RF Test Report

Report No.:	AQUJ-ESH-P20031302B-2
FCC ID:	2ALS8-KS0002
Product:	Ninebot KickScooter
Model:	Air T15
Serial Model:	Air T15 Pro
Received Date:	Mar.13,2020
Test Date:	Mar.13 to Apr.13, 2020
Issued Date:	Apr.13, 2020

Applicant:	Ninebot (Changzhou) Tech Co.,Ltd.
Address:	16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, 213100, China.

Manufacturer:	Ninebot (Changzhou) Tech Co.,Ltd.
Address:	16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, 213100, China.

Issued By:	BUREAU VERITAS ADT (Shanghai) Corporation
Lab Address:	No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

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Release Control Record

Issue No.	Description	Date Issued
AQUJ-ESH-P20031302B-2	Original release	Apr.13, 2020

1 Certificate of Conformity

Product: Ninebot KickScooter

Brand: --

Model: Air T15

Serial Model: Air T15 Pro

Applicant: Ninebot (Changzhou) Tech Co.,Ltd.

Test Date: Mar.13 to Apr.13, 2020

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 : Will Yan , **Date:** Apr.13, 2020

Will YAN

Project Engineer

Approved by : , **Date:** Apr.13, 2020

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
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	PASS	Meet the requirement of limit.
15.247(d)	Emissions in non-restricted frequency bands	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	Feb.08,20	Feb.09,19	Feb.07,21
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Aug.26,19	Aug.25,20
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Oct.19, 18	Oct.17, 20
Pre-Amplifier(1GHz-26.5GHz)	Agilent	8449B	E1A2002	Mar. 25, 20	Mar. 24, 21
EMI test recerver	R&S	ESR7	E1R1005	Dec.04, 19	Dec.03, 20
Spectrum Analyzer	Keysight	N9030B	E1S1003	Jul.23,19	Jul.22, 20
EMI test recerver	R&S	ESCS30	E1R1001	Mar.25, 20	Mar.24, 21
LISN	R&S	ENV216	E1L1011	Jul.18, 19	Jul.17, 20
Humidity&Temp Tester	Baolima	WS508	E1H1011	Apr. 03, 20	Apr. 02, 21
Test Software	ADT	ADT_COND_V 7.3.1	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	Ninebot KickScooter
Brand	--
Test Model	Air T15
Serial Model	Air T15 Pro
Model Difference	Air T15, Air T15 Pro have the same electronic structure. The difference is the cell capacity. We choose the high capacity to test and record in this test report.
Power Rating	DC 42V,1.7A
Adapter:	Model: BCTA+71420-1700 Input:AC100-240V,50/60Hz,2.0A Max Output: DC42V, 1.7A
Modulation Type	GFSK
Modulation Technology	Bluetooth Low Energy 4.1
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Antenna Type	PCB Antenna
Antenna Gain	-1.26dBi

Note: For more details, please refer to the User's manual of the EUT.

Modulation Mode	TX /RX Function
BLE	1TX / 1RX

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.

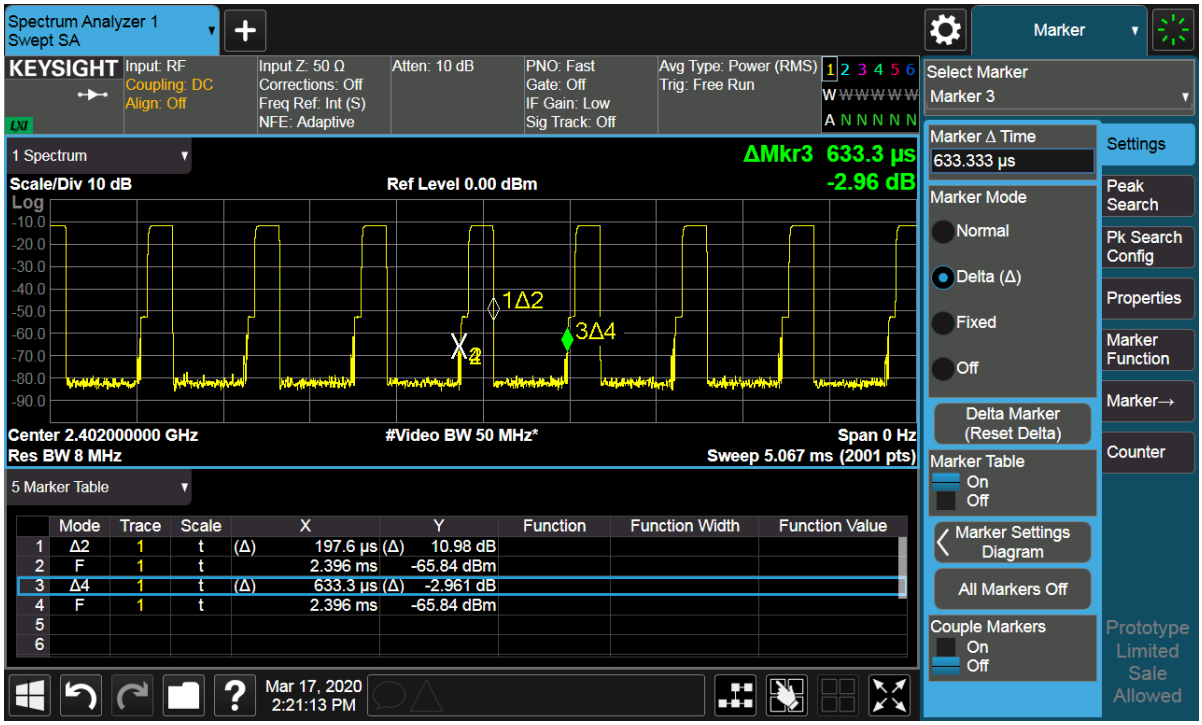
EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	BLE	0 to 39	0, 19, 39	GFSK

