FCC Test Report

Report No.: ULC-ESH-P21101621B-7

FCC ID: 2AG62FS29

Product: EASEL STUDIO TV FLOOR STAND

Model: FS29-46F-03, FS29-46F-04

Received Date: Dec.20, 2021

Test Date: Dec.20, 2021 to Jan.16, 2022

Issued Date: Jan.17, 2022

Applicant: LUMI LEGEND CORPORATION

Address: 22/F., Building 1, Lisi Plaza, Huifeng East Road, Ningbo, China 315100

Manufacturer: LUMI LEGEND CORPORATION

Address: 22/F., Building 1, Lisi Plaza, Huifeng East Road, Ningbo, China 315100

Issued By: BUREAU VERITAS ADT (Shanghai) Corporation

Lab Address: No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

Test Lab
Cert 2343.01

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record 4
1 Certificate of Conformity 5
2 Summary of Test Results 6
2.1 Test Instruments 7
2.2 Measurement Uncertainty 8
2.3 Modification Record 8
3 General Information 9
3.1 General Description of EUT 9
3.2 Description of Test Modes 10
3.2.1 Test Mode Applicability: 11
3.2.2 Test Condition: 12
3.3 Description of Support Units 13
3.4 General Description of Applied Standards 13
4 Test Procedure and Results 14
4.1 AC Power Conducted Emission 14
4.1.1 Limits 14
4.1.2 Test Procedures 14
4.1.3 Deviation from Test Standard 14
4.1.4 Test Setup 15
4.1.5 EUT Operating Conditions 15
4.1.6 Test Results 16
4.2 Minimum 6dB Bandwidth 20
4.2.1 Limit 20
4.2.2 Test Setup 20
4.2.3 Test Procedures 20
4.2.4 Deviation of Test Standard 20
4.2.5 Test Results 21
4.3 Conducted Output Power 23
4.3.1 Limit 23
4.3.2 Test Setup 23
4.3.3 Test Procedures 23
4.3.4 Deviation of Test Standard 23

4.3.5 Test Results 24
4.4 Power Spectral Density 26
4.4.1 Limit 26
4.4.2 Test Setup 26
4.4.3 Test Procedures 26
4.4.4 Deviation of Test Standard 26
4.4.5 Test Results 27
4.5 Conducted Band Edges Measurement 29
4.5.1 Limit 29
4.5.2 Test Setup 29
4.5.3 Test Procedures 29
4.5.4 Deviation of Test Standard 29
4.5.5 Test Results 30
4.6 Conducted Spurious Emissions 32
4.6.1 Limit 32
4.6.2 Test Setup 32
4.6.3 Test Procedures 32
4.6.4 Deviation of Test Standard 32
4.6.5 Test Results 33
4.7 Emissions in restricted frequency bands 37
4.7.1 Test Limit 37
4.7.2 Test Procedure Reference 38
4.7.3 Test Procedures 38
4.7.4 Test Setup 39
4.7.5 Test Results 40
4.8 Radiated Emission Measurement 42
4.8.1 Limits 42
4.8.2 Test Procedures 42
4.8.3 Deviation from Test Standard 43
4.8.4 Test Setup 44
4.8.5 EUT Operating Conditions 45
4.8.6 Test Results 45
5 Pictures of Test Arrangements 52

Release Control Record

Issue No.	Description	Date Issued
ULC-ESH-P21101621B-7	Original release	Jan.17, 2022

1 Certificate of Conformity

Product: EASEL STUDIO TV FLOOR STAND

Brand: --

Model: FS29-46F-03, FS29-46F-04

Applicant: LUMI LEGEND CORPORATION

Test Date: Dec.20, 2021 to Jan.16, 2022

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Yuan Zhang , **Date:** Jan.17, 2022

Yuan ZHANG

Project Engineer

Approved by : , **Date:** Jan.17, 2022

Daniel SUN

EMC Lab Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.203	Antenna Requirement	PASS	No antenna connector is used.
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	Minimum 6dB Bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.247(d)	Conducted Band Edges Measurement	PASS	Meet the requirement of limit.
15.247(d)	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
15.247(d)	Emissions in restricted frequency bands	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	PASS	Meet the requirement of limit.

2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid Antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	E1A1012	Jul.29, 20	Jul.28, 22
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Aug.25, 20	Aug.24, 22
Double Ridge Horn Antenna(18G-40G)	COM-POWER	AH-840	E1A1040	Jul.15, 20	Jul.14, 22
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Apr.19, 21	Apr.18, 22
Pre-Amplifier(0.5GHz-18GHz)	EMCI	EMC184045SE	E1A2009	Jul.05, 21	Jul.04, 22
Pre-Amplifier(18GHz-40GHz)	EMCI	EMC051845SE	E1A2008	Jul.05, 21	Jul.04, 22
EMI test recerver	R&S	ESR7	E1R1005	Apr.19, 21	Apr.18, 22
Spectrum Analyzer	Keysight	N9030B	E1S1003	Jul.22, 21	Jul.21, 22
Spectrum Analyzer	Keysight	N9020A	E1S1004	Mar.02, 21	Mar.01, 22
EMI test recerver	R&S	ESCS30	E1R1001	May.11, 21	May.10, 22
LISN	R&S	ENV216	E1L1011	May.11, 21	May.10, 22
Humidity&Temp Tester	Baolima	WS508	E1H1011	Apr. 02, 21	Apr. 01, 22
RF Control Unit	Toscend	JS0806-2	E1C5003	N/A	N/A
Test Software	ADT	ADT_COND_V7.3.1	N/A	N/A	N/A
Test Software	Toscend	JS32-RE	N/A	N/A	N/A
Test Software	Toscend	JS1120	N/A	N/A	N/A
Test Software	Toscend	JS1120-3	N/A	N/A	N/A

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	EASEL STUDIO TV FLOOR STAND
Brand	--
Model	FS29-46F-03, FS29-46F-04
Difference	FS29-46F-03 and FS29-46F-04, electronic parts are exactly the same, the difference between just to support leg material, model: FS29-46F-03 used to wooden leg, model: FS29-46F-04 used to metal leg.
Power Rating	100-240V~, 50/60Hz, 1.5A
Modulation Type	GFSK
Modulation Technology	1Mbps for Bluetooth V5.0 (BLE)
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	4.67dBm
Antenna Type	External Antenna
Antenna Connector	--
Antenna Gain	3dBi

Note:

1. For more details, please refer to the User's manual of the EUT.
2. FS29-46F-03 and FS29-46F-04, electronic parts are exactly the same, the difference between just to support leg material, model: FS29-46F-03 used to wooden leg, model: FS29-46F-04 used to metal leg. We choose model FS29-46F-03 to apply full EMC tests, the test result is applicable to all models.

3.2 Description of Test Modes

40 channels are provided for Bluetooth LE.

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

3.2.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz **RE< 1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

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

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	BLE	0 to 39	0, 19, 39	GFSK

Radiated Emission Test (Below 1 GHz):

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

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	BLE	0 to 39	0	GFSK

Power Line Conducted Emission Test:

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

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	BLE	0 to 39	0	GFSK

Antenna Port Conducted Measurement

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

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	BLE	0 to 39	0, 19, 39	GFSK

3.2.2 Test Condition:

Applicable to	Normal Environmental Conditions	Normal Input Power
RE ≥ 1G	23deg. C, 58%RH	120Vac,60Hz
RE < 1G	23deg. C, 58%RH	120Vac,60Hz
PLC	23deg. C, 58%RH	120Vac,60Hz
APCM	25deg. C, 60%RH	120Vac,60Hz

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10:2013

All relaxed test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

4.1 AC Power Conducted Emission

4.1.1 Limits

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.1.2 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

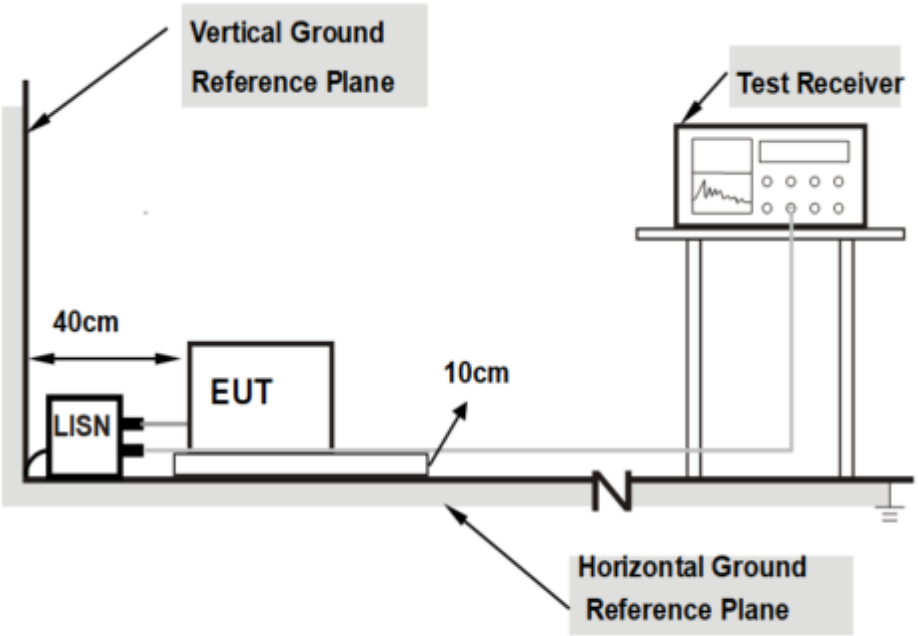
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup



Note: 1.Support units were connected to second LISN.

