26.5GHz: 2.1 dB 26.5GHz – 40GHz: 2.5 dB
Uncertainty for Power Line Conduction Emission Test	3.4 dB (150 kHz - 30 MHz)

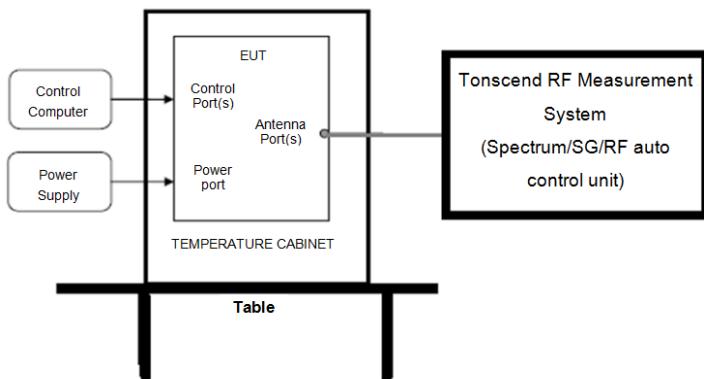
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. Equipment Used During Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
RF Conducted Test					
MXG Vector Signal Generator(100kHz-6GHz)	Agilent	N5182A	MY50144775	2024/1/30	1 Year
Spectrum Analyzer(9kHz-40GHz)	R&S	FSV40-N	101642	2024/1/30	1 Year
Vector Signal Generator(4kHz-7.125GHz)	R&S	SMCV100B	103781	2024/1/30	1 Year
WIDBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	167141	2024/1/30	1 Year
Signal Analyzer(10Hz-26.5GHz)	Keysight	N9020B	MY56080159	2024/3/12	1 Year
RF Control Unit	Tonscend	JS0806-3	24A80620795	2024/4/11	1 Year
Signal Generator	R&S	SMF 100A	101396	2024/2/21	1 Year
Programmable Temperature Humidity Chamber	Zhi Xiang	ZXGDJS-225L	ZX20171127A	2024/4/11	1 Year
Temperature, humidity and pressure recorder	Huhanwei	TH10R	c00286000Ebc	2024/1/30	1 Year
Test Software	TONSCEND	JS1120-3	3.5.39	N/A	N/A
Radiated Spurious Emission 3m EMI Chamber					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	R&S	ESCI7	101138	2024/01/30	1 Year
Signal Analyzer	R&S	FSV40	101730	2024/02/21	3 Year
Hybrid antenna	TESEQ	CBL6141B	27421	2024/01/10	3 Year
Horn Antenna	ETS	ETS 3117	157735	2024/01/19	3 Year
Pre-Amplifier_HF	COM-MW	DPA8-1000-18 000-1012	9BH231242575	2024/01/30	1 Year
Temperature, humidity and pressure recorder	Huhanwei	TH10R	c0222020002F	2024/1/30	1 Year
3m Anechoic Chamber	CeRuiTong	3m-SAC	N/A	2024/5/10	3 Year
Test Software	TONSCEND	JS32-RE	5.0.0	N/A	N/A
Power Line Conducted Emissions Test					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESCI3	101705	2024/1/30	1 Year
Two-Line V-Network	Rohde & Schwarz	ENV216	101063	2024/1/30	1 Year
Test software	TONSCEND	JS32-CE	5.0.0	N/A	N/A

4. 6 dB Bandwidth and 99% Bandwidth

4.1. Block diagram of test setup



4.2. Limits

For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz

4.3. Test procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) 99% Bandwidth set the spectrum analyzer as follows:

RBW:

RBW, prefer 1% to 5% of OBW,
or a minimum of 1 MHz if this is
not possible due to a large OBW

VBW:

VBW approximately $3 \times$ RBW

Detector Mode:

Peak

Sweep time:

auto

Trace mode

Max hold

- (3) 6 dB Bandwidth set the spectrum analyzer as follows:

RBW:

100 kHz

VBW:

300 kHz

Detector Mode:

Peak

Sweep time:

auto

Trace mode

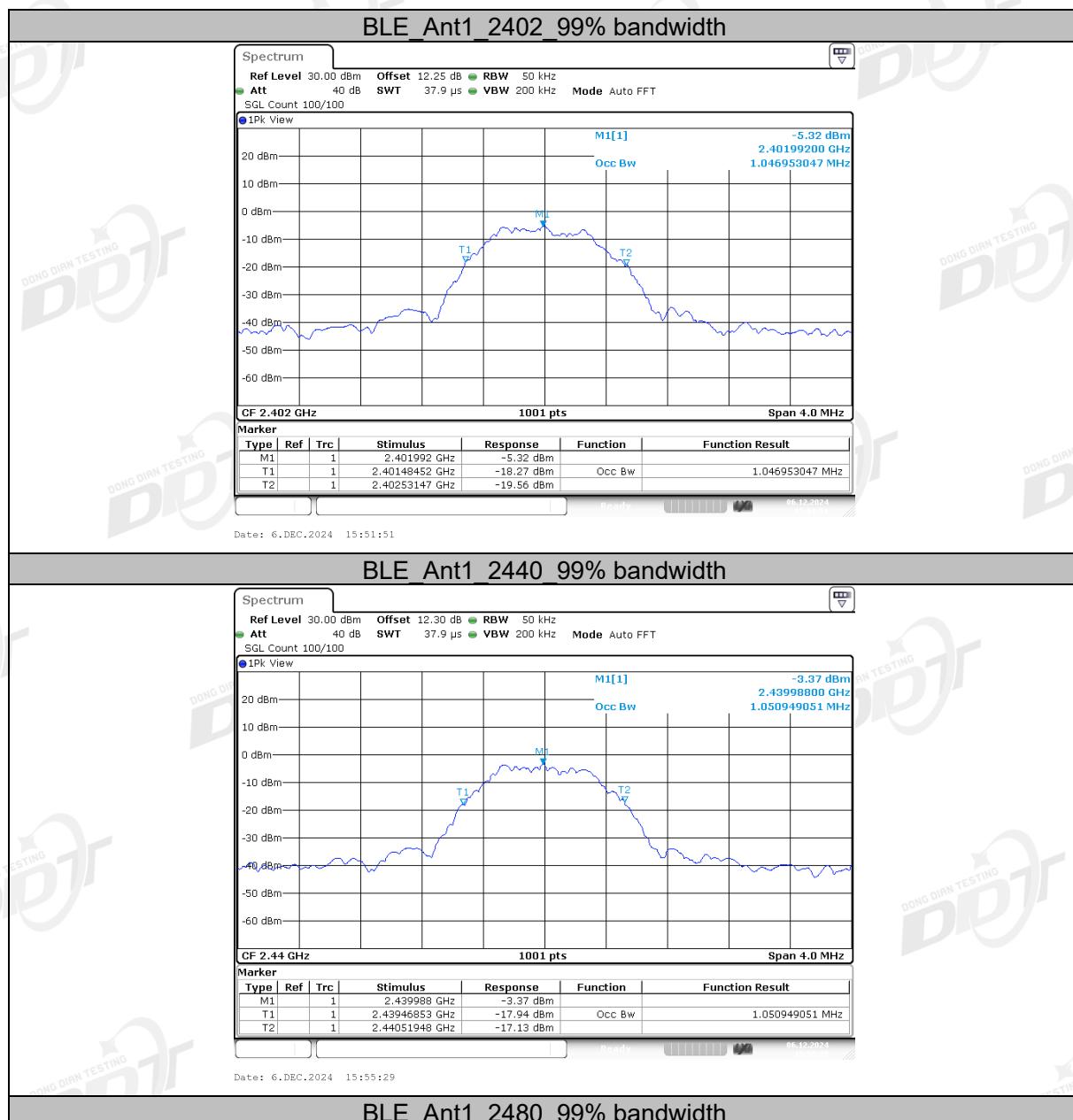
Max hold

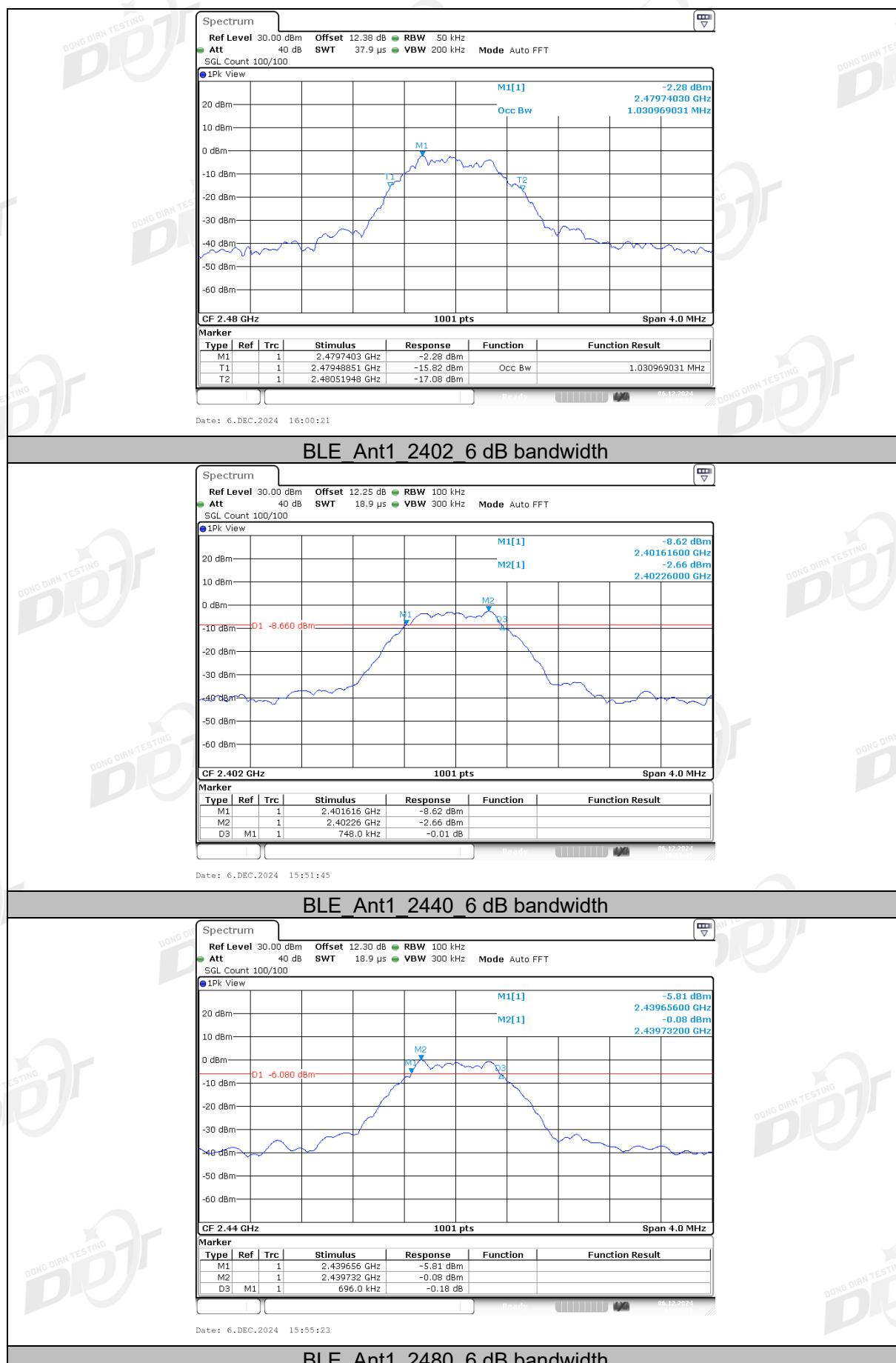
- (4) Allow the trace to stabilize, measure the 6 dB and 99% bandwidth of signal.

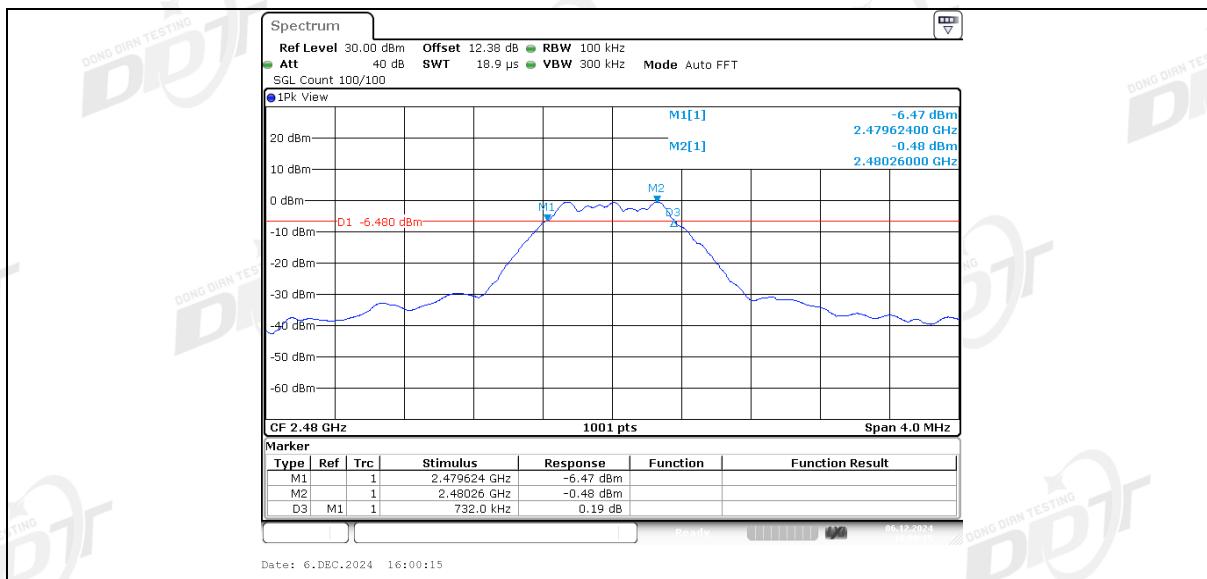
4.4. Test result

Mode	Channel	99% bandwidth Result (MHz)	6 dB bandwidth Result (MHz)	6 dB width Limit (MHz)	Verdict
GFSK	CH0	1.047	0.75	>0.5	Pass
	CH19	1.051	0.70	>0.5	Pass
	CH39	1.031	0.73	>0.5	Pass