3.2.2 Test Condition:

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

3.3 Duty Cycle of Test Signal

Modulation	Test Freq (MHz)	Duty Cycle (%)
BLE	2402	31.2



Note: Duty Cycle Factor = 10*log (1/Duty Cycle). Duty Cycle Factor =5.06

3.4 Description of Support Units

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

3.5 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.

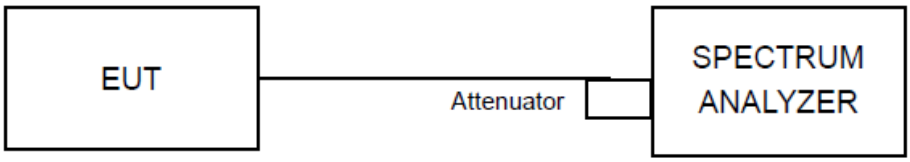
4 Test Procedure and Results

4.1 6dB Bandwidth Measurement

4.1.1 Limit

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

4.1.2 Test Setup



4.1.3 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 $\geqslant$ 3 · RBW, peak detector with maximum hold) is implemented by the instrumentation function.

4.1.4 Deviation of Test Standard

No deviation.

4.1.5 Test Results

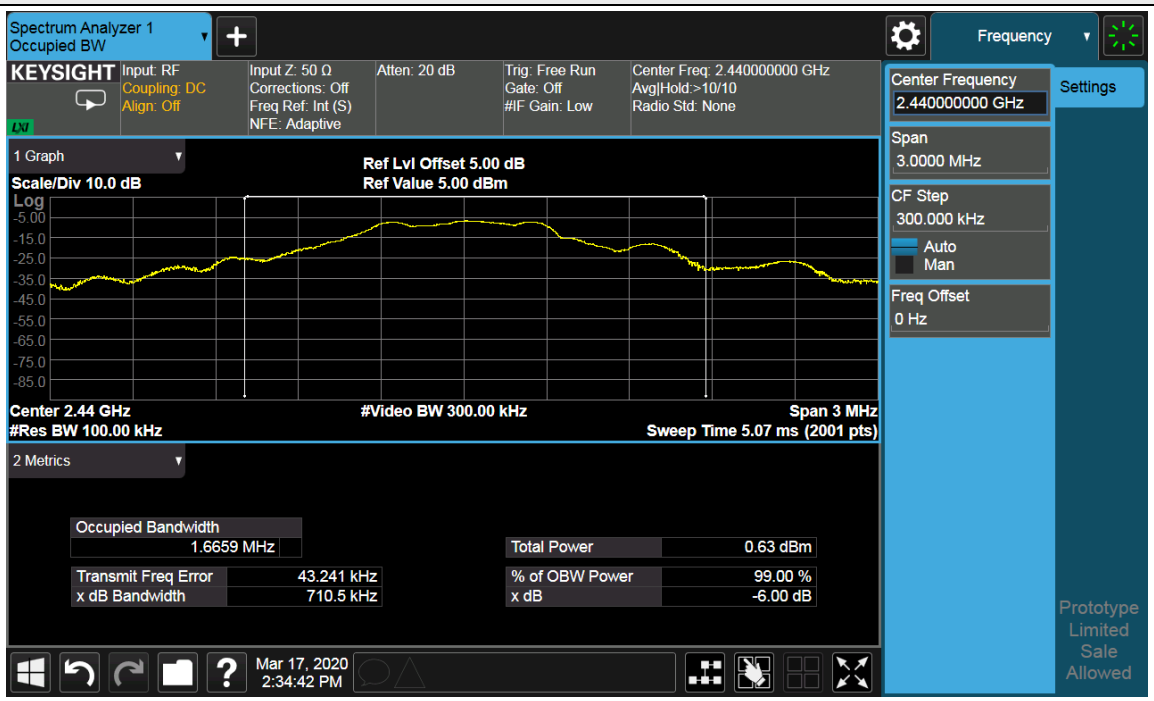
BLE

Channel	Frequency (MHz)	Occpuied Bandwidth (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.7391	0.7018	0.5	Pass
19	2440	1.6659	0.7105	0.5	Pass
39	2480	1.5334	0.7026	0.5	Pass

6dB Bandwidth

Spectrum Plot
BLE (2402MHz)

BLE (2440MHz)



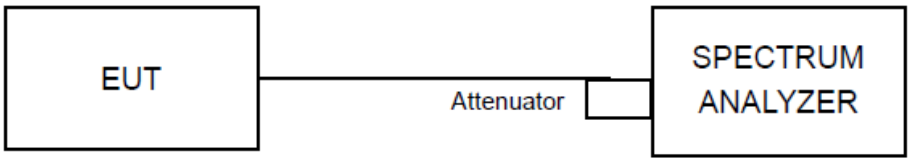
BLE (2480MHz)

4.2 Conducted Output Power Measurement

4.2.1 Limit

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

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 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.