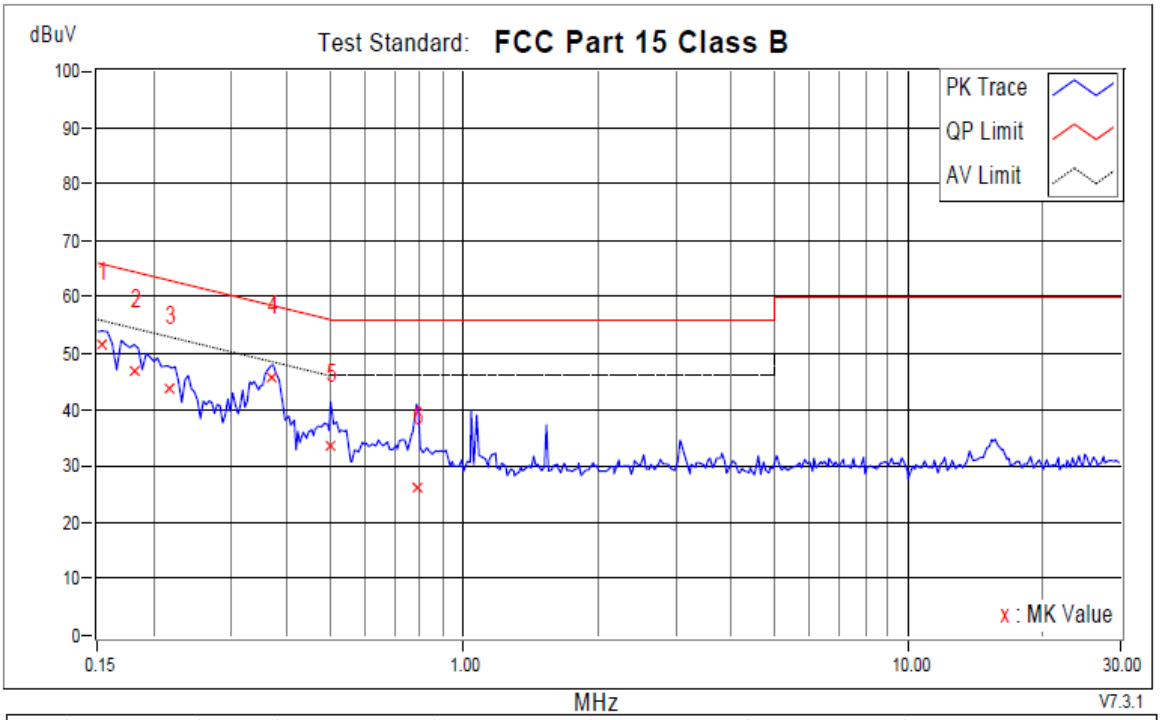
For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.5 EUT Operating Conditions

Same as 4.1.6.

4.1.6 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Power supply	AC 120V, 60Hz		

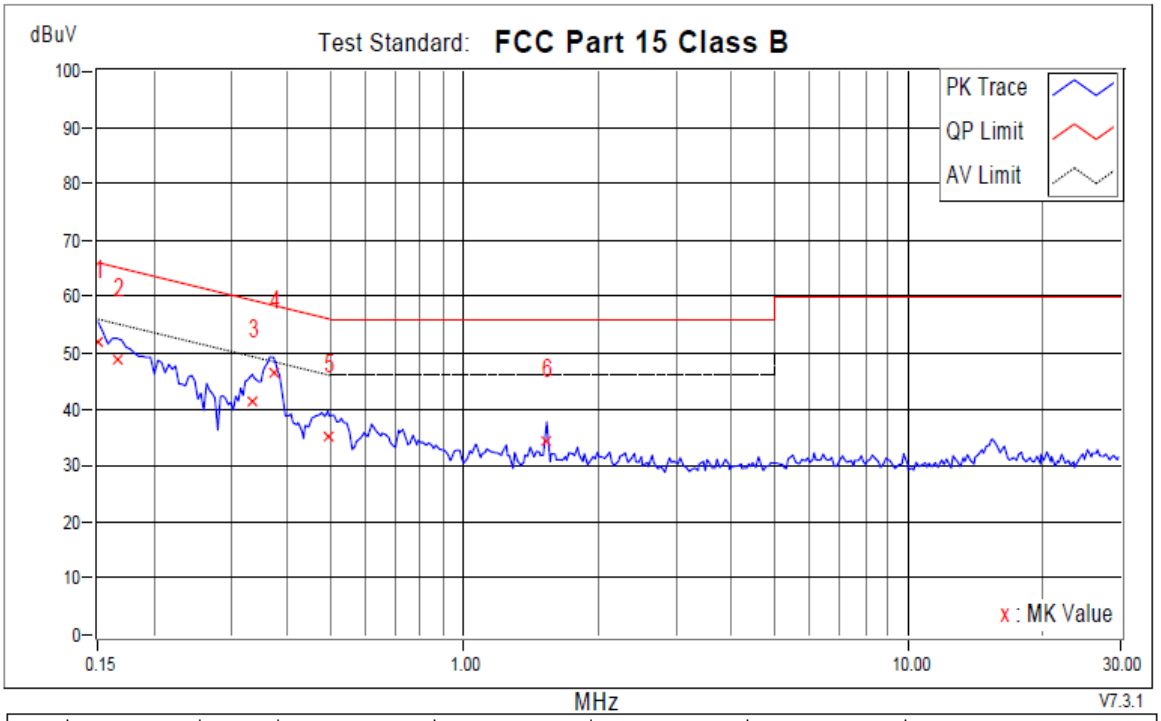


	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
No.	MHz	dB	QP	AV	QP	AV	QP	AV	QP	AV	
1	0.15391	9.77	41.84	21.30	51.61	31.07	65.79	55.79	-14.17	-24.71	
2	0.18128	9.81	37.20	21.45	47.01	31.26	64.43	54.43	-17.42	-23.17	
3	0.21647	9.80	33.76	19.19	43.56	28.99	62.95	52.95	-19.39	-23.96	
+4	0.36896	9.68	35.84	28.27	45.52	37.95	58.52	48.52	-13.01	-10.58	
5	0.50190	9.67	23.76	14.67	33.43	24.34	56.00	46.00	-22.57	-21.66	
6	0.78342	9.56	16.50	8.37	26.06	17.93	56.00	46.00	-29.94	-28.07	