4.5. Original test data







5. Maximum Peak Output Power

5.1. Block diagram of test setup

Same with 4.1

5.2. Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3. Test procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Set the spectrum analyzer as follows:

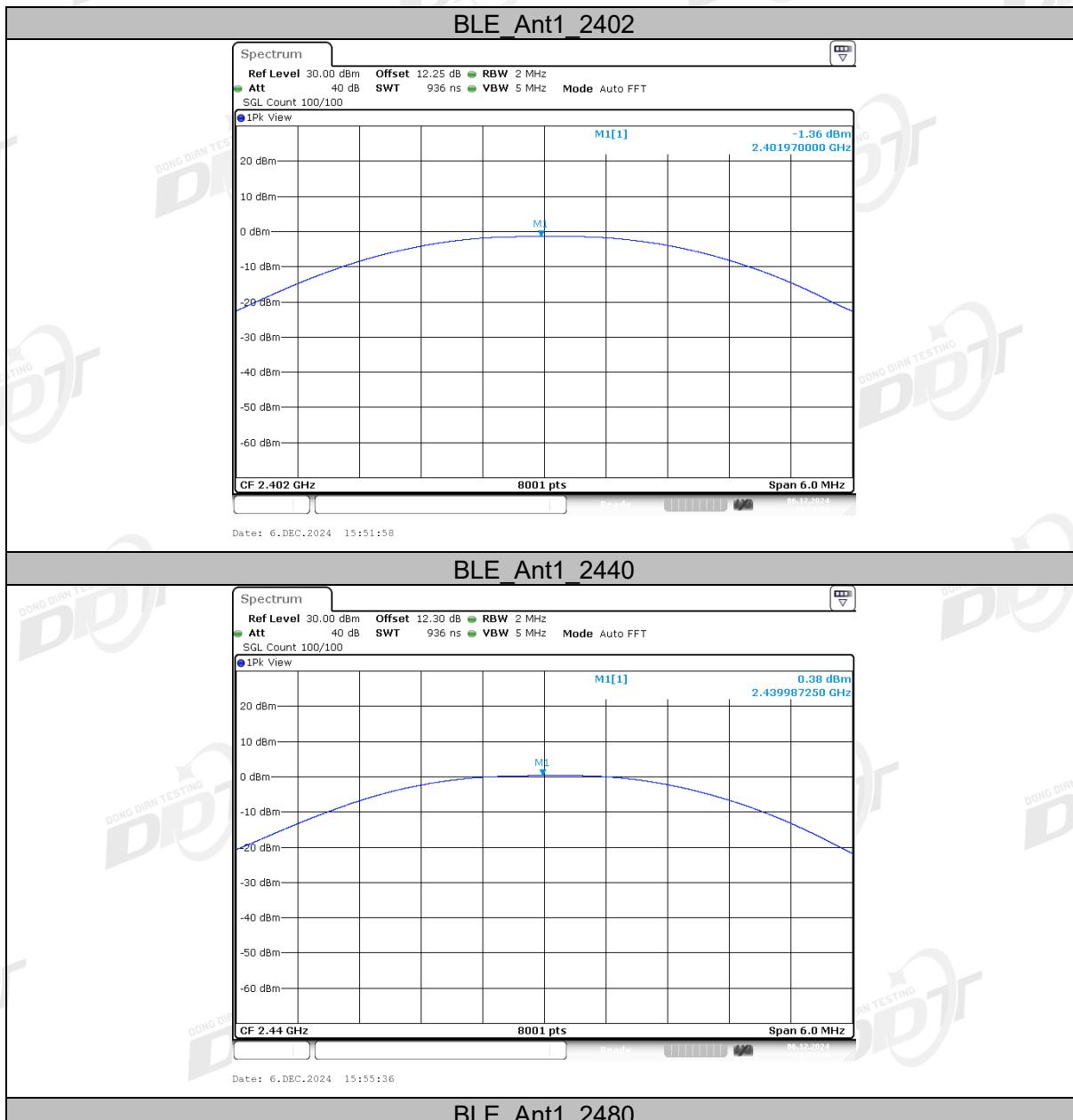
RBW:	\geq DTS bandwidth
VBW:	$\geq 3 \times$ RBW
Span	$\geq 3 \times$ RBW
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

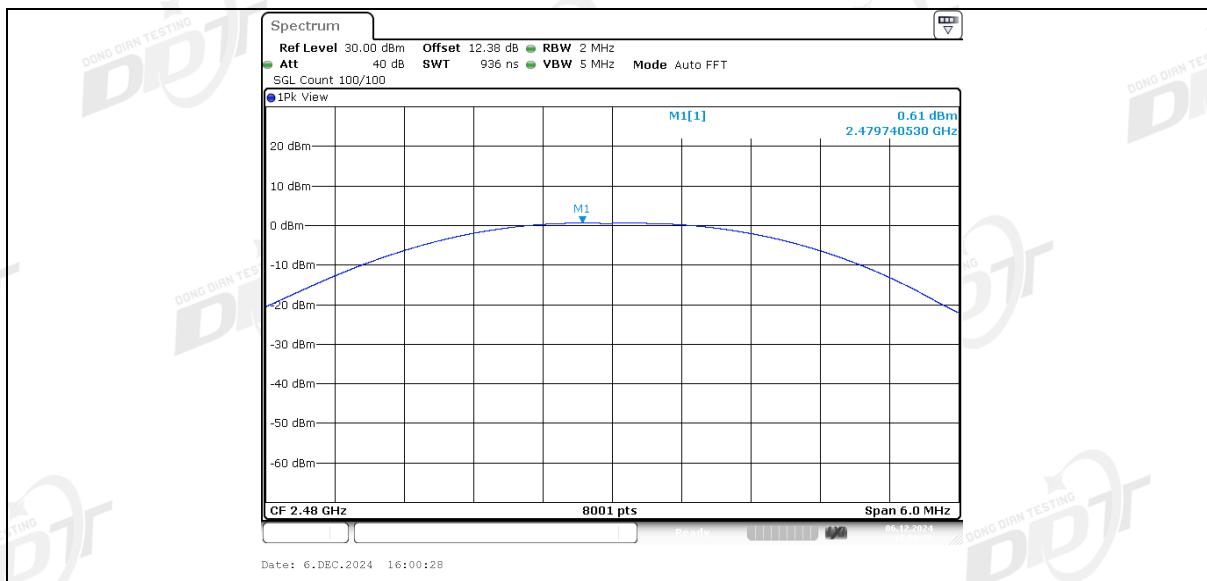
- (3) Allow the trace to stabilize, Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges measure out the PK output power.

5.4. Test result

Mode	Freq. (MHz)	Peak Output Power (dBm)	Limit (dBm)	Verdict
GFSK	2402	-1.36	≤ 20.97	Pass
	2440	0.38	≤ 20.97	Pass
	2480	0.61	≤ 20.97	Pass

5.5. Original test data





6. Power Spectral Density

6.1. Block diagram of test setup

Same with 4.1

6.2. Limits

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

6.3. Test procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Set the spectrum analyzer as follows:

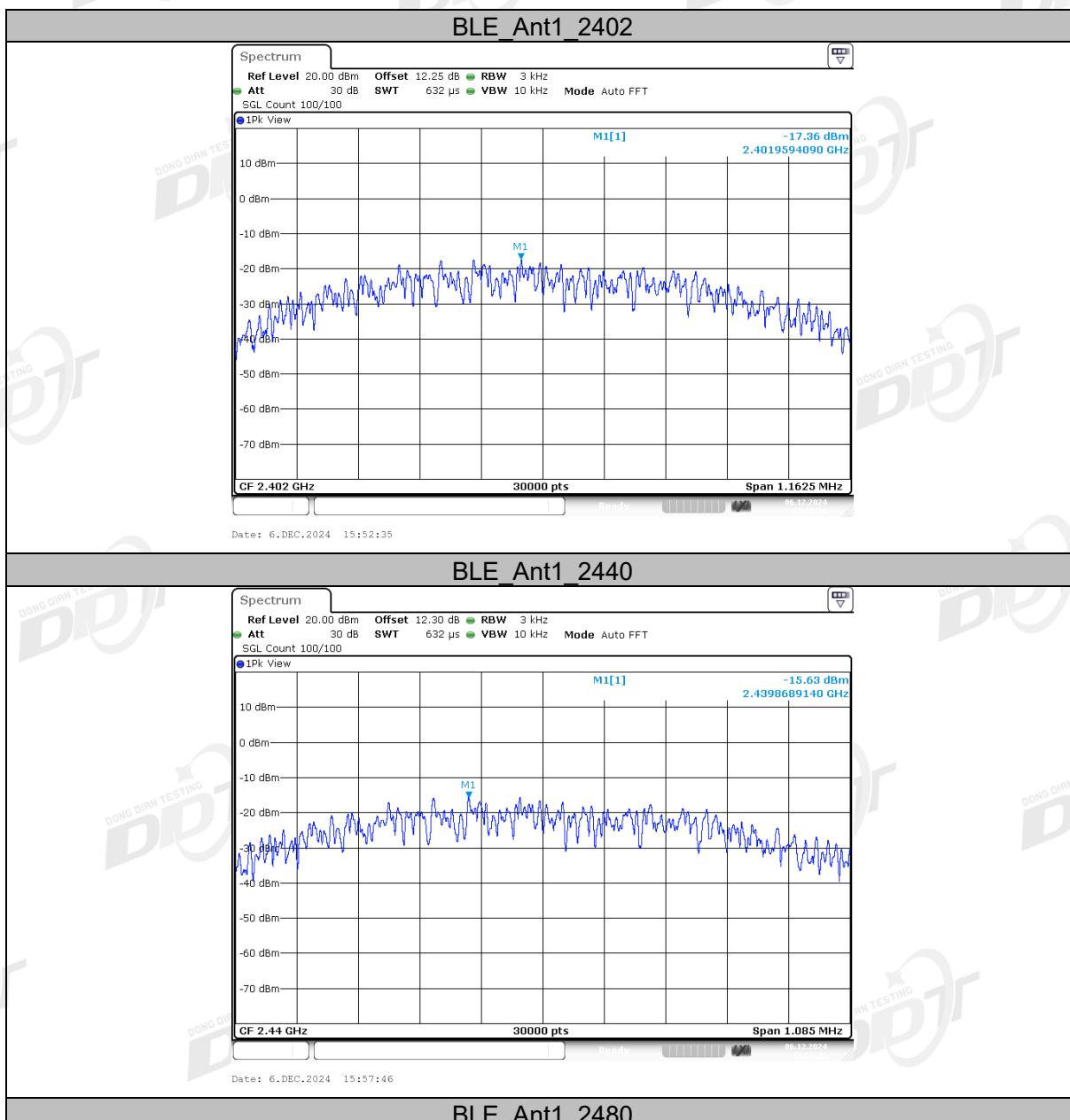
Center frequency	DTS Channel center frequency
RBW:	3 kHz ≤ RBW ≤ 100 kHz
VBW:	≥ 3RBW
Span	1.5 times the DTS bandwidth
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

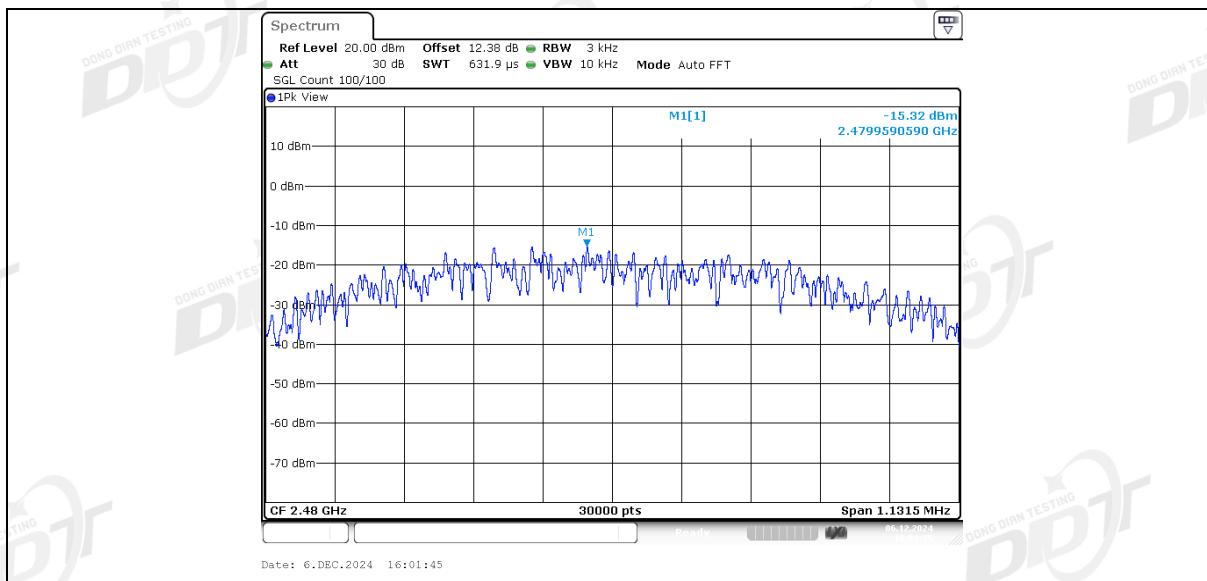
- (3) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- (4) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.4. Test result

EUT Set Mode	Antenna	Channel	Result (dBm/10 kHz)
GFSK	ANT1	CH0	-17.36
	ANT1	CH19	-15.63
	ANT1	CH39	-15.32
Limit: <8 dBm/3 kHz			Verdict: Pass