4.2.4 Deviation of Test Standard

No deviation.

4.2.5 Test Results

BLE

Channel	Frequency (MHz)	Duty Cycle Factor	Peak Power (dBm)	Final Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	5.06	-6.47	-1.41	30	Pass
19	2440	5.06	-6.42	-1.36	30	Pass
39	2480	5.06	-7.07	-2.01	30	Pass

Spectrum Plot
BLE (2402MHz)

BLE (2440MHz)

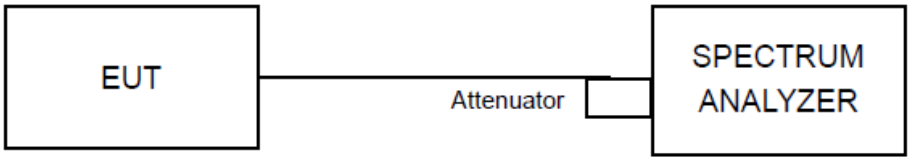
BLE (2480MHz)

4.3 Power Spectral Density Measurement

4.3.1 Limit

The Maximum of Power Spectral Density Measurement is 8 dBm.

4.3.2 Test Setup



4.3.3 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.

4.3.4 Deviation of Test Standard

No deviation.

4.3.5 Test Results

BLE

Channel	Frequency (MHz)	Duty Cycle Factor	PSD (dBm/3kHz)	Final PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	2402	5.06	-21.15	-16.09	8	Pass
19	2440	5.06	-21.18	-16.12	8	Pass
39	2480	5.06	-21.32	-16.26	8	Pass

Spectrum Plot
BLE (2402MHz)

BLE (2440MHz)

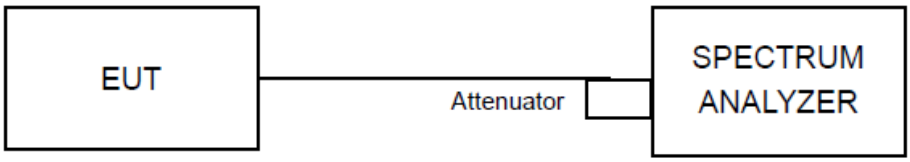
BLE (2480MHz)

4.4 Emissions in non-restricted frequency bands

4.4.1 Limit

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

4.4.2 Test Setup



4.4.3 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.

4.4.4 Deviation of Test Standard

No deviation.

4.4.5 Test Results

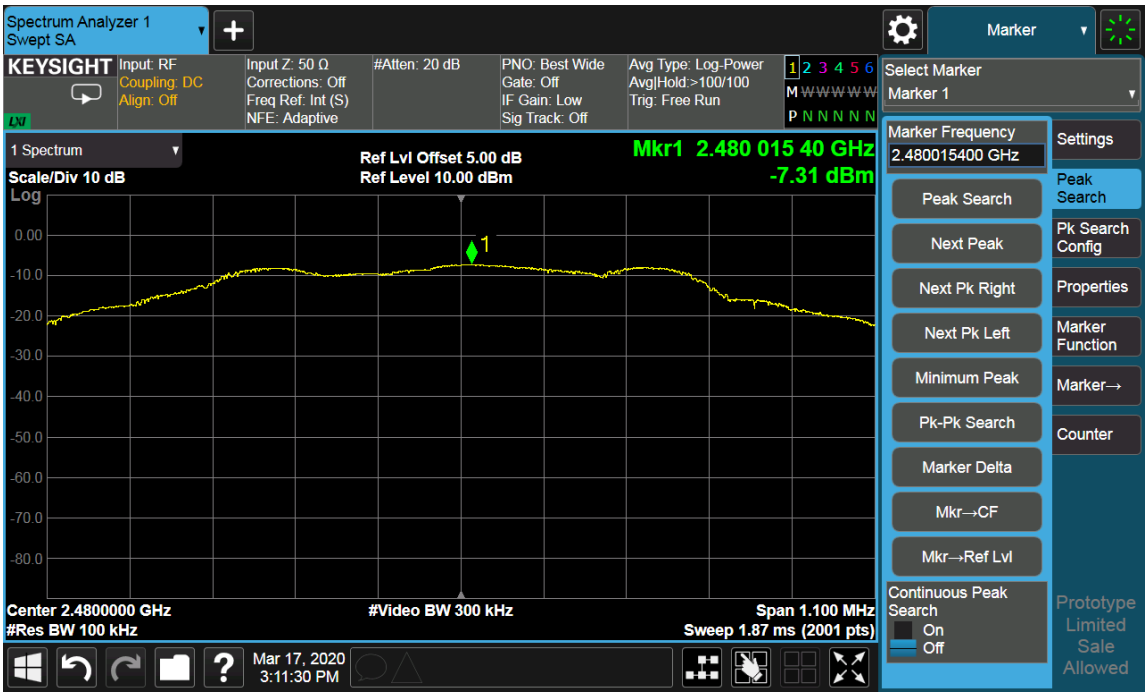
BLE

Channel	Frequency (MHz)	Pass / Fail
1	2402	Pass
19	2440	Pass
39	2480	Pass

Spectrum Plot
BLE (2402MHz)

BLE (2440MHz)

BLE (2480MHz)