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Power supply	AC 120V, 60Hz		

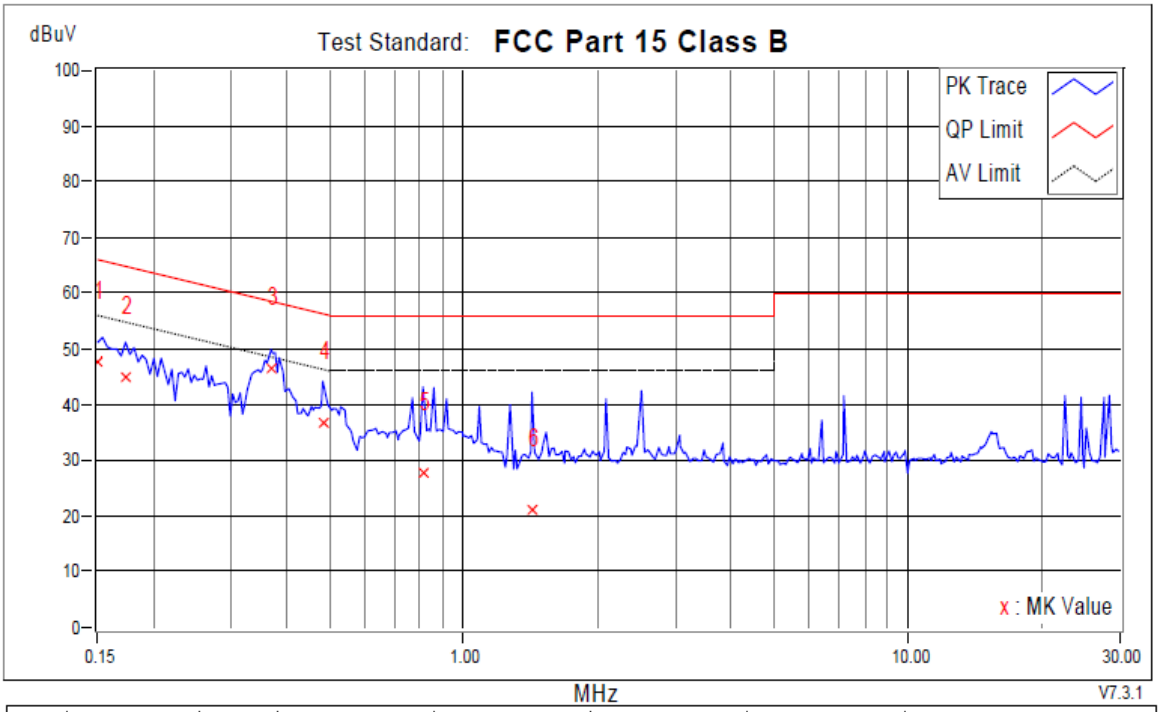


	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
No.	MHz	dB	QP	AV	QP	AV	QP	AV	QP	AV	
1	0.15000	9.79	42.26	22.12	52.05	31.91	66.00	56.00	-13.95	-24.09	
2	0.16564	9.78	39.16	19.86	48.94	29.64	65.18	55.18	-16.24	-25.54	
3	0.33377	9.84	31.64	20.95	41.48	30.79	59.36	49.36	-17.87	-18.56	
+4	0.37287	9.84	36.56	27.82	46.40	37.66	58.44	48.44	-12.04	-10.78	
5	0.49408	9.79	25.46	17.07	35.25	26.86	56.10	46.10	-20.85	-19.24	
6	1.53567	9.84	24.68	23.19	34.52	33.03	56.00	46.00	-21.48	-12.97	

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Power supply	AC 240V, 50Hz		

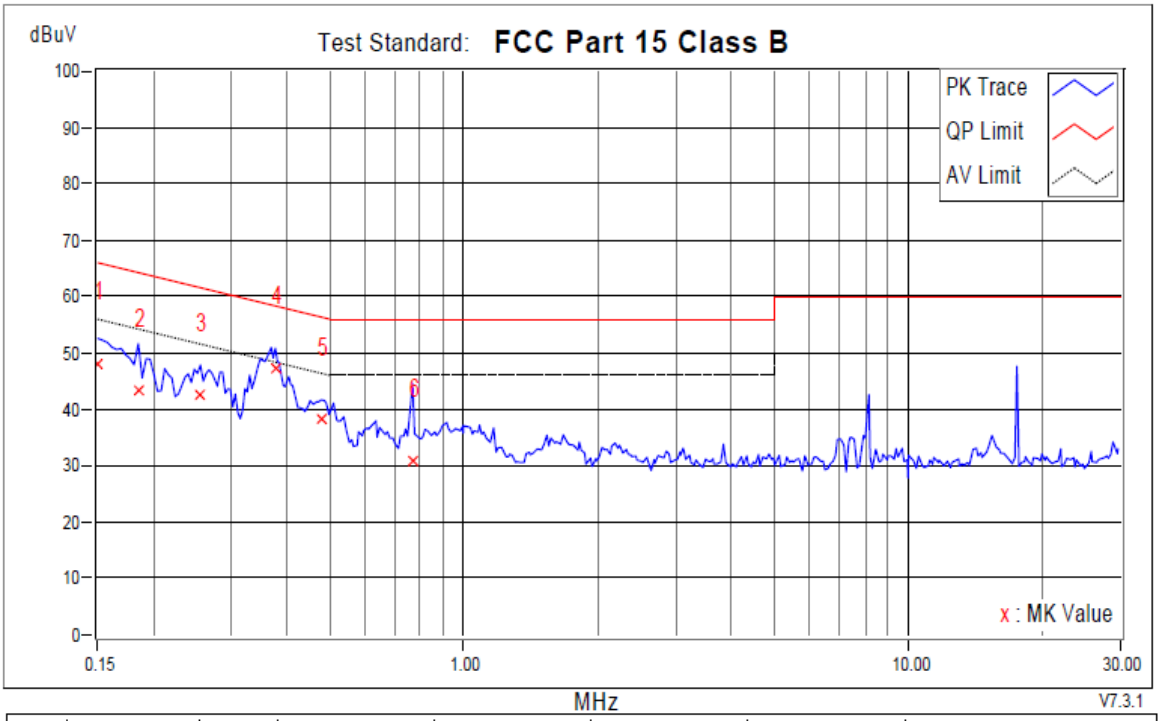


	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
No.	MHz	dB	QP	AV	QP	AV	QP	AV	QP	AV	
1	0.15000	9.77	38.04	19.69	47.81	29.46	66.00	56.00	-18.19	-26.54	
2	0.17346	9.80	35.06	19.19	44.86	28.99	64.79	54.79	-19.93	-25.80	
+3	0.36896	9.68	36.82	28.49	46.50	38.17	58.52	48.52	-12.03	-10.36	
4	0.48235	9.67	26.88	17.41	36.55	27.08	56.30	46.30	-19.75	-19.22	
5	0.81079	9.56	18.32	9.19	27.88	18.75	56.00	46.00	-28.12	-27.25	
6	1.42619	9.55	11.64	4.67	21.19	14.22	56.00	46.00	-34.81	-31.78	

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Power supply	AC 240V, 50Hz		



	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
No.	MHz	dB	QP	AV	QP	AV	QP	AV	QP	AV	
1	0.15000	9.79	38.42	20.56	48.21	30.35	66.00	56.00	-17.79	-25.65	
2	0.18519	9.77	33.50	20.56	43.27	30.33	64.25	54.25	-20.98	-23.92	
3	0.25557	9.81	32.94	21.80	42.75	31.61	61.57	51.57	-18.82	-19.96	
+4	0.37678	9.83	37.34	26.91	47.17	36.74	58.35	48.35	-11.18	-11.61	
5	0.47844	9.80	28.52	18.95	38.32	28.75	56.37	46.37	-18.05	-17.62	
6	0.76778	9.81	20.86	14.13	30.67	23.94	56.00	46.00	-25.33	-22.06	

REMARKS:

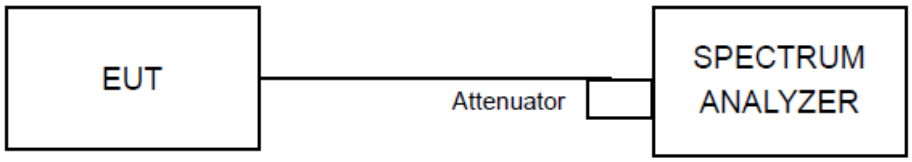
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

4.2 Minimum 6dB Bandwidth

4.2.1 Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz

4.2.2 Test Setup



4.2.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ⩾ 3 · RBW, peak detector with maximum hold) is implemented by the instrumentation function.

4.2.4 Deviation of Test Standard

No deviation.

4.2.5 Test Results

Test Mode	Antenna	Channel [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE	Ant1	2402	0.654	2401.676	2402.330	>=0.5	PASS
		2440	0.660	2439.664	2440.324	>=0.5	PASS
		2480	0.672	2479.652	2480.324	>=0.5	PASS

BLE_Ant1_2402

BLE_Ant1_2440

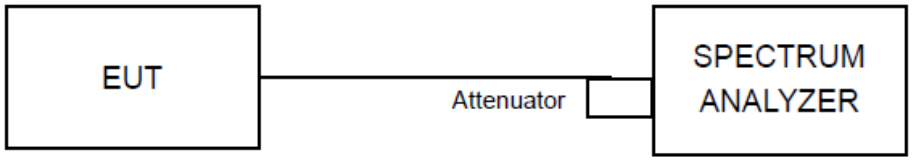
BLE_Ant1_2480

4.3 Conducted Output Power

4.3.1 Limit

For systems using digital modulation in the 2400 – 2483.5 MHz bands: 1 Watt (30 dBm)

4.3.2 Test Setup



4.3.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

a) Set RBW ⩾ DTS bandwidth

b) Set VBW ⩾ 3 RBW.

c) Set Span ⩾ 3 RBW.

d) Sweep time = auto couple.

e) Detector = peak

f) Trace mode = max hold.

g) Allow trace to fully stabilize

h) Use peak marker function to determine the peak amplitude level.