6.5. Original test data





7. Band Edge Compliance (Conducted Method)

7.1. Block diagram of test setup

Same with 4.1

7.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

7.3. Test procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Set the spectrum analyzer as follows:

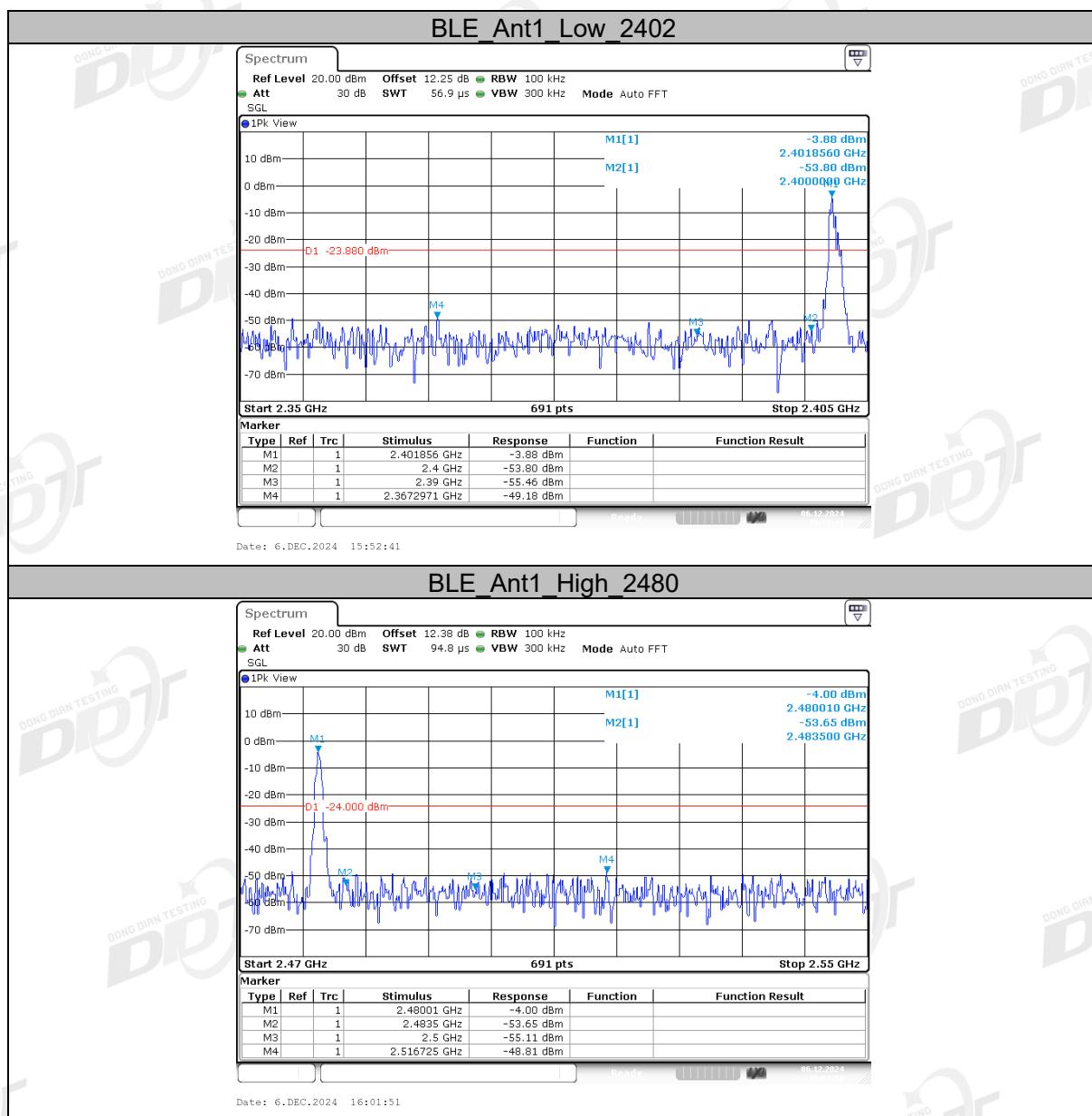
RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Number of measurement points	\geq span/RBW
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

- (3) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

7.4. Test result

EUT Set Mode	CH or Frequency	Measured Range	Verdict
GFSK	CH0	2.300 GHz - 2.405 GHz	Pass
	CH39	2.470 GHz - 2.550 GHz	Pass

7.5. Original test data



8. RF Conducted Spurious Emissions

8.1. Block diagram of test setup

Same as section 4.1

8.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

8.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

Center frequency	Test frequency
RBW:	100 kHz
VBW:	300 kHz
Span	Wide enough to capture the peak level of the in-band emission
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Set the spectrum analyzer as follows:

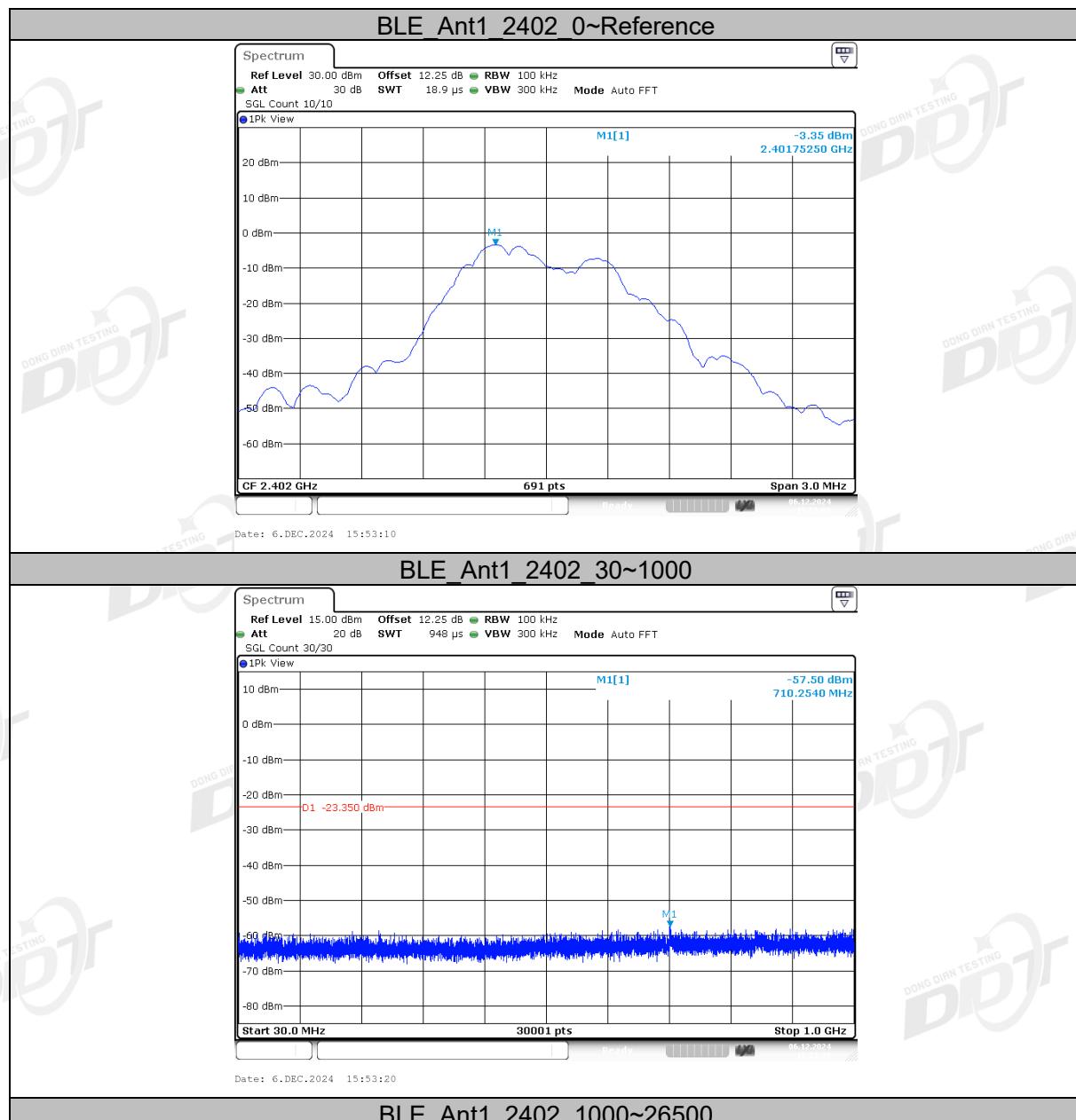
RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Number of measurement points	\geq span/RBW
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

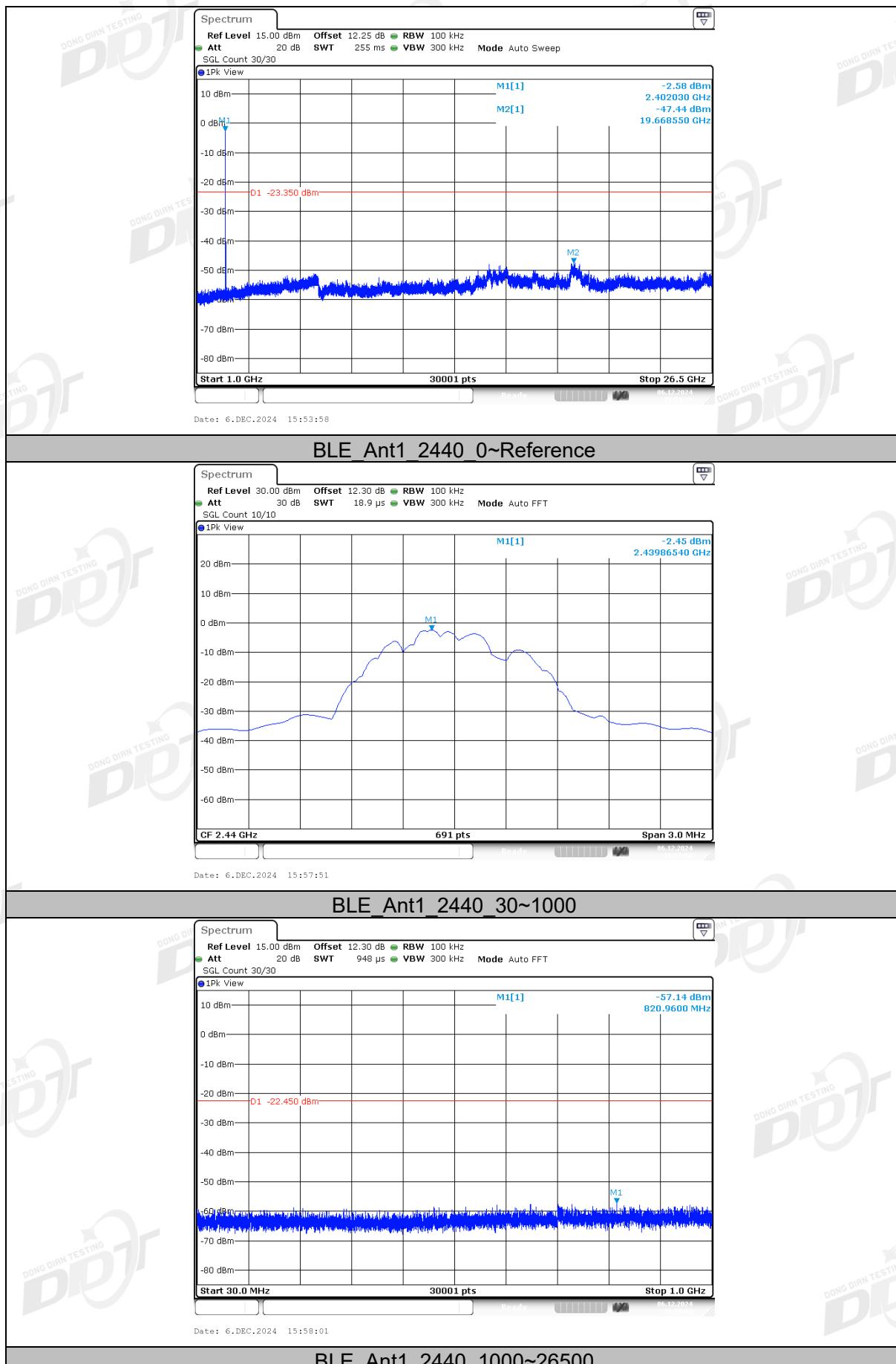
(5) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