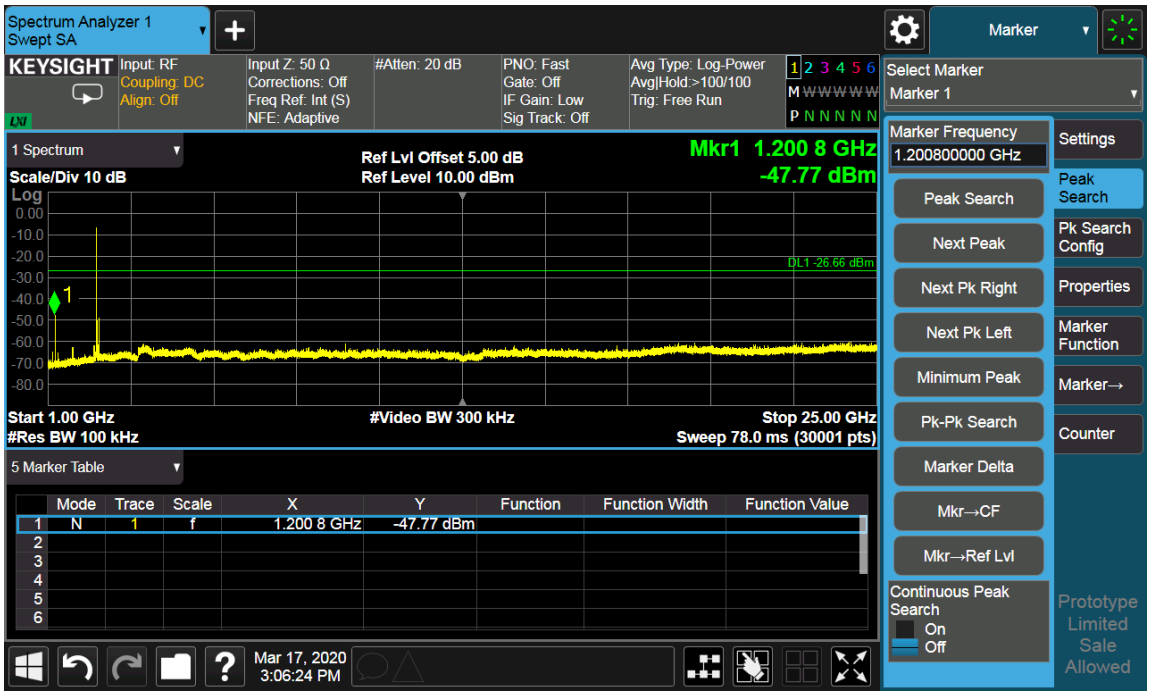
Spectrum Plot

BLE (2402MHz) Band Edge

BLE (2480MHz) Band Edge

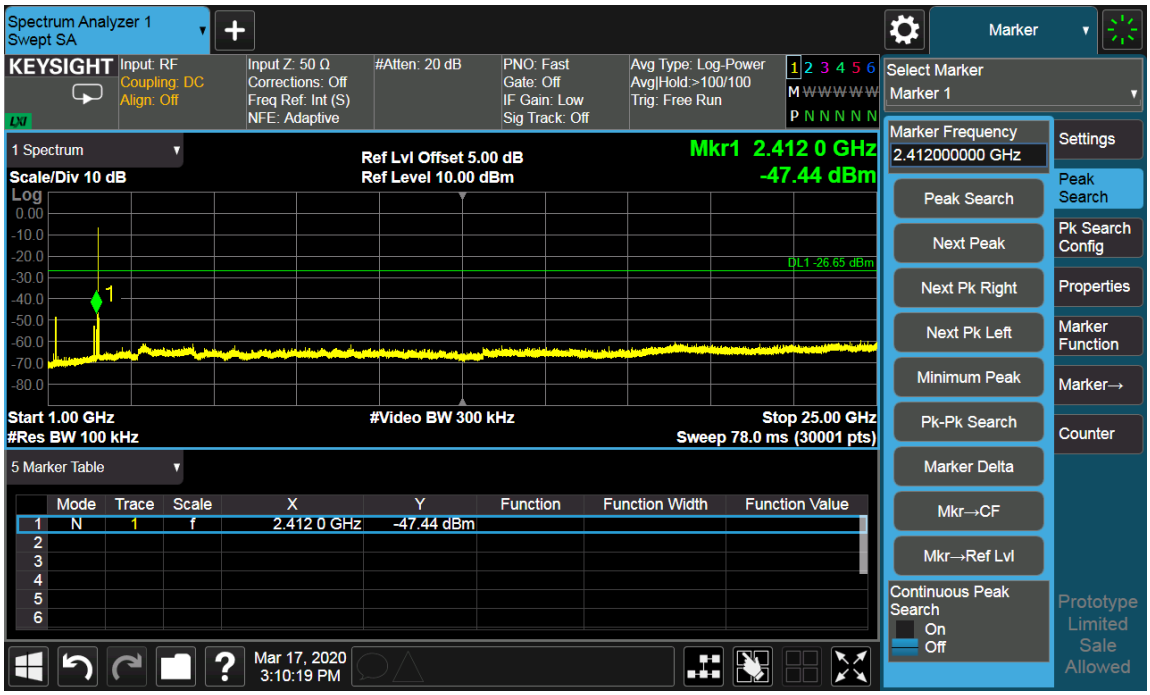
Spectrum Plot

BLE (2402MHz) Out-of-Band Emissions



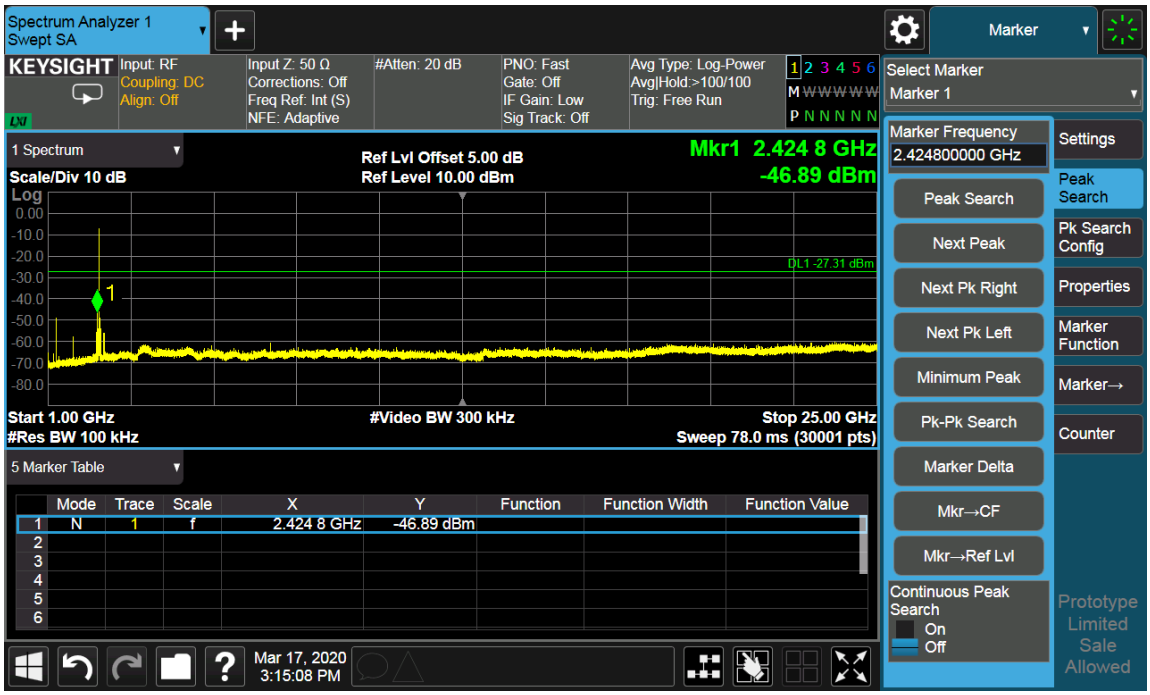
Spectrum Plot

BLE (2440MHz) Out-of-Band Emissions



Spectrum Plot

BLE (2480MHz) Out-of-Band Emissions



4.5 Radiated Emission Measurement

4.5.1 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.