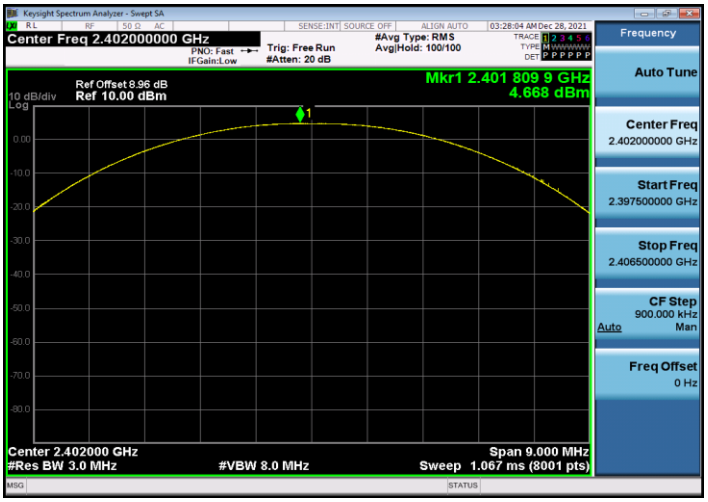
4.3.4 Deviation of Test Standard

No deviation.

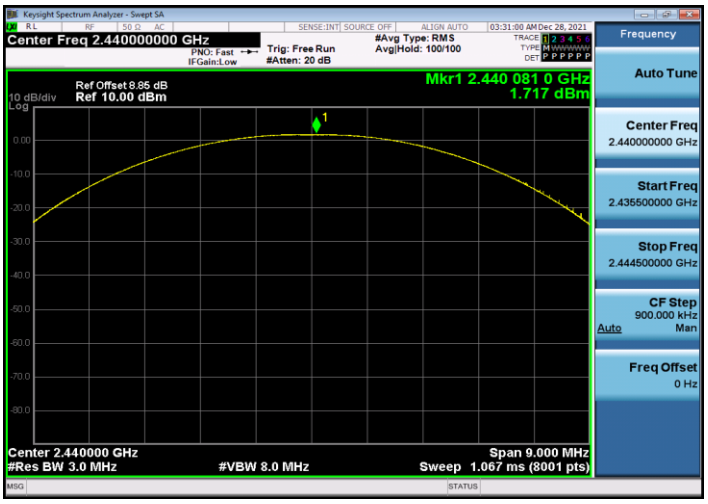
4.3.5 Test Results

Test Mode	Antenna	Channel [MHz]	Power [dBm]	Limit [dBm]	Verdict
BLE	Ant1	2402	4.67	<=30	PASS
		2440	1.72	<=30	PASS
		2480	-1.12	<=30	PASS

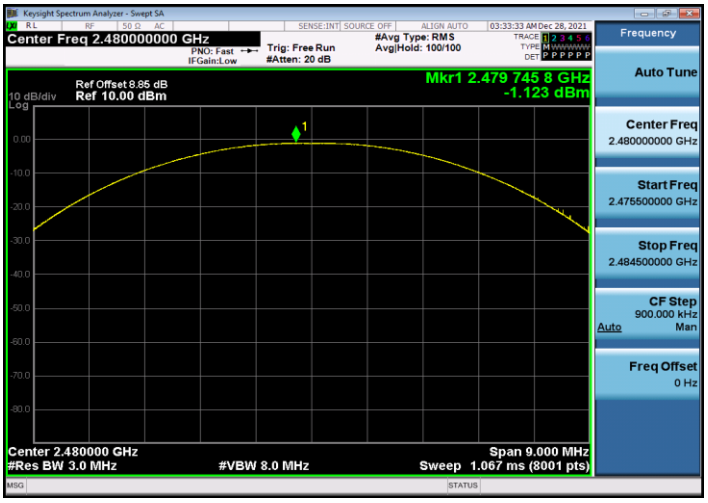
BLE_Ant1_2402



BLE_Ant1_2440



BLE_Ant1_2480

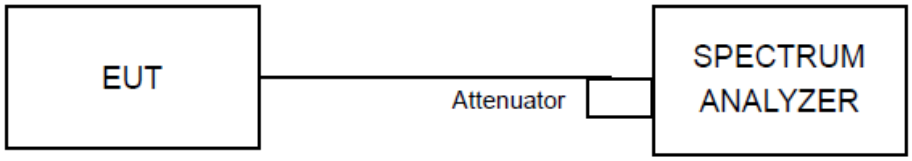


4.4 Power Spectral Density

4.4.1 Limit

The Maximum of Power Spectral Density Measurement is 8 dBm.

4.4.2 Test Setup



4.4.3 Test Procedures

The power output per FCC § 15.247(e) was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to: 3 kHz ⩽ RBW ⩽ 100 kHz.

d) Set the VBW ⩾ 3 ×RBW.

e) Detector = peak.

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level within the RBW.

j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

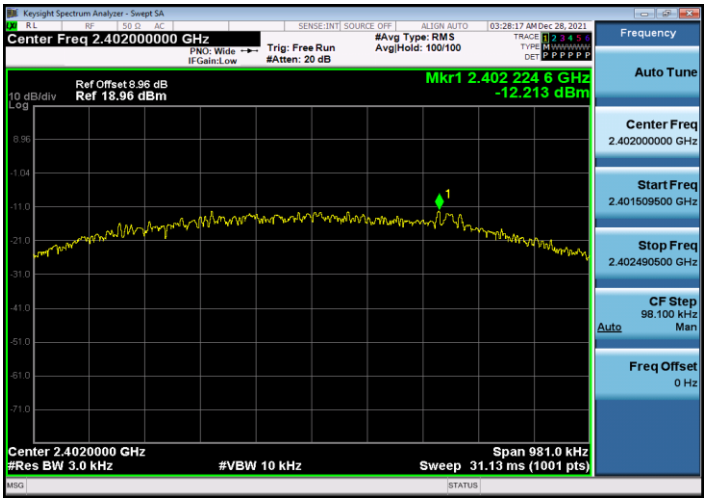
4.4.4 Deviation of Test Standard

No deviation.

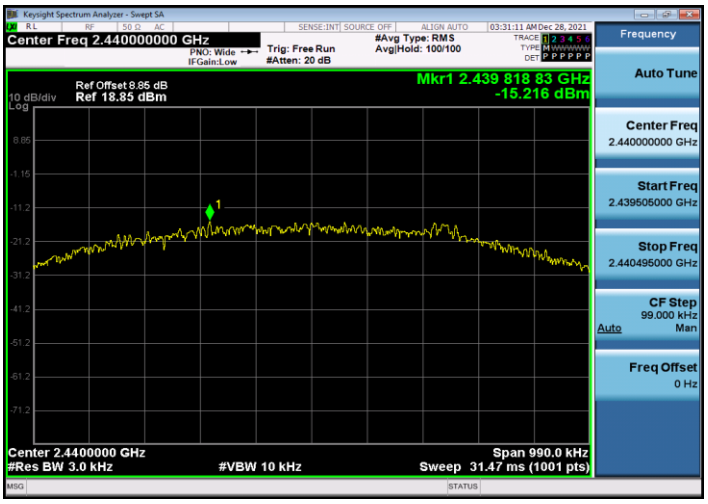
4.4.5 Test Results

Test Mode	Antenna	Channel [MHz]	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE	Ant1	2402	-12.21	<=8	PASS
		2440	-15.22	<=8	PASS
		2480	-18.01	<=8	PASS