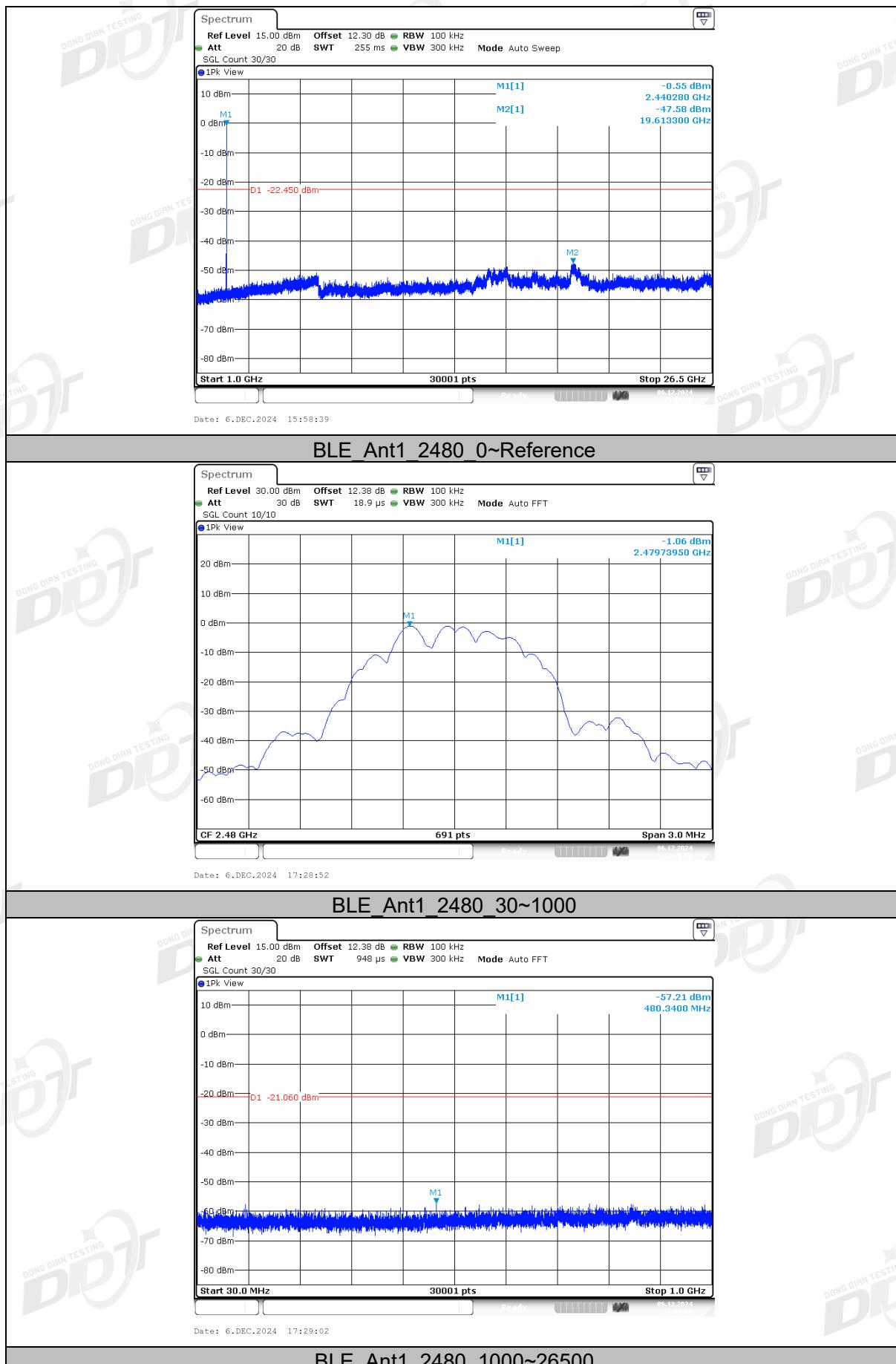
8.4. Test result

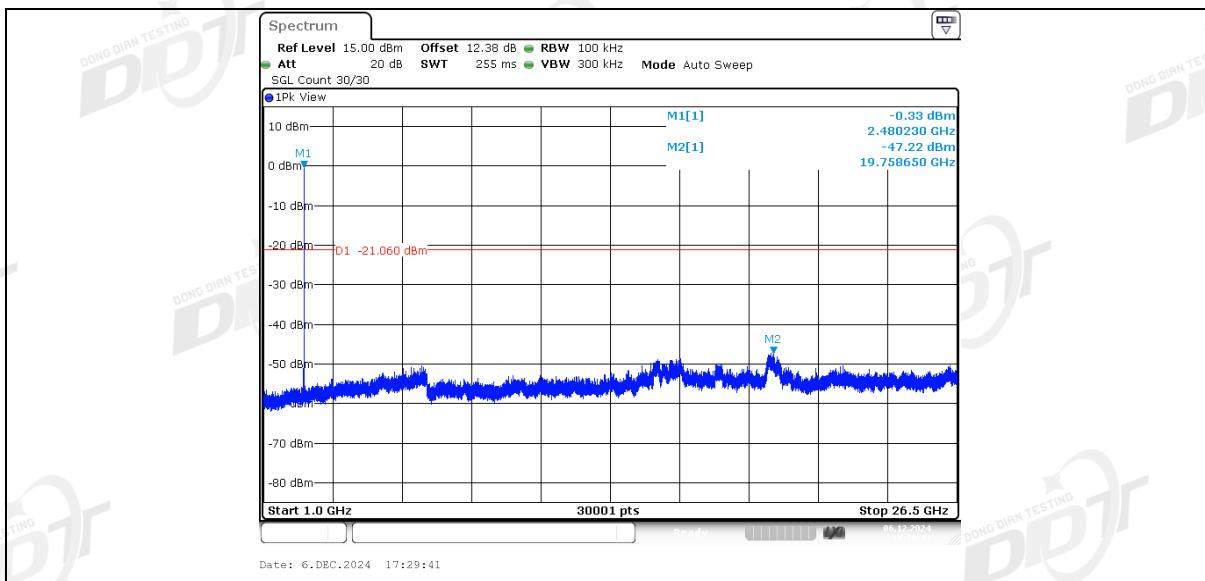
Mode	Freq. (MHz)	Verdict
GFSK	2402	Pass
	2440	Pass
	2480	Pass

8.5. Original test data





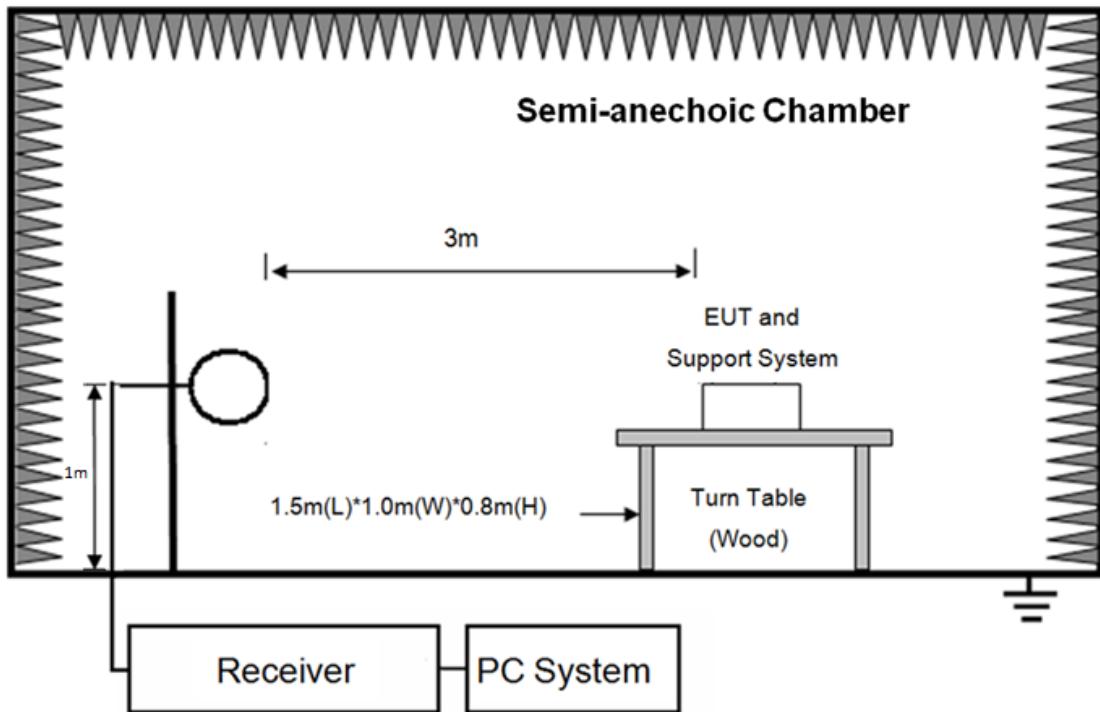




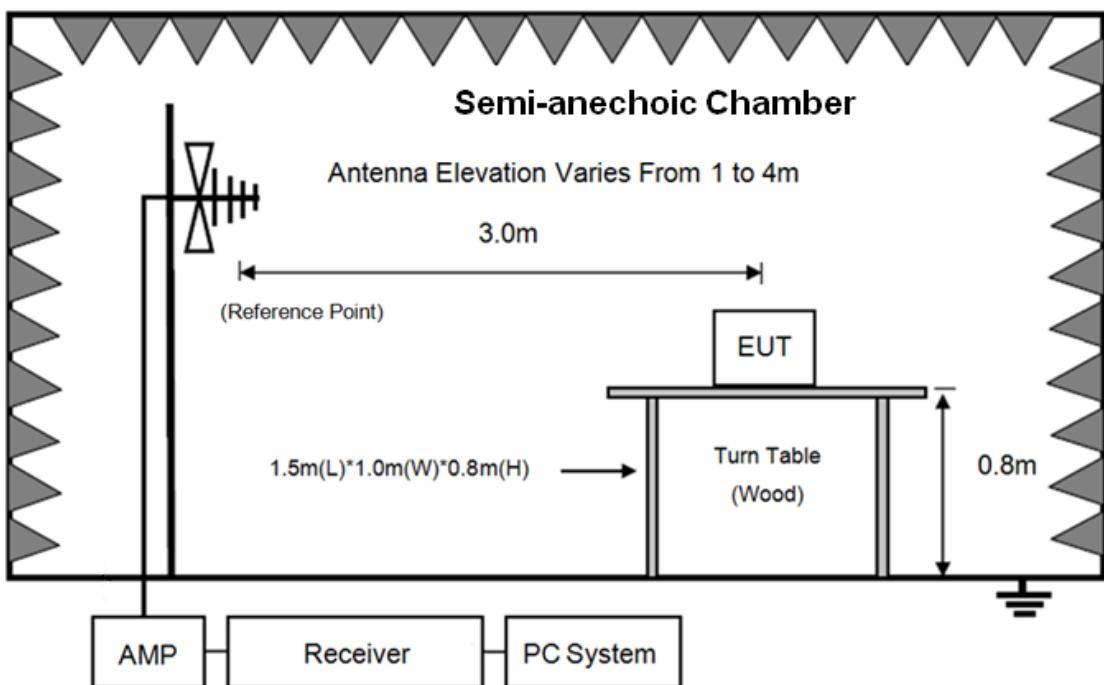
9. Radiated Emission

9.1. Block diagram of test setup

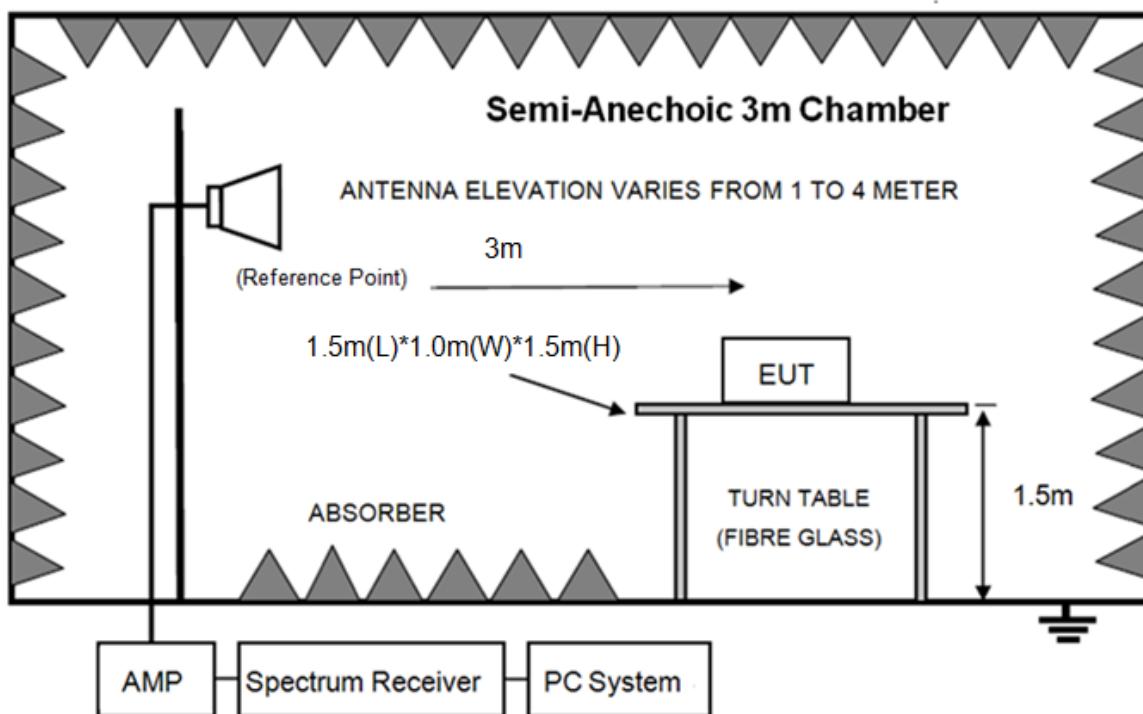
In 3 m Anechoic Chamber, test setup diagram for 9 kHz - 30 MHz:



In 3 m Anechoic Chamber, test setup diagram for 30 MHz - 1 GHz:



In 3 m Anechoic Chamber, test setup diagram for frequency above 1 GHz:



Note: For harmonic emissions test an appropriate high pass filter was inserted in the input port of AMP.

9.2. Limit

8.2.1 FCC 15.205 Restricted frequency band

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
4.1772&4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.2072&4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6

8.2.2 FCC 15.209 Limit.

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μ V/m	dB(μ V/m)
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μ V/m) (Peak) 54.0 dB(μ V/m) (Average)	

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9 - 90 kHz, 110 - 490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30 MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$$\text{Limit}_{3m}(\text{dBuV/m}) = \text{Limit}_{30m}(\text{dBuV/m}) + 40\text{Log}(30m/3m)$$

8.2.3 Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20 dB below the fundamental emissions or comply with 15.209 limits.

9.3. Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1 G and 150 cm above the ground plane inside a semi-anechoic chamber for above 1 G.
- (2) Test antenna was located 3 m from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used	Test antenna distance
9 kHz - 30 MHz	Active Loop antenna	3 m
30 MHz - 1 GHz	Trilog Broadband Antenna	3 m
1 GHz - 18 GHz	Double Ridged Horn Antenna (1 GHz - 18 GHz)	3 m
18 GHz - 40 GHz	Horn Antenna (18 GHz - 40 GHz)	3 m

According ANSI C63.10:2013 clause 6.4.4.2 and 6.5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also is positioned with its plane horizontal at the specified distance from the EUT. The center of the

loop is 1 m above the ground. For measurement above 30 MHz, the Trilog Broadband Antenna or Horn Antenna was located 3 m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(3) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9 kHz to 26 GHz:

(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1 m to 4 m (Except loop antenna, it's fixed 1 m above ground.)

(b) Change work frequency or channel of device if practicable.

(c) Change modulation type of device if practicable.

(d) Change power supply range from 85% to 115% of the rated supply voltage

(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.

Spectrum frequency from 9 kHz to 26 GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 9 kHz to 30 MHz and 18 GHz to 26 GHz, so below final test was performed with frequency range from 30 MHz to 18 GHz.

(4) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013 on Radiated Emission test.

(5) The emissions from 9 kHz to 1 GHz were measured based on CISPR QP detector except for the frequency bands 9 - 90 kHz, 110 - 490 kHz, for emissions from 9 kHz - 90 kHz, 110 kHz - 490 kHz and above 1 GHz were measured based on average detector, for emissions above 1 GHz, peak emissions also be measured and need comply with Peak limit.