4.5.2 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.1 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 0.1 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:

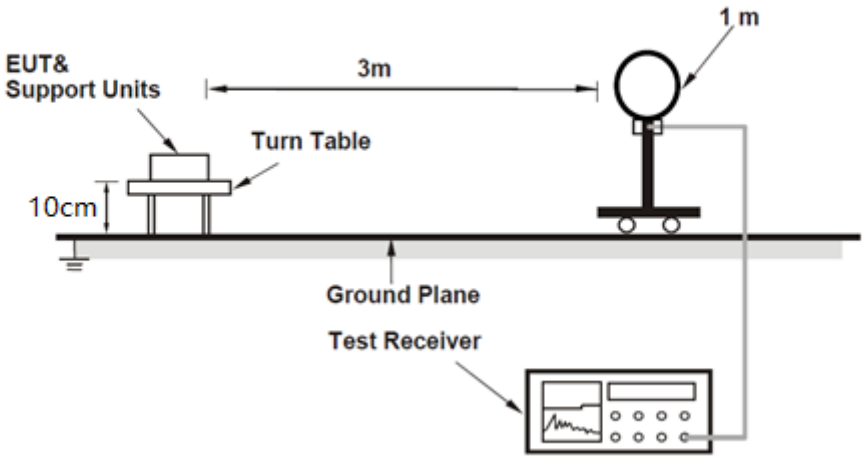
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency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

4.5.3 Deviation from Test Standard

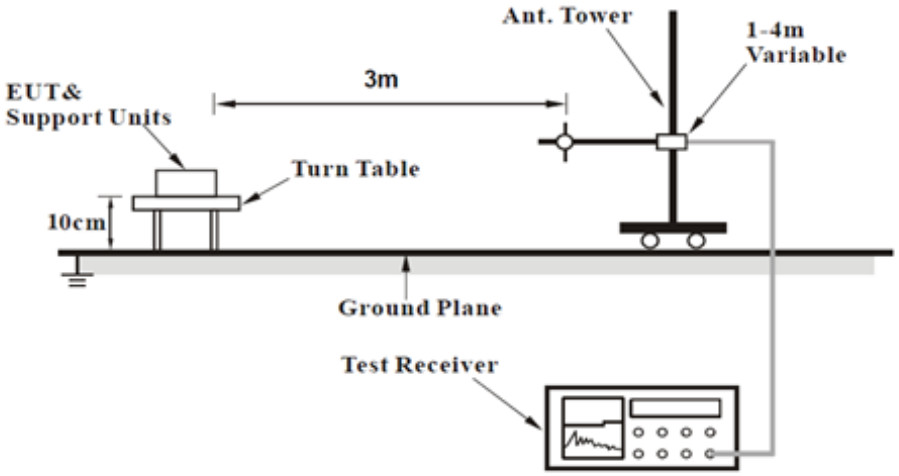
No deviation.