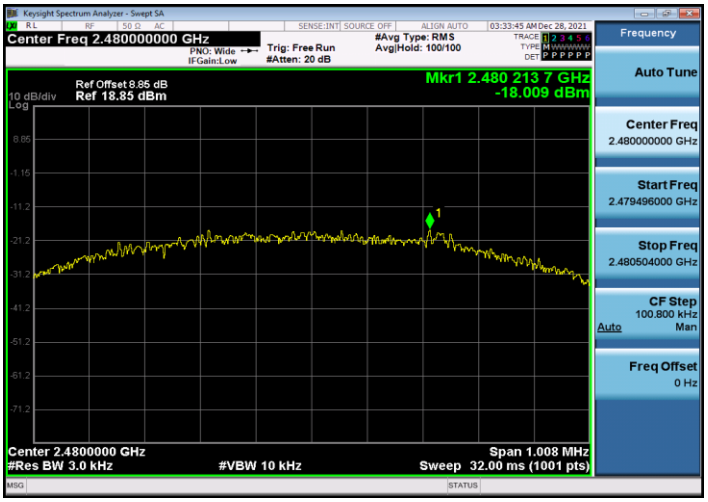
BLE_Ant1_2402



BLE_Ant1_2440



BLE_Ant1_2480

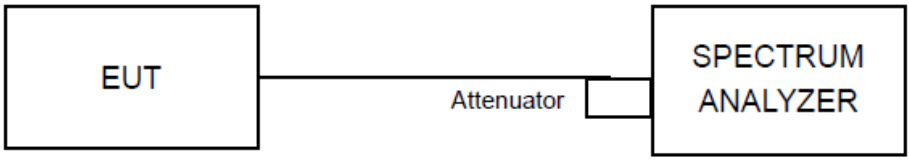


4.5 Conducted Band Edges Measurement

4.5.1 Limit

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.5.2 Test Setup



4.5.3 Test Procedures

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

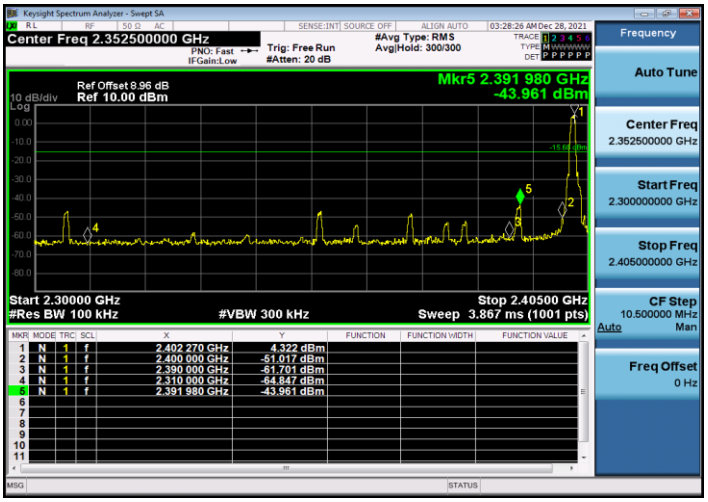
4.5.4 Deviation of Test Standard

No deviation.

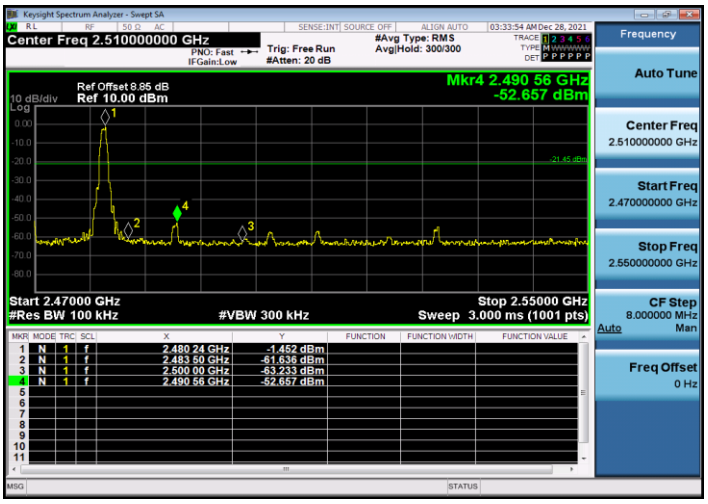
4.5.5 Test Results

Test Mode	Antenna	ChName	Channel [MHz]	RefLevel [dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	Ant1	Low	2402	4.32	-43.96	<=-15.68	PASS
		High	2480	-1.45	-52.66	<=-21.45	PASS

BLE_Ant1_Low_2402



BLE_Ant1_High_2480

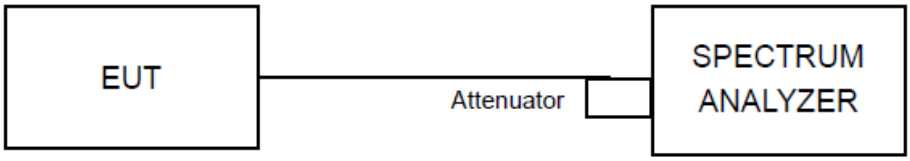


4.6 Conducted Spurious Emissions

4.6.1 Limit

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Procedures

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.6.4 Deviation of Test Standard

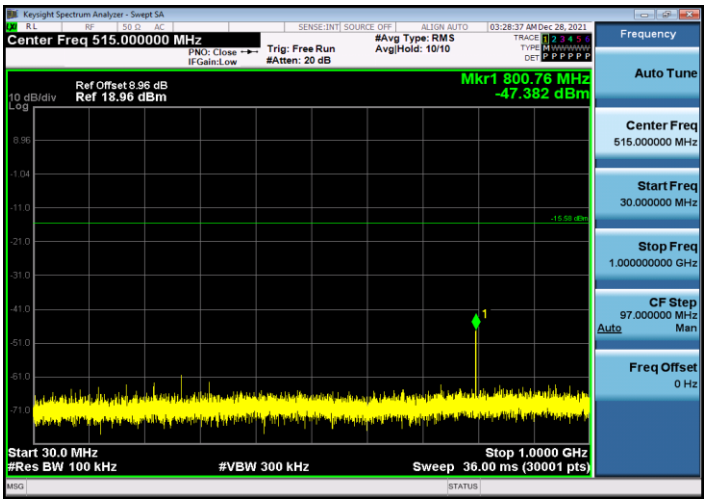
No deviation.

4.6.5 Test Results

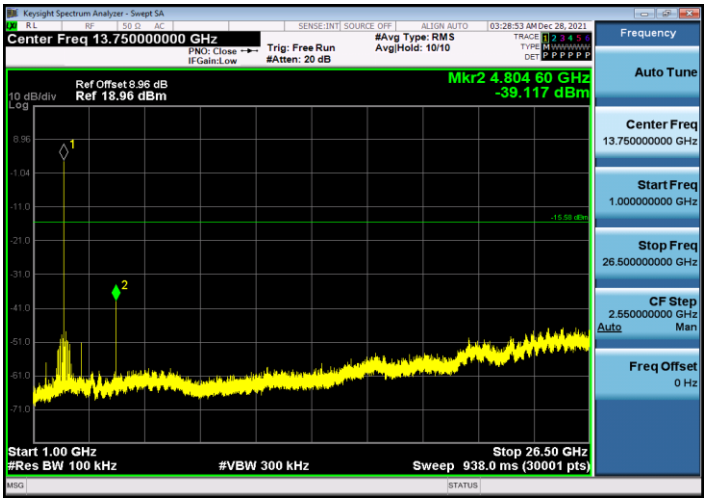
Test Mode	Antenna	Channel [MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE	Ant1	2402	Reference	4.42	4.42	---	PASS
			30~1000	4.42	-47.38	<=-15.58	PASS
			1000~26500	4.42	-39.12	<=-15.58	PASS
		2440	Reference	1.56	1.56	---	PASS
			30~1000	1.56	-48.95	<=-18.44	PASS
			1000~26500	1.56	-46.81	<=-18.44	PASS
		2480	Reference	-2.10	-2.10	---	PASS
			30~1000	-2.10	-50.87	<=-22.1	PASS
			1000~26500	-2.10	-46.07	<=-22.1	PASS