(6) The emissions from 9 kHz to 1 GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9 kHz - 150 kHz	200 Hz
150 kHz - 30 MHz	9 kHz
30 MHz - 1 GHz	120 kHz

(7) For emissions above 1 GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1 MHz, VBW is set at 3 MHz for Peak measure; According ANSI C63.10:2013 clause 4.1.4.2.2 procedure for average measure.

(8) X axis, Y axis, Z axis are tested, and worse setup X axis is reported.

9.4. Test result

Pass. (See below detailed test result)

All the emissions except fundamental emission from 9 kHz to 26 GHz were comply with 15.209 limits.

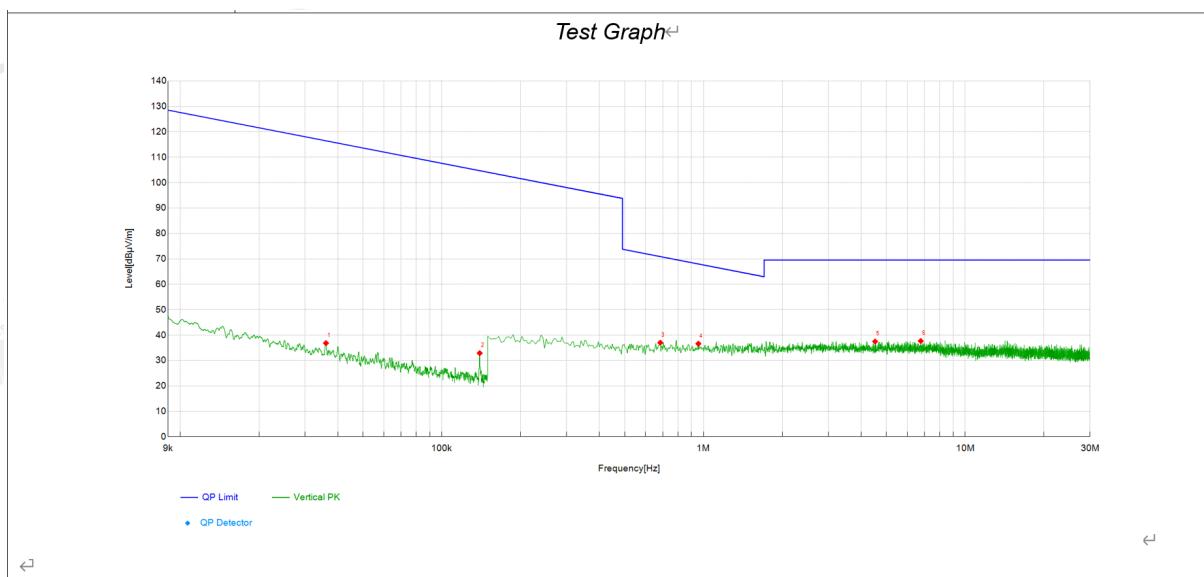
Note1: For emissions 9KHz to 30 MHz and 18 GHz to 26 GHz, according exploratory explorer test, when change Tx mode and channel, have no distinct influence on emissions level, so for emissions 9KHz to 30 MHz and 18 GHz to 26 GHz, the final test was only performed with EUT working in the worst case, Tx 2402 MHz mode.

Note2: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

Note3: Scan with all modes, the worst case was recorded in this report.

Radiated Emission test (9KHz-30MHz)

Mode	Test channel	Ant. Pol.
GFSK	2402MHz	N/A

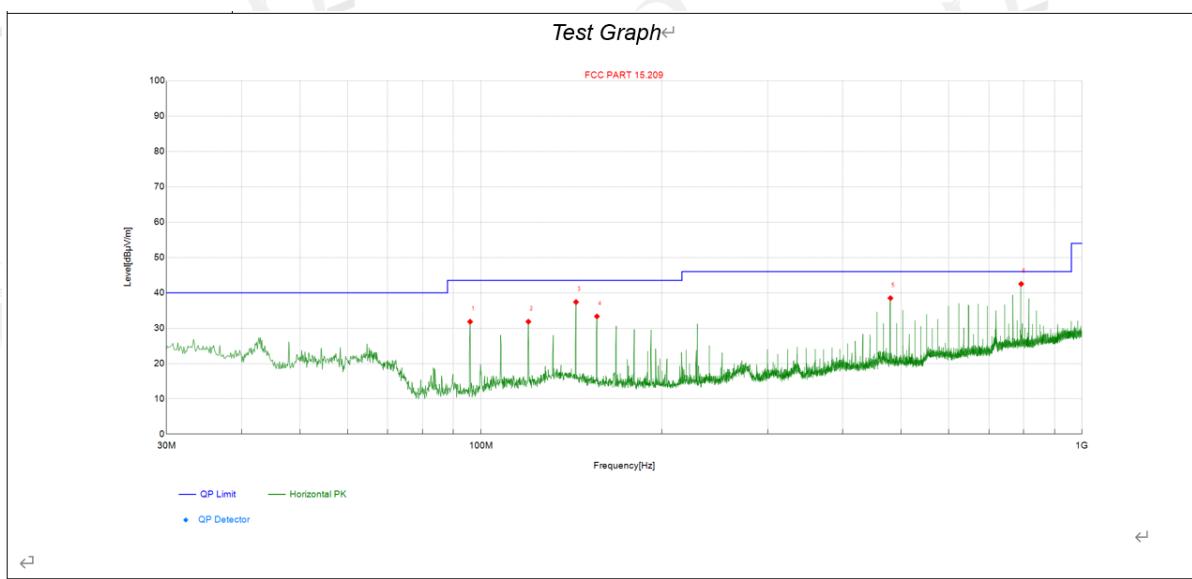


NO.	Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Verdict
1	0.04	16.35	36.86	20.51	116.46	79.60	100	130	PK	PASS
2	0.14	12.53	32.91	20.38	104.71	71.80	100	220	PK	PASS
3	0.68	16.69	37.03	20.34	70.91	33.88	100	78	PK	PASS
4	0.96	16.22	36.63	20.41	68.00	31.37	100	314	PK	PASS
5	4.53	17.12	37.48	20.36	69.54	32.06	100	85	PK	PASS
6	6.77	17.41	37.69	20.28	69.54	31.85	100	65	PK	PASS

Note: If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

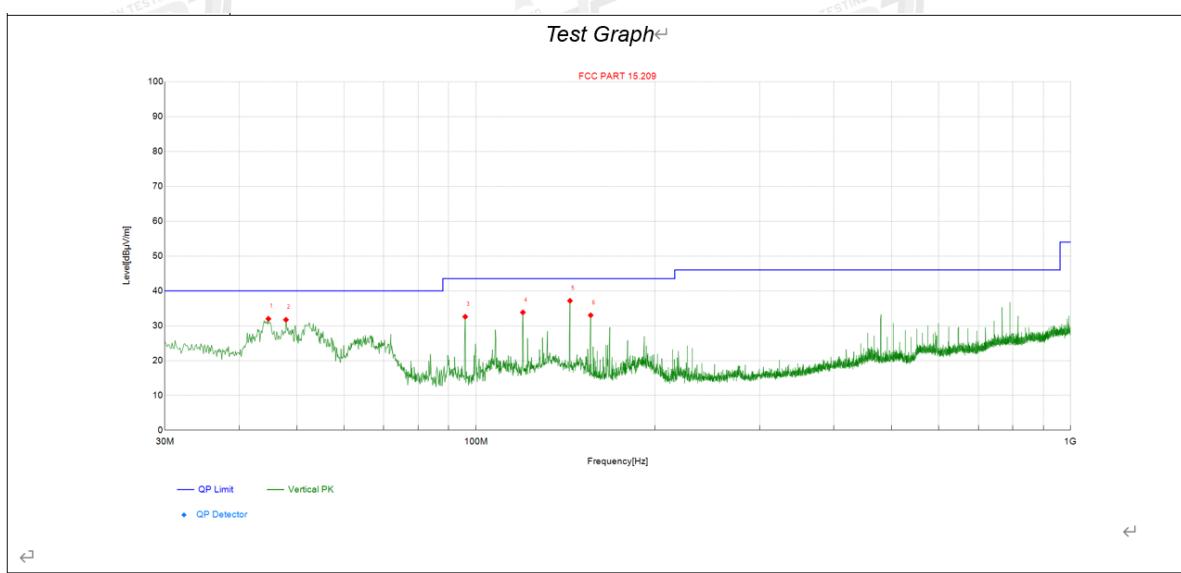
Radiated Emission test (30MHz-1 GHz)

Mode	Test channel	Ant. Pol.
GFSK	2402MHz	N/A



Suspected Data List												
NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	95.96	51.48	31.82	-19.66	43.50	11.68	200	164	PK	H	PASS	
2	119.97	49.02	31.83	-17.19	43.50	11.67	200	154	PK	H	PASS	
3	143.98	53.75	37.39	-16.36	43.50	6.11	200	99	PK	H	PASS	
4	155.98	50.35	33.32	-17.03	43.50	10.18	200	99	PK	H	PASS	
5	480.08	49.06	38.49	-10.57	46.00	7.51	200	339	PK	H	PASS	
6	792.18	47.47	42.50	-4.97	46.00	3.50	100	49	PK	H	PASS	

Note: If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

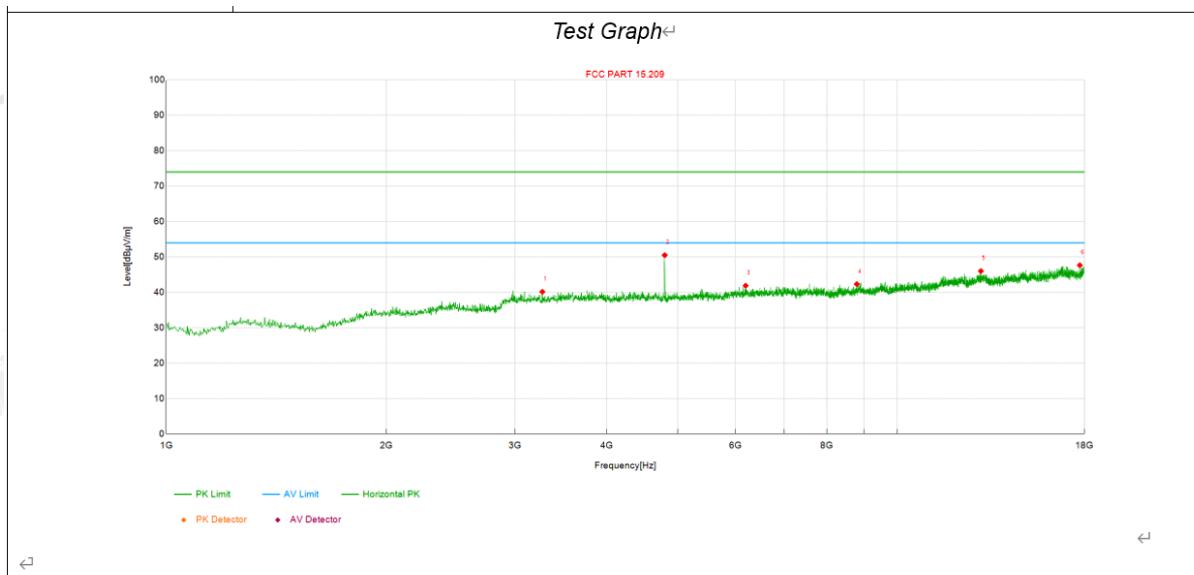


Suspected Data List												
NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	44.79	45.35	31.98	-13.37	40.00	8.02	100	136	PK	V	PASS	
2	47.95	46.52	31.70	-14.82	40.00	8.30	100	220	PK	V	PASS	
3	95.96	52.24	32.58	-19.66	43.50	10.92	100	284	PK	V	PASS	
4	119.97	51.01	33.82	-17.19	43.50	9.68	100	62	PK	V	PASS	
5	143.98	53.52	37.16	-16.36	43.50	6.34	100	6	PK	V	PASS	
6	155.98	50.03	33.00	-17.03	43.50	10.50	100	34	PK	V	PASS	

Note: If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

Radiated Emission test (1GHz-18GHz)

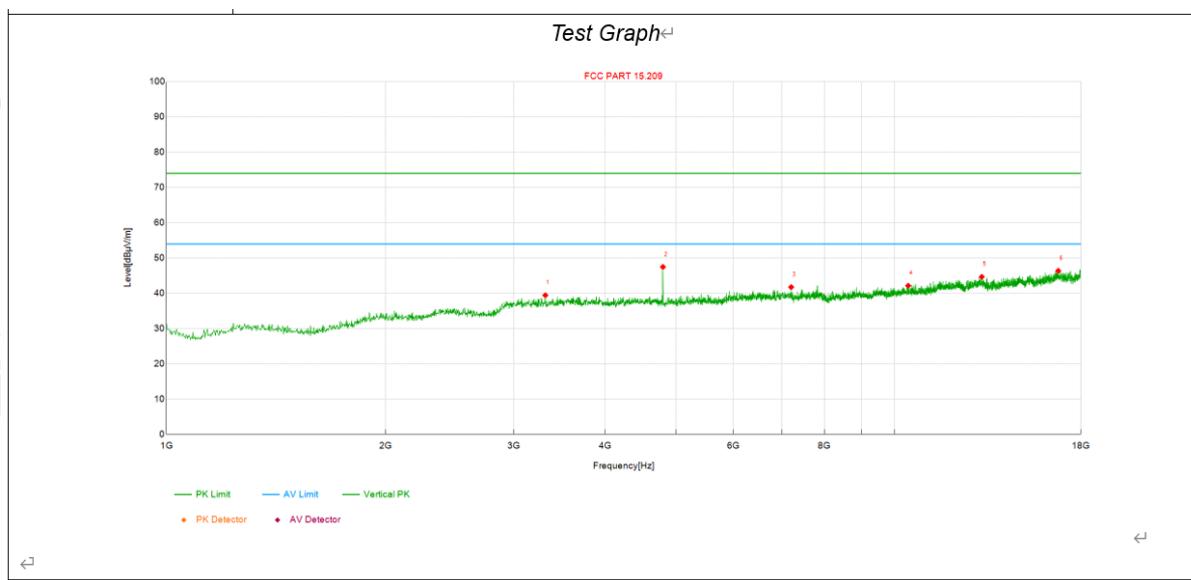
Mode	Test channel	Ant. Pol.
GFSK	2402MHz	Horizontal