4.5.4 Test Setup

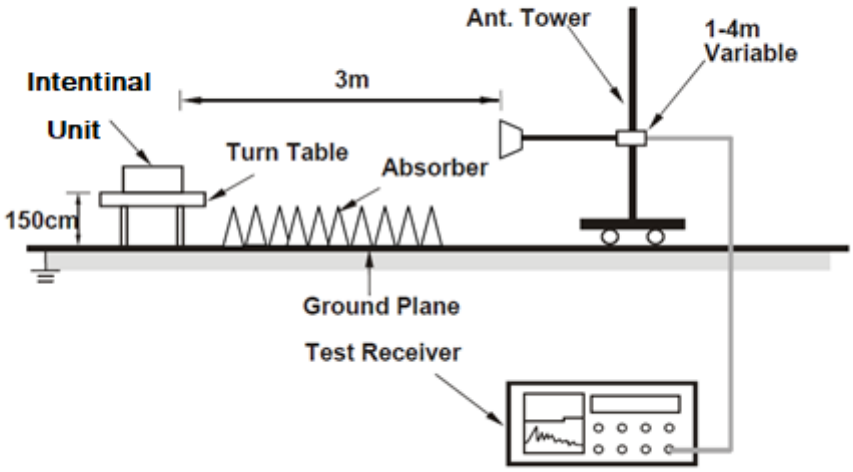
For Radiated emission below 30MHz



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).

4.5.5 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.

4.5.6 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	TX Channel 0	**Detector Function**	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	**Antenna Polarity**	Horizontal

Spurious Emission Level					
No.	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Correction Factor (dB/m)**
1	39.5060	20.01	40.00	-19.99	-9.52
2	53.4740	18.82	40.00	-21.18	-10.00
3	111.6740	20.47	43.50	-23.03	-12.03
4	210.8080	17.82	43.50	-25.68	-11.88
5	473.8720	21.29	46.50	-25.21	-5.92
6	745.4720	25.96	46.50	-20.54	-1.52

REMARKS:

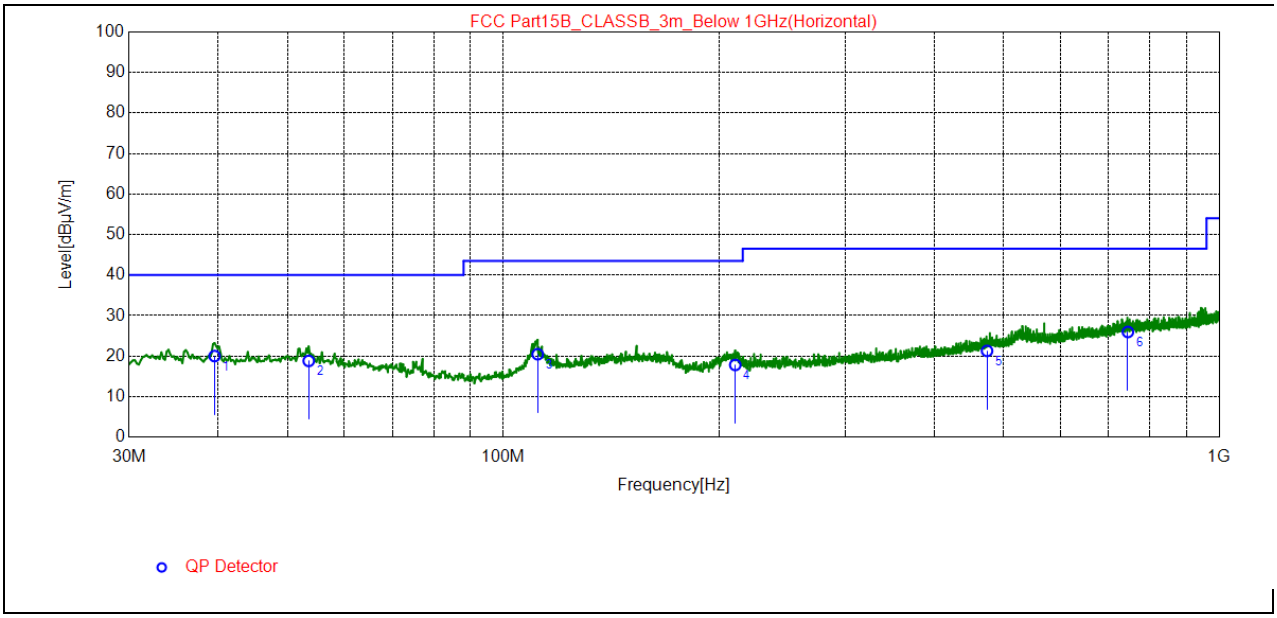
1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)

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 = Emission Level – Limit value

Test Plot:



Channel	TX Channel 0	**Detector Function**	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	**Antenna Polarity**	Vertical

Spurious Emission Level					
No.	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Correction Factor (dB/m)**
1	39.3120	24.98	40.00	-15.02	-9.54
2	51.7280	25.56	40.00	-14.44	-9.85
3	69.7700	21.52	40.00	-18.48	-12.07
4	110.8980	21.88	43.50	-21.62	-12.05
5	211.9720	22.73	43.50	-20.77	-11.83
6	709.7760	24.56	46.50	-21.94	-2.39