BLE_Ant1_2402_0~Reference

BLE_Ant1_2402_30~1000

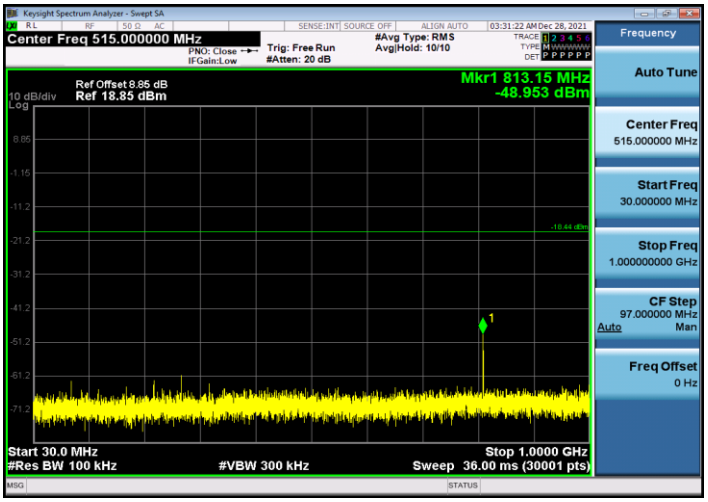


BLE_Ant1_2402_1000~26500

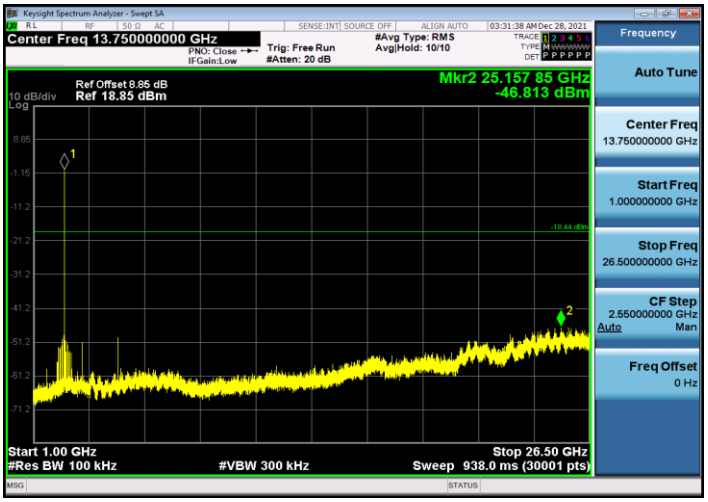


BLE_Ant1_2440_0~Reference

BLE_Ant1_2440_30~1000

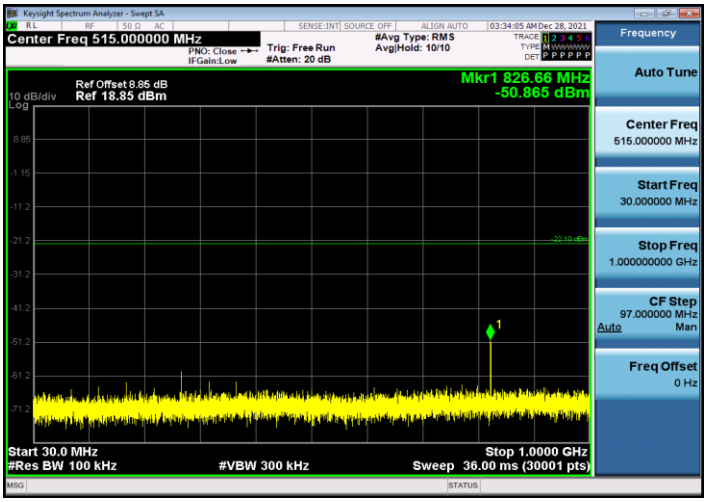


BLE_Ant1_2440_1000~26500

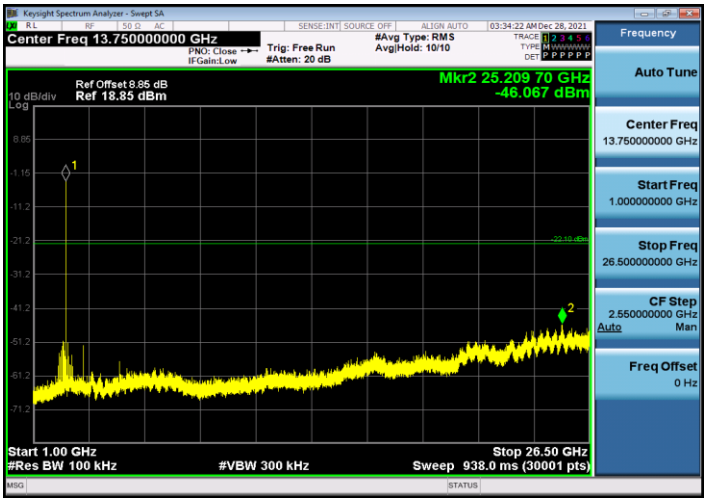


BLE_Ant1_2480_0~Reference

BLE_Ant1_2480_30~1000



BLE_Ant1_2480_1000~26500



4.7 Emissions in restricted frequency bands

4.7.1 Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (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 - 156.525	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	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

4.7.2 Test Procedure Reference

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

4.7.3 Test Procedures

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

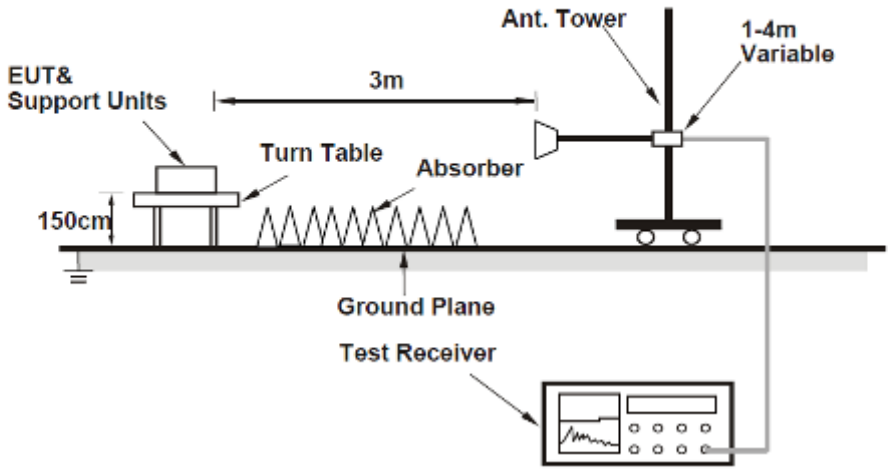
Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

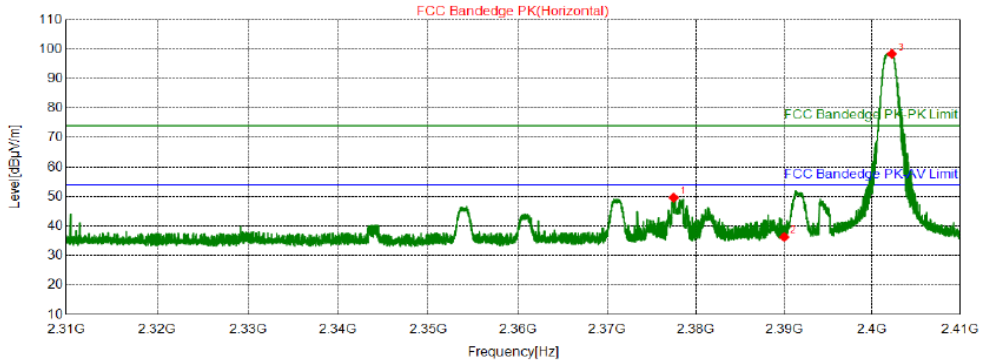
4.7.4 Test Setup

For Radiated emission above 1GHz



4.7.5 Test Results

BLE_2402_Ant1/ Horizontal

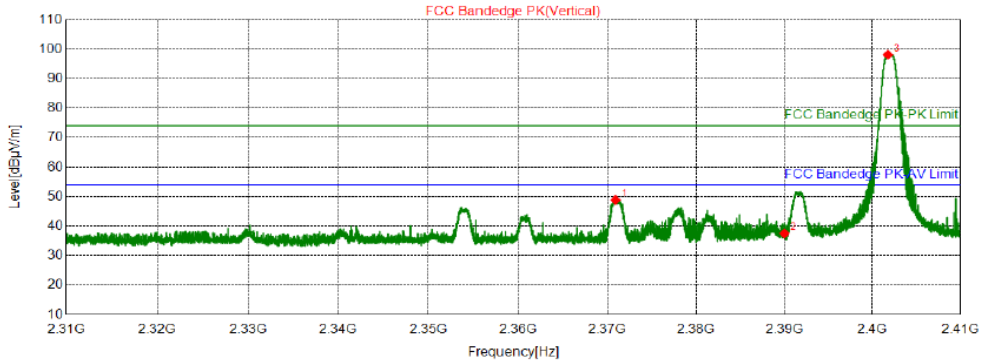


--

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2377.5125	67.41	49.65	74.00	24.35	155	162	Horizontal	PK
2	2390.0000	54.05	36.33	74.00	37.67	155	251	Horizontal	PK
3	2402.2250	116.12	98.44	74.00	-24.44	155	192	Horizontal	PK