NO.	Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Pol.	Verdict
1	3267.38	56.17	40.16	-16.01	74.00	33.84	200	Hori	PASS
2	4803.75	62.74	50.51	-12.23	74.00	23.49	200	Hori	PASS
3	6197.75	51.33	41.89	-9.44	74.00	32.11	200	Hori	PASS
4	8794.50	49.79	42.33	-7.46	74.00	31.67	200	Hori	PASS
5	12995.63	47.64	46.00	-1.64	74.00	28.00	200	Hori	PASS
6	17747.13	45.10	47.65	2.55	74.00	26.35	200	Hori	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

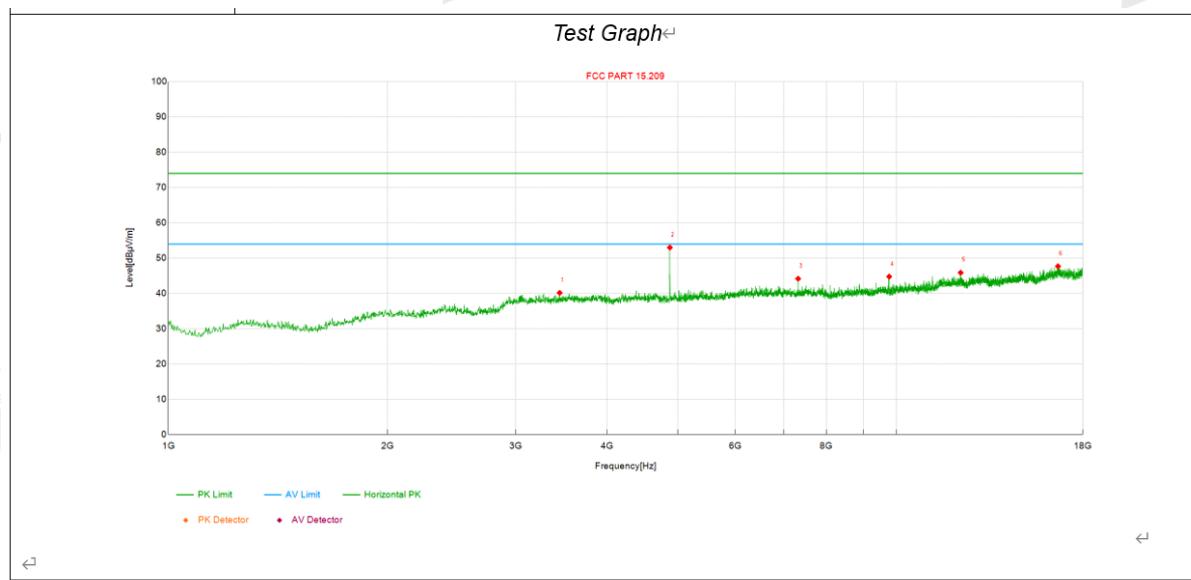
Mode	Test channel	Ant. Pol.
GFSK	2402MHz	Vertical



NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Det.	Pol.	Verdict
1	3312.00	55.36	39.44	-15.92	74.00	34.56	PK	Vert	PASS
2	4803.75	59.70	47.47	-12.23	74.00	26.53	PK	Vert	PASS
3	7205.00	50.25	41.75	-8.50	74.00	32.25	PK	Vert	PASS
4	10430.75	47.08	42.14	-4.94	74.00	31.86	PK	Vert	PASS
5	13159.25	46.27	44.66	-1.61	74.00	29.34	PK	Vert	PASS
6	16759.00	44.09	46.37	2.28	74.00	27.63	PK	Vert	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

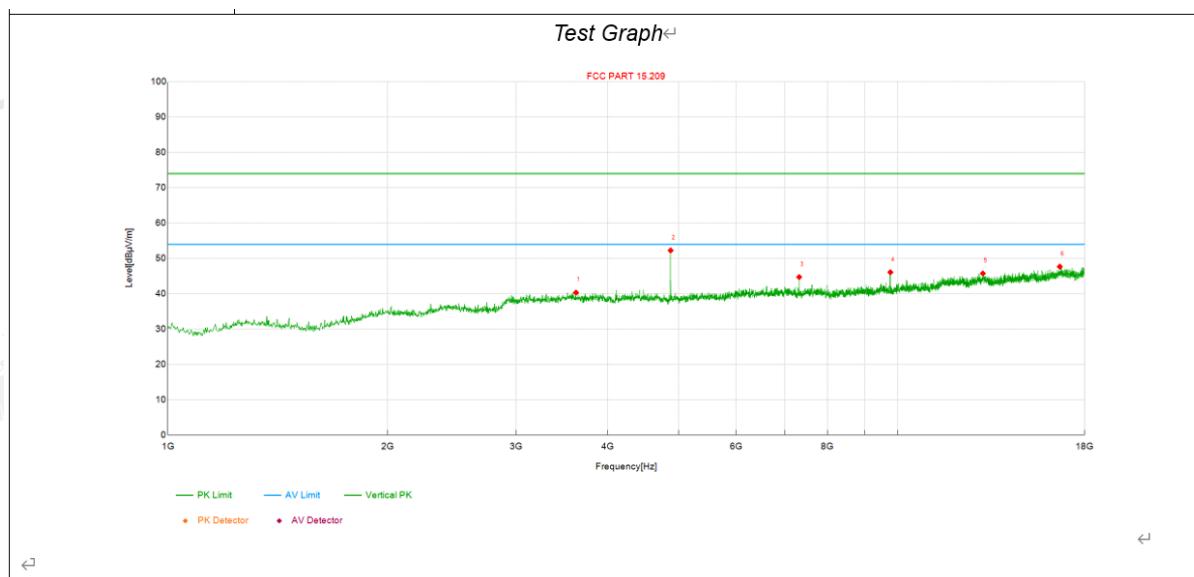
Mode	Test channel	Ant. Pol.
GFSK	2440MHz	Horizontal



NO.	Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Limit [dB μ V/m]	Margin [dB]	Det	Pol	Verdict
1	3443.75	55.57	40.16	-15.41	74.00	33.84	PK	Hori	PASS
2	4880.25	65.15	53.01	-12.14	74.00	20.99	PK	Hori	PASS
3	7319.75	52.72	44.17	-8.55	74.00	29.83	PK	Hori	PASS
4	9761.38	50.72	44.77	-5.95	74.00	29.23	PK	Hori	PASS
5	12234.88	48.24	45.86	-2.38	74.00	28.14	PK	Hori	PASS
6	16644.25	45.42	47.69	2.27	74.00	26.31	PK	Hori	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

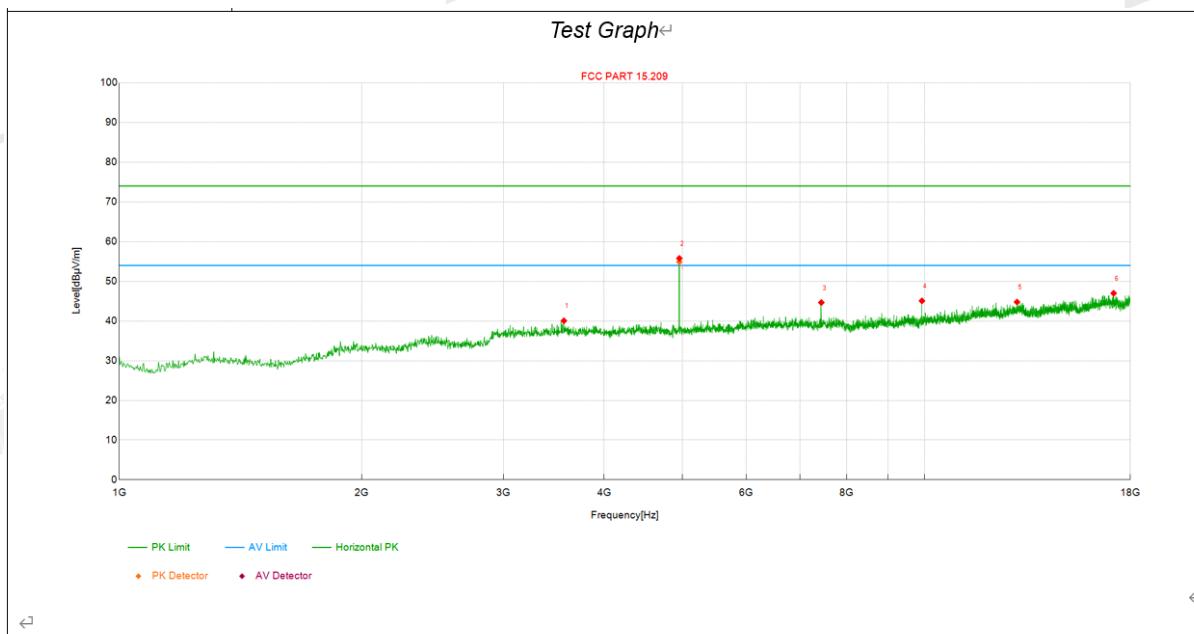
Mode	Test channel	Ant. Pol.
GFSK	2440MHz	Vertical



NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Verdict
1	3620.13	55.05	40.33	-14.72	74.00	33.67	200	Vert	PASS
2	4880.25	64.41	52.27	-12.14	74.00	21.73	100	Vert	PASS
3	7319.75	53.27	44.72	-8.55	74.00	29.28	100	Vert	PASS
4	9759.25	52.03	46.08	-5.95	74.00	27.92	100	Vert	PASS
5	13061.50	47.30	45.74	-1.56	74.00	28.26	200	Vert	PASS
6	16648.50	45.41	47.68	2.27	74.00	26.32	100	Vert	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

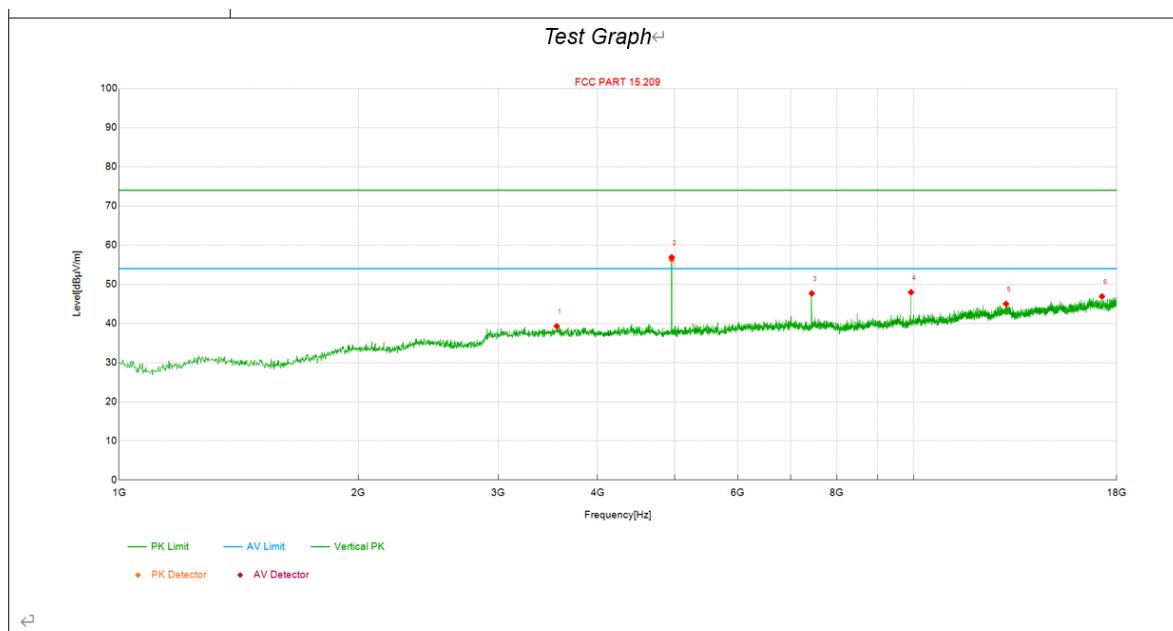
Mode	Test channel	Ant. Pol.
BLE	2480MHz	Horizontal



NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Det.	Pol.	Verdict
1	3564.88	54.91	40.05	-14.86	74.00	33.95	PK	Hori	PASS
2	4958.88	67.79	55.78	-12.01	74.00	18.22	PK	Hori	PASS
3	4958.88	62.40	50.39	-12.01	54.00	3.61	AV	Hori	PASS
4	7440.88	53.23	44.64	-8.59	74.00	29.36	PK	Hori	PASS
5	9920.75	50.73	45.07	-5.66	74.00	28.93	PK	Hori	PASS
6	13019.00	46.40	44.78	-1.62	74.00	29.22	PK	Hori	PASS
7	17160.63	44.54	46.98	2.44	74.00	27.02	PK	Hori	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

Mode	Test channel	Ant. Pol.
BLE	2480MHz	Vertical

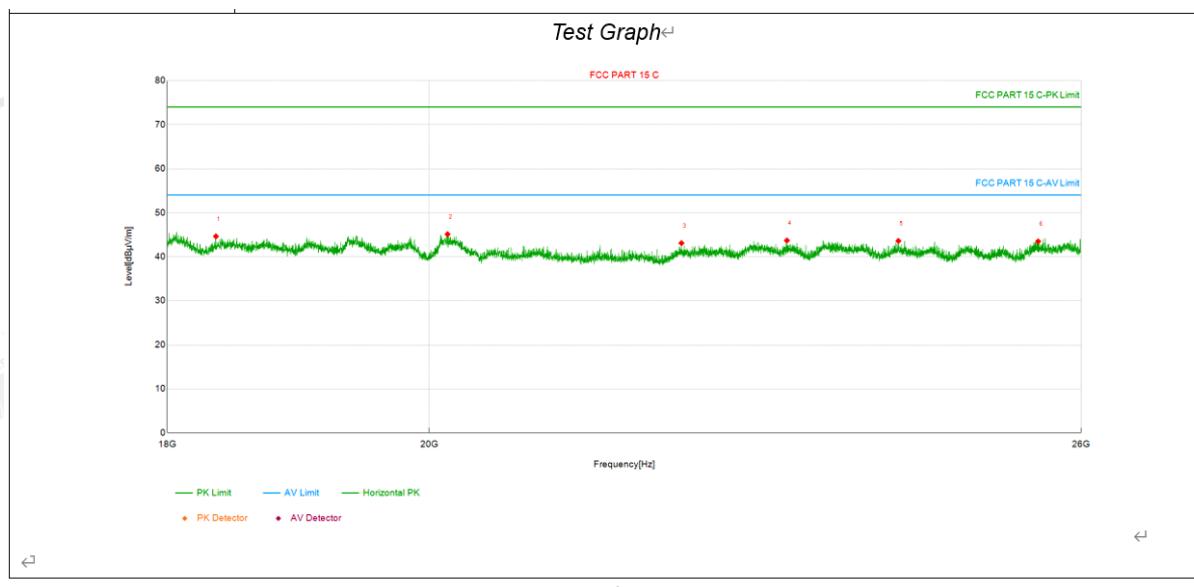


NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Det.	Pol.	Verdict
1	3554.25	54.17	39.28	-14.89	74.00	34.72	PK	Vert	PASS
2	4958.88	68.88	56.87	-12.01	74.00	17.13	PK	Vert	PASS
3	4958.88	64.58	52.57	-12.01	54.00	1.43	AV	Vert	PASS
4	7440.88	56.25	47.66	-8.59	74.00	26.34	PK	Vert	PASS
5	9920.75	53.61	47.95	-5.66	74.00	26.05	PK	Vert	PASS
6	13061.50	46.52	44.96	-1.56	74.00	29.04	PK	Vert	PASS
7	17249.88	44.42	46.88	2.46	74.00	27.12	PK	Vert	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