REMARKS:

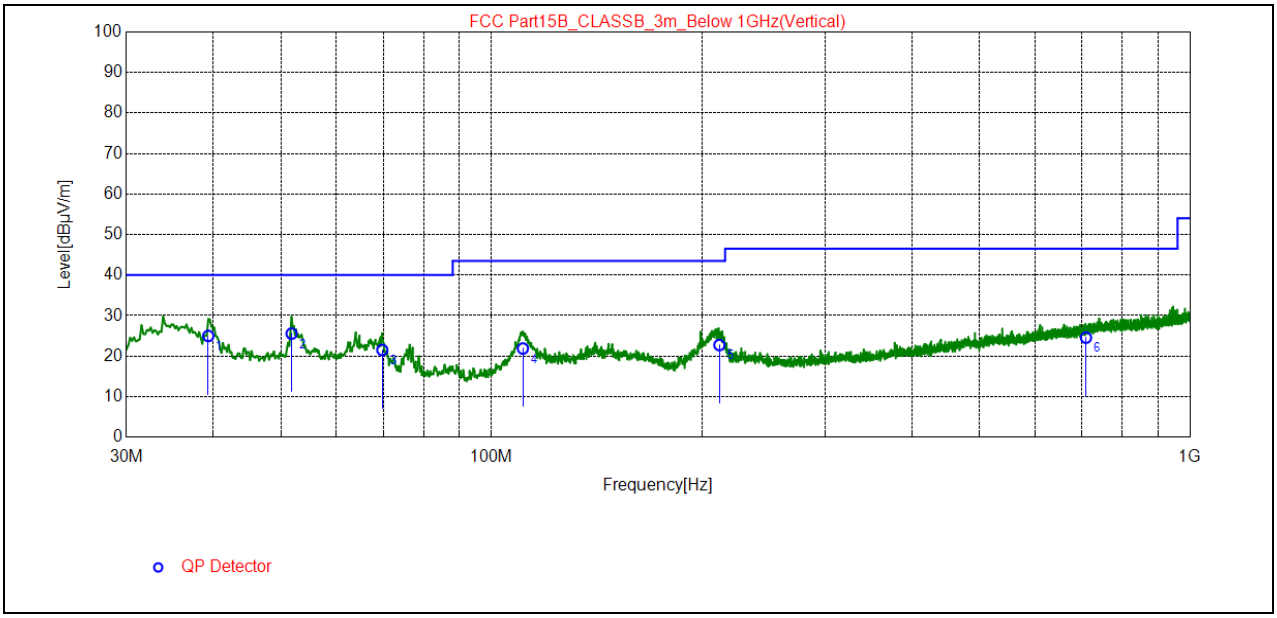
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

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 = Emission Level – Limit value

Test Plot:



Radiated Emission Range 1GHz~10th Harmonic

BLE

Below is the worst test data

Channel	TX Channel 0	**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	4804.60	49.18	74.00	-24.82	-6.24	H	PK
2	4804.60	42.88	54.00	-11.12	-6.24	H	AV
3	4804.60	48.65	74.00	-25.35	-6.24	V	PK
4	4803.75	44.79	54.00	-9.21	-6.24	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 = Emission Level – Limit value

Channel	TX Channel 19	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	4880.25	51.16	74.00	-22.84	-6.38	H	PK
2	4880.25	44.07	54.00	-9.93	-6.38	H	AV
3	4880.25	48.77	74.00	-25.23	-6.38	V	PK
4	4876.85	44.47	54.00	-9.53	-6.38	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 = Emission Level – Limit value

Channel	TX Channel 39	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	4959.30	50.98	74.00	-23.02	-6.53	H	PK
2	4961.00	45.16	54.00	-8.84	-6.54	H	AV
3	4960.15	50.13	74.00	-23.87	-6.53	V	PK
4	4961.00	45.02	54.00	-8.98	-6.54	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 = Emission Level – Limit value

4.6 Conducted Emission Measurement

4.6.1 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.

4.6.2 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.

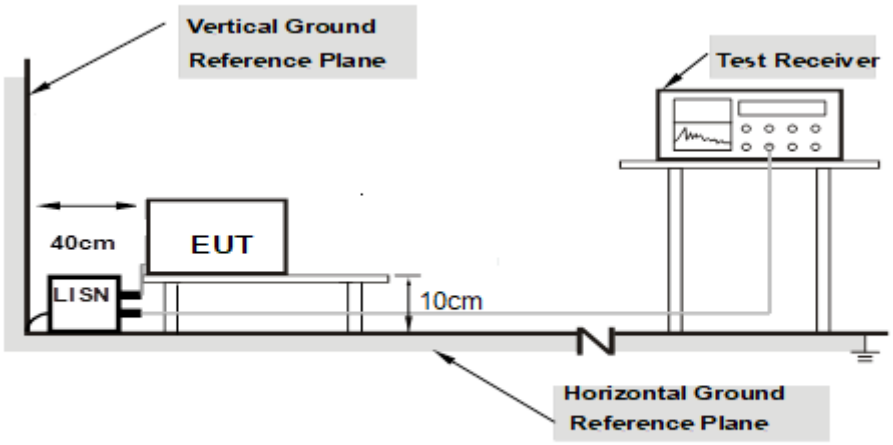
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

4.6.3 Deviation from Test Standard

No deviation.