BLE_2402_Ant1/ Vertical

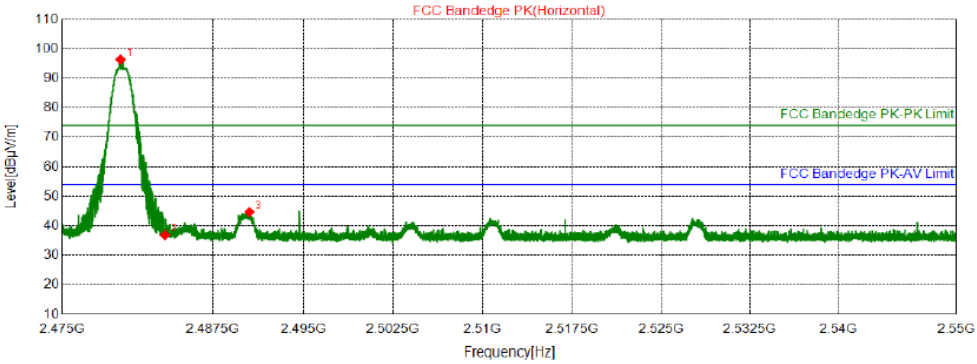


--

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2370.9375	66.65	48.87	74.00	25.13	155	103	Vertical	PK
2	2390.0000	55.26	37.54	74.00	36.46	155	68	Vertical	PK
3	2401.7500	115.81	98.13	74.00	-24.13	155	86	Vertical	PK

BLE_2480_Ant1/ Horizontal



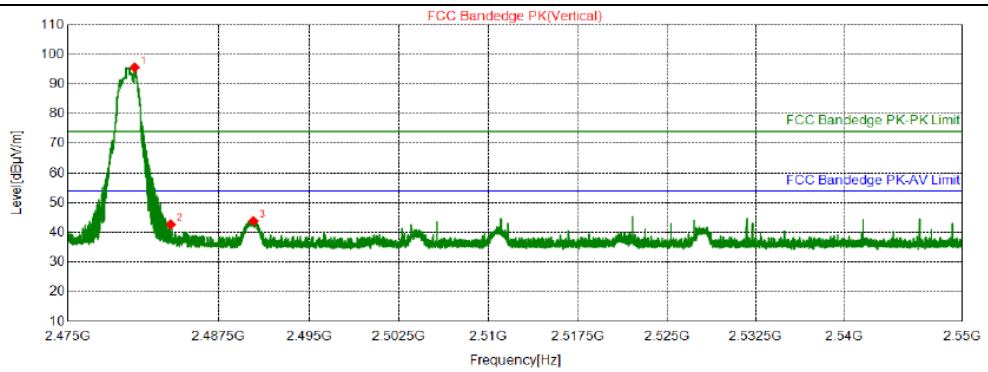
✱ AV Detector

--

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8188	113.86	96.41	74.00	-22.41	155	205	Horizontal	PK
2	2483.5031	54.31	36.87	74.00	37.13	155	205	Horizontal	PK
3	2490.5156	62.09	44.68	74.00	29.32	155	175	Horizontal	PK

BLE_2480_Ant1/ Vertical



✱ AV Detector

--

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.5125	113.05	95.61	74.00	-21.61	155	167	Vertical	PK
2	2483.5031	60.15	42.71	74.00	31.29	155	90	Vertical	PK
3	2490.3656	61.29	43.88	74.00	30.12	155	102	Vertical	PK

4.8 Radiated Emission Measurement

4.8.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.8.2 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degree to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from 0 degree to 360 degree to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

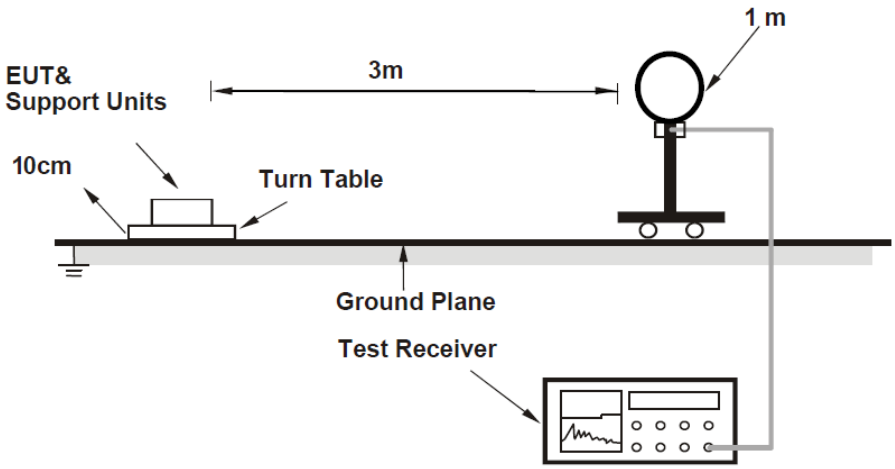
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ⩾ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.8.3 Deviation from Test Standard

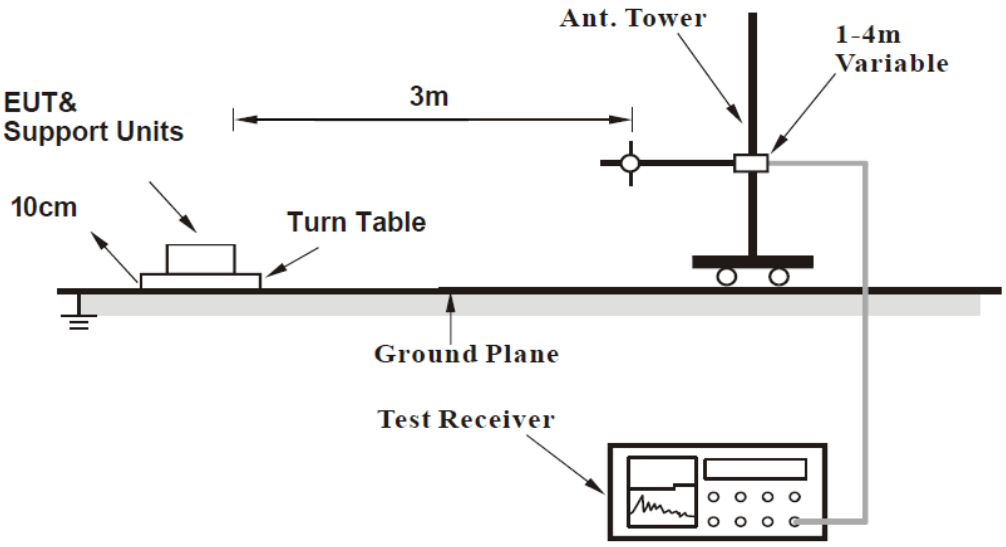
No deviation.

4.8.4 Test Setup

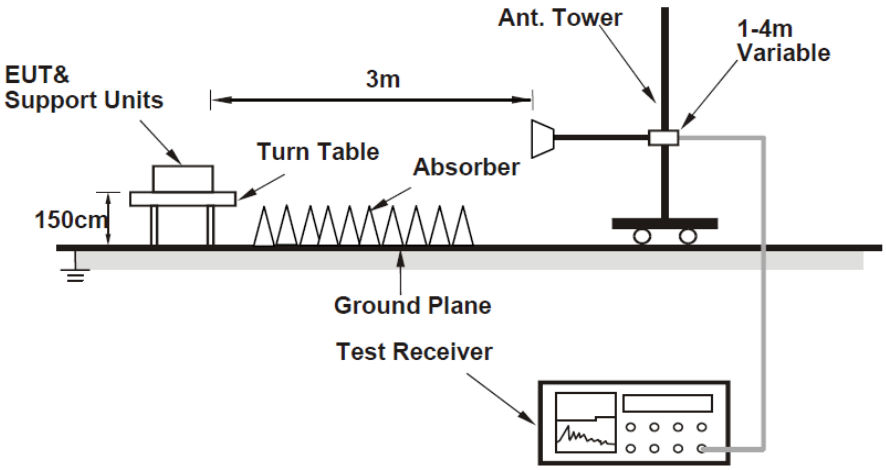
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 EUT Operating Conditions

a. Placed the EUT on a testing table.

b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.8.6 Test Results

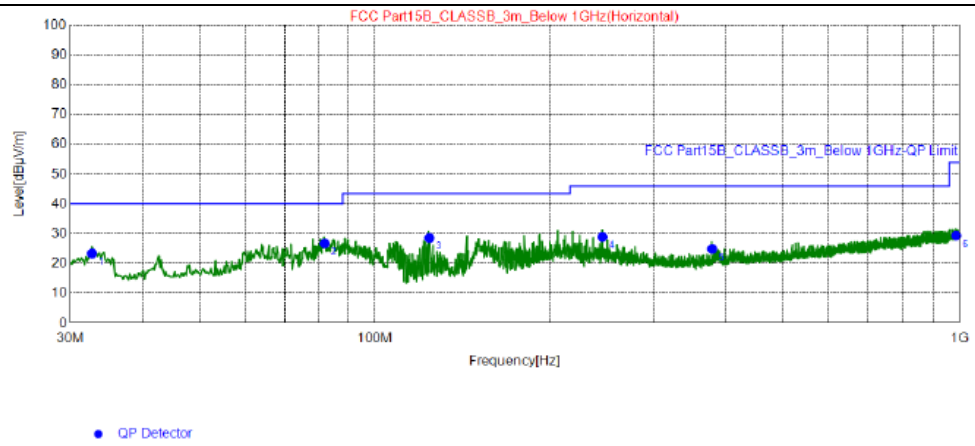
Radiated Emissions Range 9kHz~30MHz

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Radiated Emissions Range 30MHz~1GHz