Radiated Emission test (18GHz-26GHz)

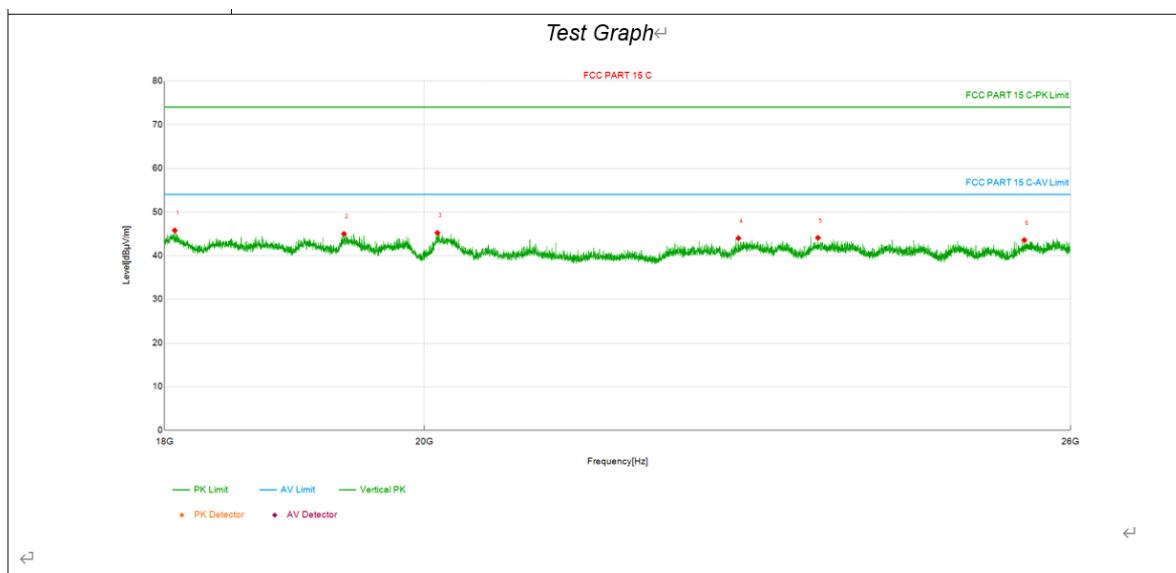
Mode	Test channel	Ant. Pol.
BLE	2402MHz	Horizontal



Suspected Data List												
NO.	Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	18355.00	36.40	44.64	8.24	74.00	29.36	100	279	PK	Hori	PASS	
2	20148.00	38.51	45.13	6.62	74.00	28.87	100	131	PK	Hori	PASS	
3	22137.00	36.28	43.10	6.82	74.00	30.90	100	190	PK	Hori	PASS	
4	23097.00	36.21	43.70	7.49	74.00	30.30	100	3	PK	Hori	PASS	
5	24157.00	36.81	43.60	6.79	74.00	30.40	100	40	PK	Hori	PASS	
6	25555.00	36.67	43.50	6.83	74.00	30.50	100	249	PK	Hori	PASS	

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

Mode	Test channel	Ant. Pol.
BLE	2402MHz	Vertical

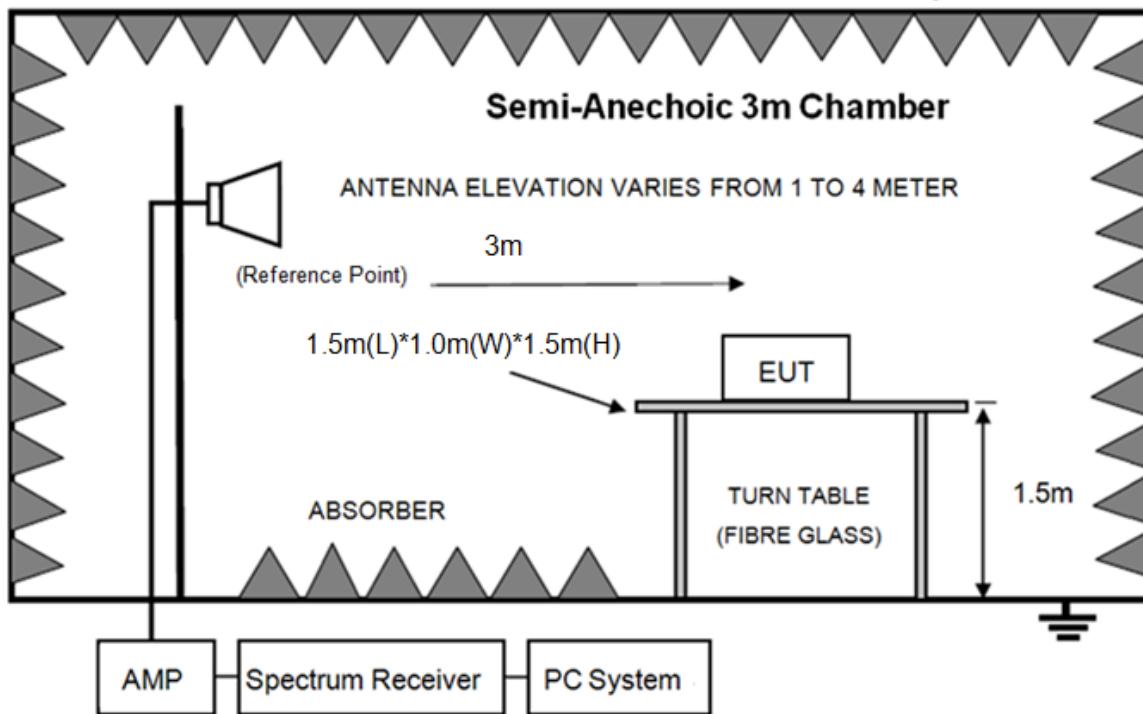


Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	18073.00	37.42	45.77	8.35	74.00	28.23	100	122	PK	Vert	PASS
2	19359.00	38.13	44.99	6.86	74.00	29.01	100	72	PK	Vert	PASS
3	20107.00	38.63	45.22	6.59	74.00	28.78	100	262	PK	Vert	PASS
4	22721.00	36.48	44.00	7.52	74.00	30.00	100	12	PK	Vert	PASS
5	23467.00	36.70	44.09	7.39	74.00	29.91	100	359	PK	Vert	PASS
6	25518.00	36.94	43.58	6.64	74.00	30.42	100	212	PK	Vert	PASS

Note: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

10. Emissions in Restricted Frequency Bands

10.1. Block diagram of test setup



10.2. Limit

All restriction band should comply with 15.209, other emission should be at least 20 dB below the fundamental.

10.3. Test Procedure

Same with clause 8.3 except change investigated frequency range from 2310 MHz to 2410 MHz and 2475 MHz to 2500 MHz.

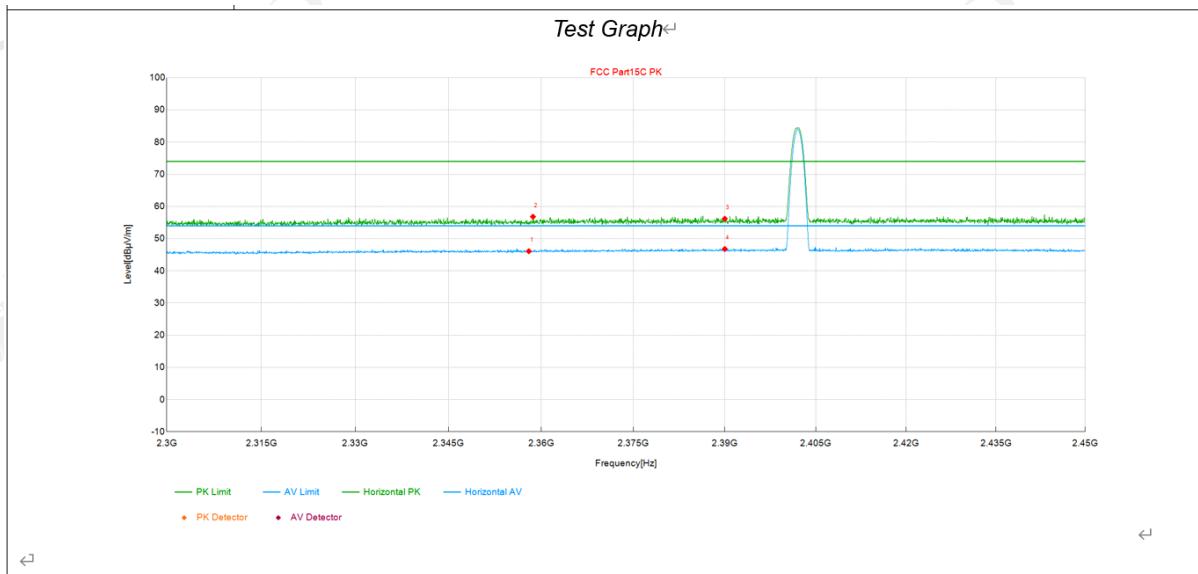
Remark: All restriction band have been tested, and only the worst case is shown in report.

10.4. Test result

Pass. (See below detailed test result)

Radiated Emission Test Result

Mode	Test channel	Ant. Pol.
BLE	2402MHz	Horizontal

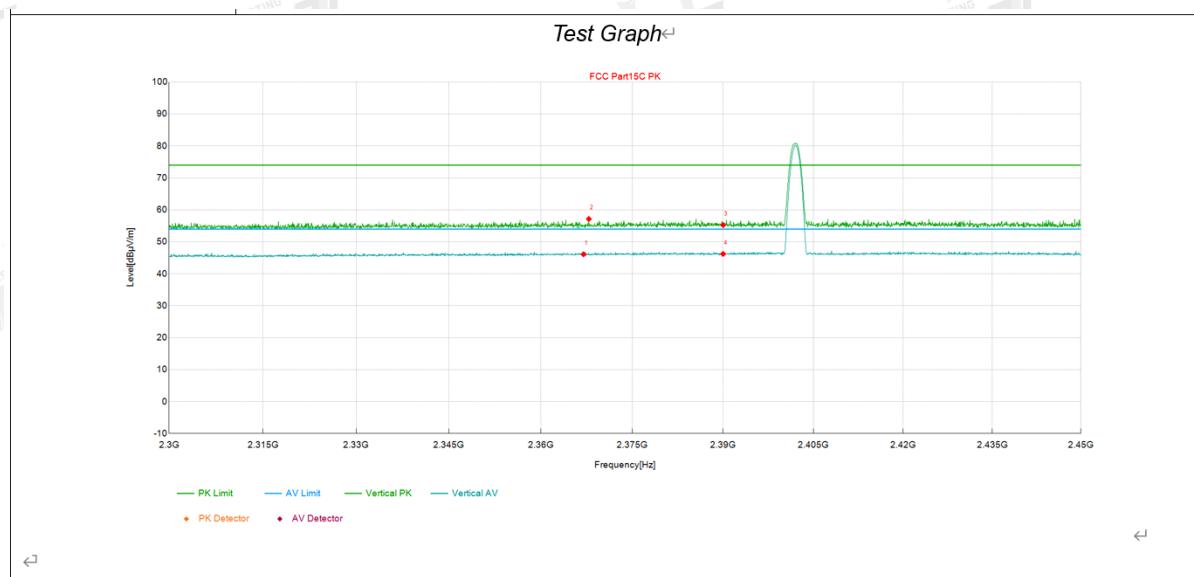


Suspected Data List												
NO.	Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	2358.00	46.92	46.11	-0.81	54.00	7.89	100	68	AV	Hori	PASS	
2	2358.67	57.64	56.83	-0.81	74.00	17.17	200	211	PK	Hori	PASS	
3	2390.00	56.77	56.20	-0.57	74.00	17.80	150	224	PK	Hori	PASS	
4	2390.00	47.37	46.80	-0.57	54.00	7.20	100	76	AV	Hori	PASS	

Note: 1. Result Level = Read Level + Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

Radiated Emission Test Result

Mode	Test channel	Ant. Pol.
BLE	2402MHz	Vertical



Suspected Data List												
NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	2367.00	46.84	46.10	-0.74	54.00	7.90	100	6	AV	Vert	PASS	
2	2367.87	57.89	57.16	-0.73	74.00	16.84	100	145	PK	Vert	PASS	
3	2390.00	55.84	55.27	-0.57	74.00	18.73	200	266	PK	Vert	PASS	
4	2390.00	46.79	46.22	-0.57	54.00	7.78	150	270	AV	Vert	PASS	

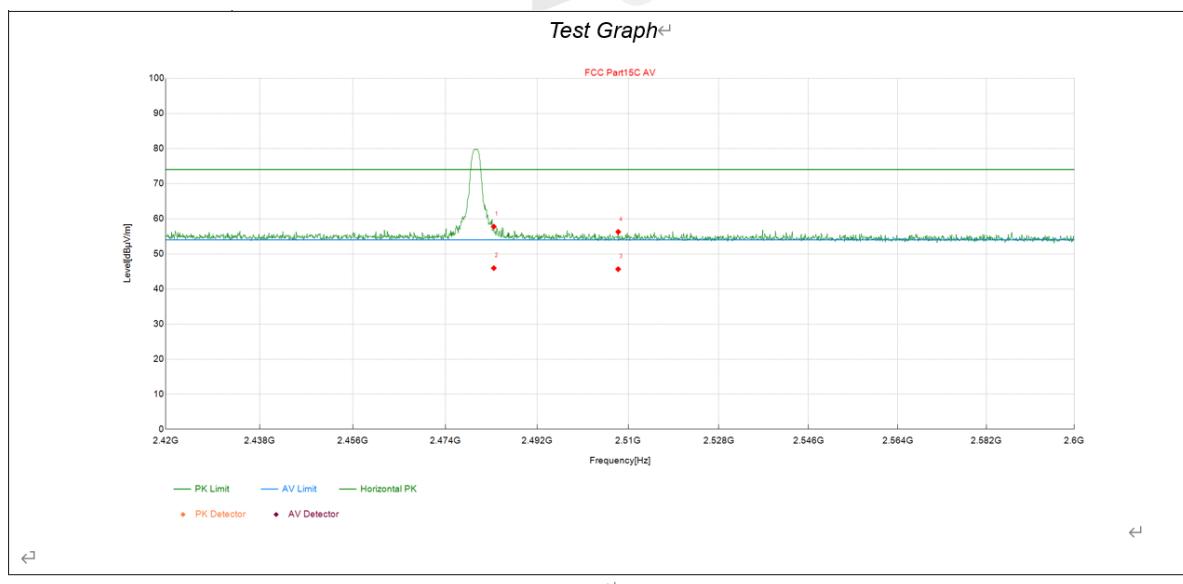
Note: 1. Result Level = Read Level + Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

Radiated Emission Test Result

Mode	Test channel	Ant. Pol.
BLE	2480MHz	Horizontal



Suspected Data List												
NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict	
1	2483.50	58.40	57.75	-0.65	74.00	16.25	200	90	PK	H	PASS	
2	2483.50	46.57	45.92	-0.65	54.00	8.08	150	270	AV	H	PASS	
3	2508.00	46.35	45.62	-0.73	54.00	8.38	150	0	AV	H	PASS	
4	2508.02	56.98	56.25	-0.73	74.00	17.75	150	0	PK	H	PASS	

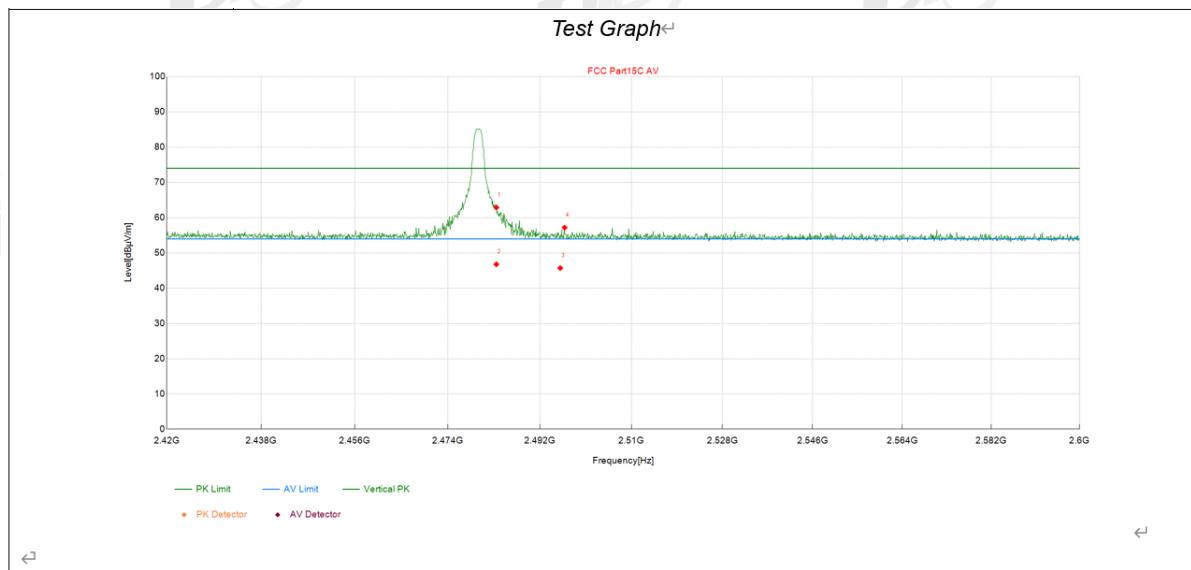
Note: 1. Result Level = Read Level + Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

Radiated Emission Test Result

Mode	Test channel	Ant. Pol.
BLE	2480MHz	Vertical



Suspected Data List											
NO.	Frequency [MHz]	Reading [dBuV]	Level [dBuV/m]	Factor [dB/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2483.50	63.53	62.88	-0.65	74.00	11.12	200	360	PK	V	PASS
2	2483.50	47.41	46.76	-0.65	54.00	7.24	200	360	AV	V	PASS
3	2496.00	46.37	45.69	-0.68	54.00	8.31	200	0	AV	V	PASS
4	2496.86	57.85	57.18	-0.67	74.00	16.82	150	0	PK	V	PASS

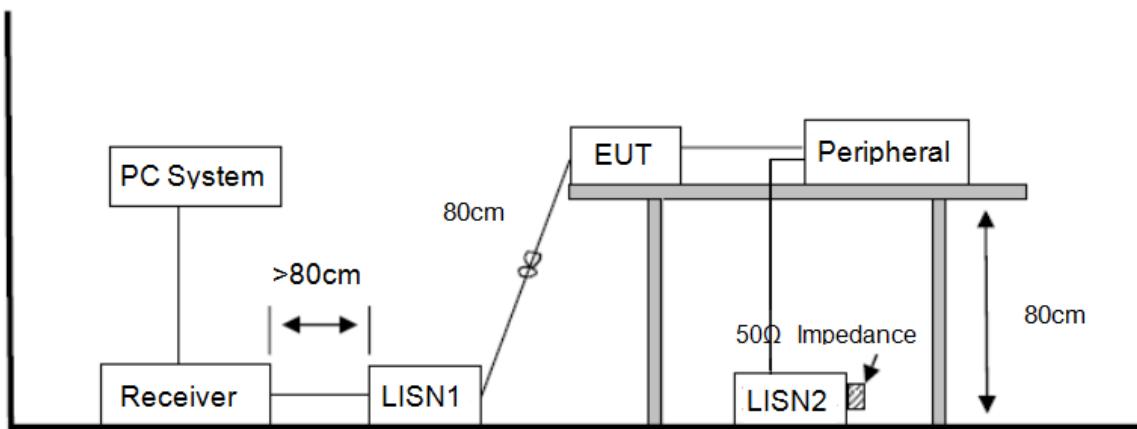
Note: 1. Result Level = Read Level + Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

11. Power Line Conducted Emission

11.1. Block diagram of test setup



11.2. Power line conducted emission limits

Frequency	Quasi-Peak Level dB(µV)	Average Level dB(µV)
150 kHz ~ 500 kHz	66 ~ 56*	56 ~ 46*
500 kHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50

Note 1: * Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

11.3. Test procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80 cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 9 kHz.

11.4. Test result

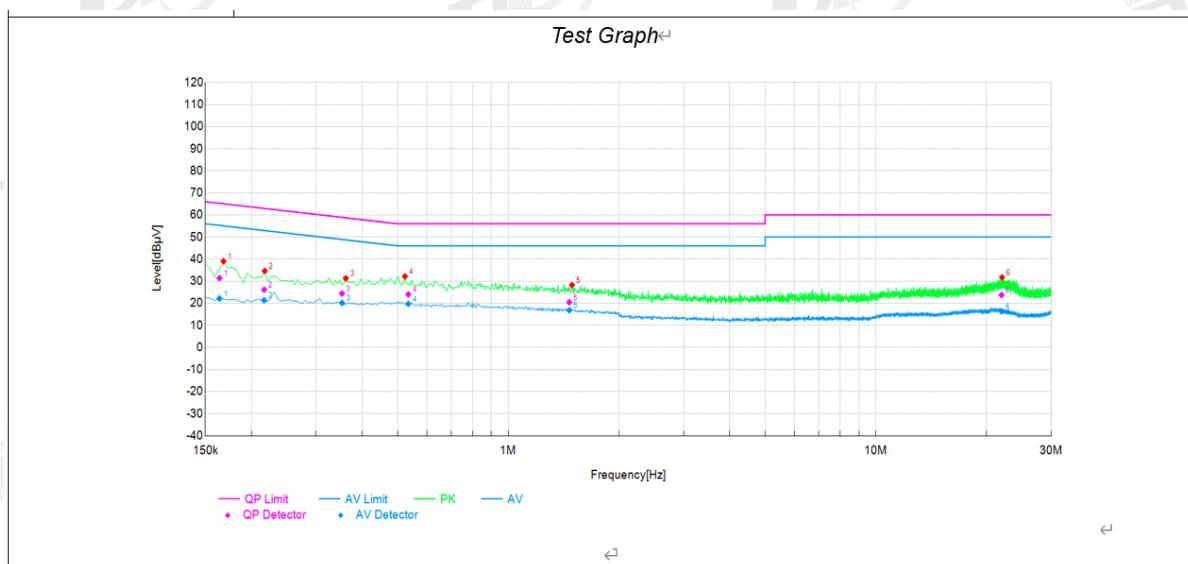
PASS. (See below detailed test result)

Note1: All emissions not reported below are too low against the prescribed limits.

Note2: “----” means Peak detection; “----” means Average detection.

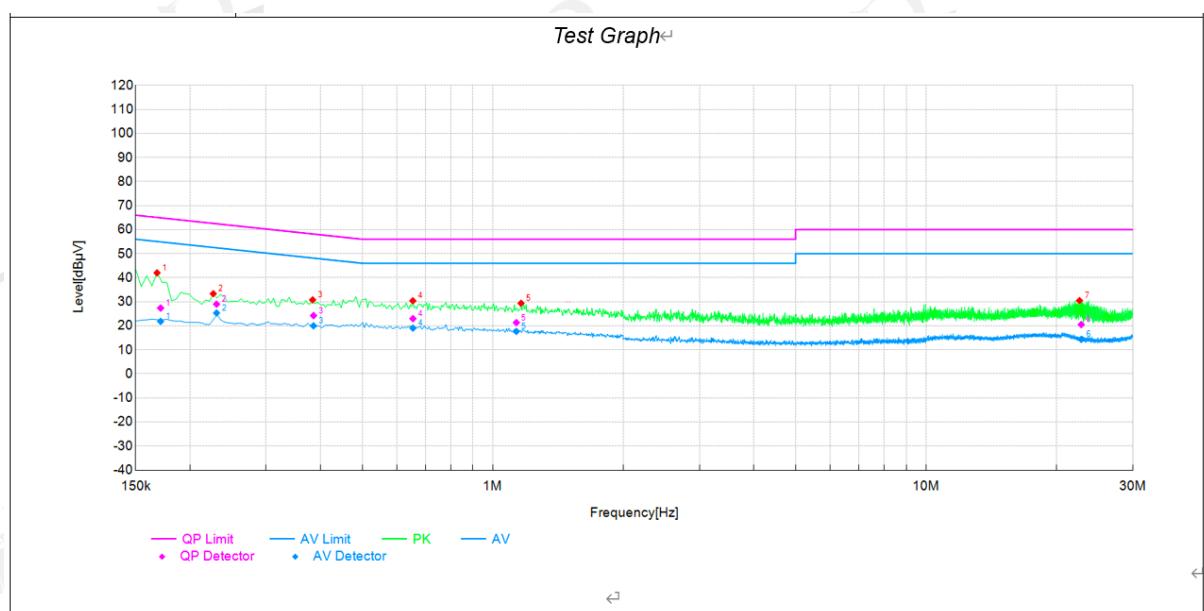
Note3: Pre-test AC conducted emission at both voltage AC 120V/60Hz and AC 240V/50Hz, recorded worse case.

Conducted Emission Test Result



Final Data List													
NO.	Frequency [MHz]	Factor [dB]	QP Readin g [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Readin g [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict	
1	0.1638	19.00	12.36	31.36	65.27	33.91	3.16	22.16	55.27	33.11	L	PASS	
2	0.2167	18.98	7.14	26.12	62.95	36.83	2.38	21.36	52.95	31.59	L	PASS	
3	0.3530	18.94	5.47	24.41	58.89	34.48	1.22	20.16	48.89	28.73	L	PASS	
4	0.5348	18.90	5.11	24.01	56.00	31.99	0.83	19.73	46.00	26.27	L	PASS	
5	1.4658	18.91	1.50	20.41	56.00	35.59	-2.12	16.79	46.00	29.21	L	PASS	
6	21.9860	20.26	3.47	23.73	60.00	36.27	-3.95	16.31	50.00	33.69	L	PASS	

Note: Result Level = Read Level + LISN Factor.



NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Phase	Verdict
1	0.1712	19.19	8.18	27.37	64.90	37.53	2.63	21.82	54.90	33.08	N	PASS
2	0.2305	19.18	9.80	28.98	62.43	33.45	6.16	25.34	52.43	27.09	N	PASS
3	0.3858	19.13	5.11	24.24	58.15	33.91	0.86	19.99	48.15	28.16	N	PASS
4	0.6545	19.10	3.87	22.97	56.00	33.03	-0.08	19.02	46.00	26.98	N	PASS
5	1.1338	19.10	2.22	21.32	56.00	34.68	-1.42	17.68	46.00	28.32	N	PASS
6	22.8129	20.72	-0.22	20.50	60.00	39.50	-6.37	14.35	50.00	35.65	N	PASS

Note: Result Level = Read Level + LISN Factor + Pulse Limiter Factor + Cable loss.

12. Antenna Requirements

12.1. Limit

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

12.2. Result

The antennas used for this product are integrated antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only -2.55 dBi.

13. Test Setup Photograph

Please find the Test Setup photos of EUT in APPENDIXES.

14. Photos of the EUT

Please refer to the appendix file

END OF REPORT