Below is the worst test data

Channel	BLE_2402_Ant1	**Detector Function**	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	**Antenna Polarity**	Horizontal
Power supply	AC 120V, 60Hz		



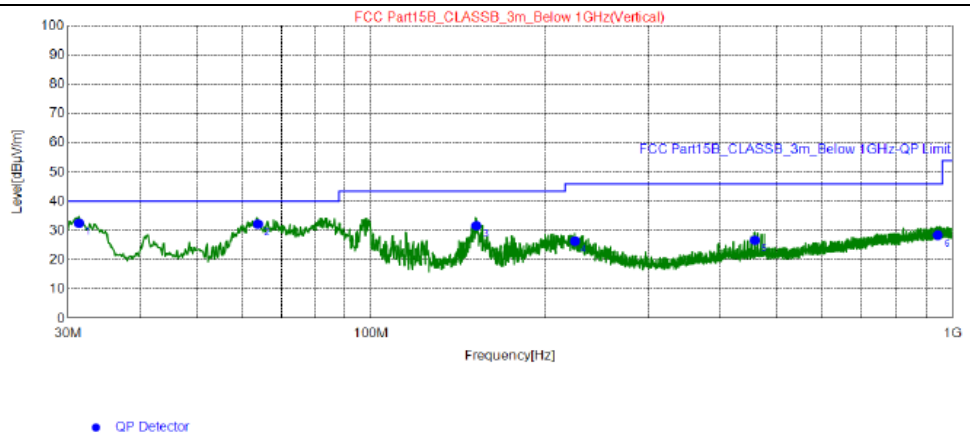
Final Data List

NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.71	34.78	-11.39	23.39	40.00	16.61	200	358	Horizontal
2	81.99	40.99	-14.29	26.70	40.00	13.30	200	358	Horizontal
3	123.8	40.24	-11.67	28.57	43.50	14.93	100	160	Horizontal
4	245.3	39	-10.08	28.92	46.00	17.08	100	76	Horizontal
5	378.6	31.12	-6.20	24.92	46.00	21.08	100	108	Horizontal
6	986.2	25.12	4.24	29.36	54.00	24.64	100	360	Horizontal

REMARKS:

1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Channel	BLE_2402_Ant1	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical
Power supply	AC 120V, 60Hz		



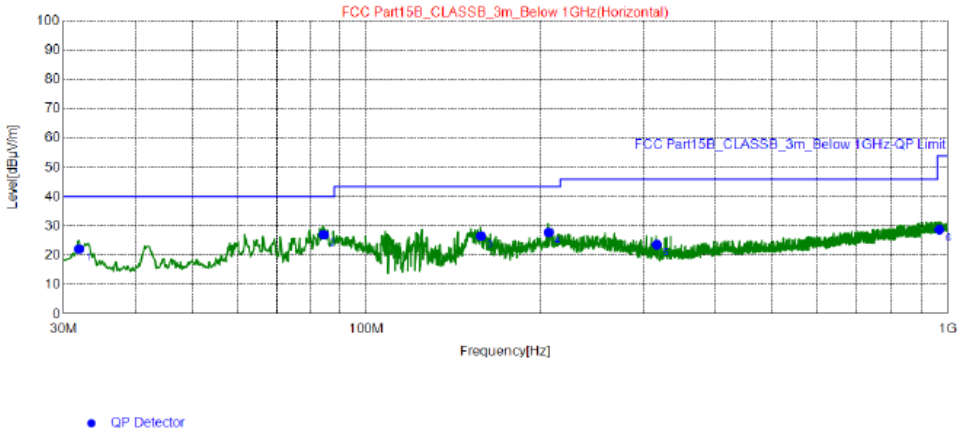
Final Data List

NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.35	44.17	-11.55	32.62	40.00	7.38	100	279	Vertical
2	63.75	43.03	-10.77	32.26	40.00	7.74	100	7	Vertical
3	151.8	41.21	-9.55	31.66	43.50	11.84	100	327	Vertical
4	224.5	37.44	-11.04	26.40	46.00	19.60	100	357	Vertical
5	458.5	31.41	-4.72	26.69	46.00	19.31	200	288	Vertical
6	942.1	24.7	3.79	28.49	46.00	17.51	100	202	Vertical

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Channel	BLE_2402_Ant1	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Horizontal
Power supply	AC 240V, 50Hz		



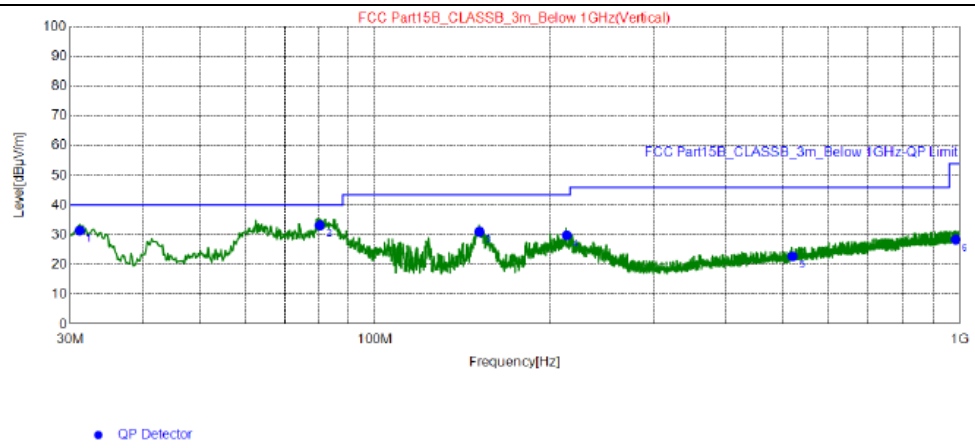
Final Data List

NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.94	33.65	-11.48	22.17	40.00	17.83	200	358	Horizontal
2	84.32	41.73	-14.67	27.06	40.00	12.94	200	358	Horizontal
3	157.6	35.93	-9.40	26.53	43.50	16.97	200	332	Horizontal
4	206.1	39.35	-11.47	27.88	43.50	15.62	200	287	Horizontal
5	316.7	31.22	-7.56	23.66	46.00	22.34	100	293	Horizontal
6	967.6	24.65	4.13	28.78	54.00	25.22	200	199	Horizontal

REMARKS:

1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Channel	BLE_2402_Ant1	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical
Power supply	AC 240V, 50Hz		



Final Data List

NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.16	43	-11.58	31.42	40.00	8.58	100	268	Vertical
2	80.44	47.28	-14.04	33.24	40.00	6.76	100	10	Vertical
3	151.0	40.66	-9.57	31.09	43.50	12.41	100	344	Vertical
4	213.1	41.26	-11.36	29.90	43.50	13.60	100	358	Vertical
5	519.8	26.68	-3.83	22.85	46.00	23.15	100	175	Vertical
6	984.2	24.22	4.24	28.46	54.00	25.54	100	66	Vertical

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Radiated Emission Range 1GHz~10th Harmonic

Below is the worst test data

Channel	BLE_2402_Ant1	**Detector Function**	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Correction Factor (dB/m)**	**Antenna Polarity**	**Detector**
1	4804.6000	58.51	74.00	15.49	-12.46	H	PK
2	4804.6000	53.86	54.00	0.14	-12.46	H	AV
3	4804.6000	57.12	74.00	16.88	-12.46	V	PK
4	4804.6000	53.49	54.00	0.51	-12.46	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Channel	BLE_2440_Ant1	**Detector Function**	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Correction Factor (dB/m)**	**Antenna Polarity**	**Detector**
1	4880.1000	50.90	74.00	23.10	-12.26	H	PK
2	4880.1000	47.14	54.00	6.86	-12.26	H	AV
3	4880.1000	52.07	74.00	21.93	-12.26	V	PK
4	4880.1000	48.20	54.00	5.80	-12.26	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Channel	BLE_2480_Ant1	**Detector Function**	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Correction Factor (dB/m)**	**Antenna Polarity**	**Detector**
1	4960.0000	45.97	74.00	28.03	-12.05	H	PK
2	4960.0000	43.81	54.00	10.19	-12.05	H	AV
3	4960.0000	46.27	74.00	27.73	-12.05	V	PK
4	4960.0000	44.34	54.00	9.66	-12.05	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

--- END ---