4.6.4 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).

4.6.5 EUT Operating Conditions

Same as 4.1.6.

4.6.6 Test Results

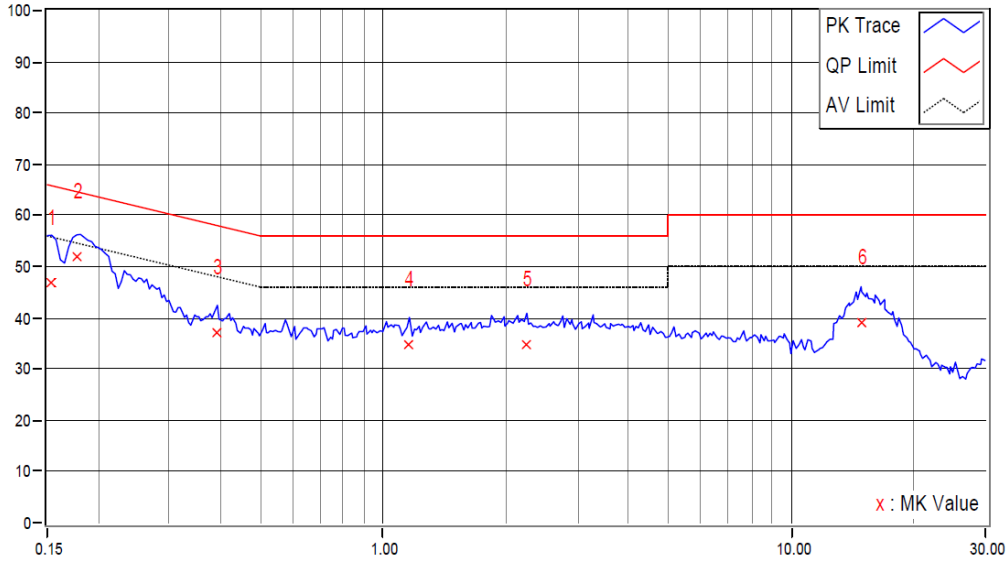
AC120V 60Hz

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.83	37.11	19.85	46.94	29.68	65.79	55.79	-18.84	-26.10
2	0.17737	9.84	42.15	28.65	51.99	38.49	64.61	54.61	-12.62	-16.12
3	0.39242	9.70	27.44	23.26	37.14	32.96	58.01	48.01	-20.87	-15.05
4	1.16031	9.62	25.18	19.87	34.80	29.49	56.00	46.00	-21.20	-16.51
5	2.25120	9.76	24.94	19.85	34.70	29.61	56.00	46.00	-21.30	-16.39
6	14.85231	10.09	29.00	22.18	39.09	32.27	60.00	50.00	-20.91	-17.73

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.

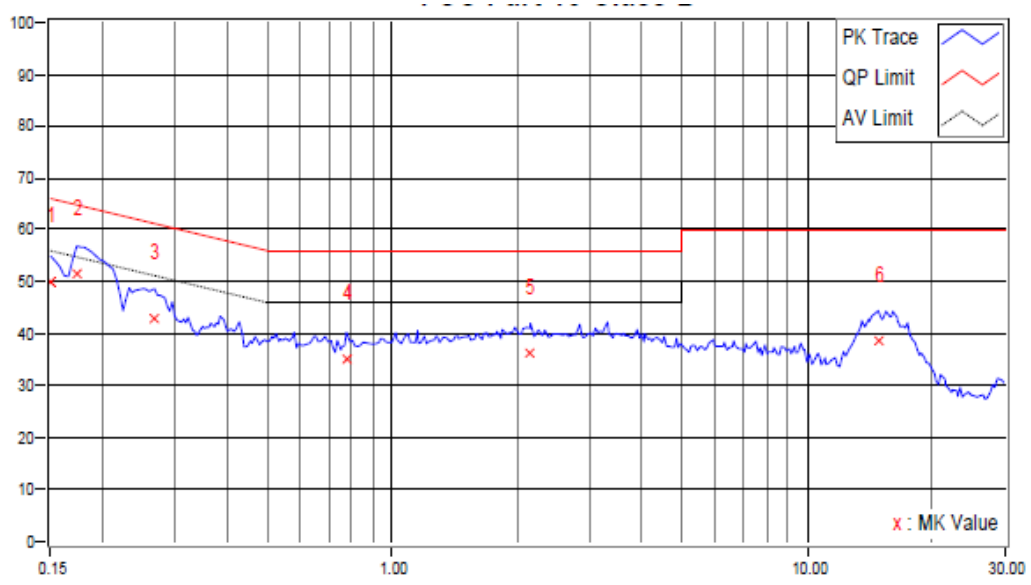


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.84	40.35	23.73	50.19	33.57	66.00	56.00	-15.81	-22.43
2	0.17346	9.82	41.92	26.54	51.74	36.36	64.79	54.79	-13.06	-18.44
3	0.26730	9.84	33.25	27.05	43.09	36.89	61.20	51.20	-18.11	-14.31
4	0.77560	9.86	25.27	20.87	35.13	30.73	56.00	46.00	-20.87	-15.27
5	2.15345	9.92	26.57	20.56	36.49	30.48	56.00	46.00	-19.51	-15.52
6	14.86013	10.09	28.57	21.55	38.66	31.64	60.00	50.00	-21.34	-18.36

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.



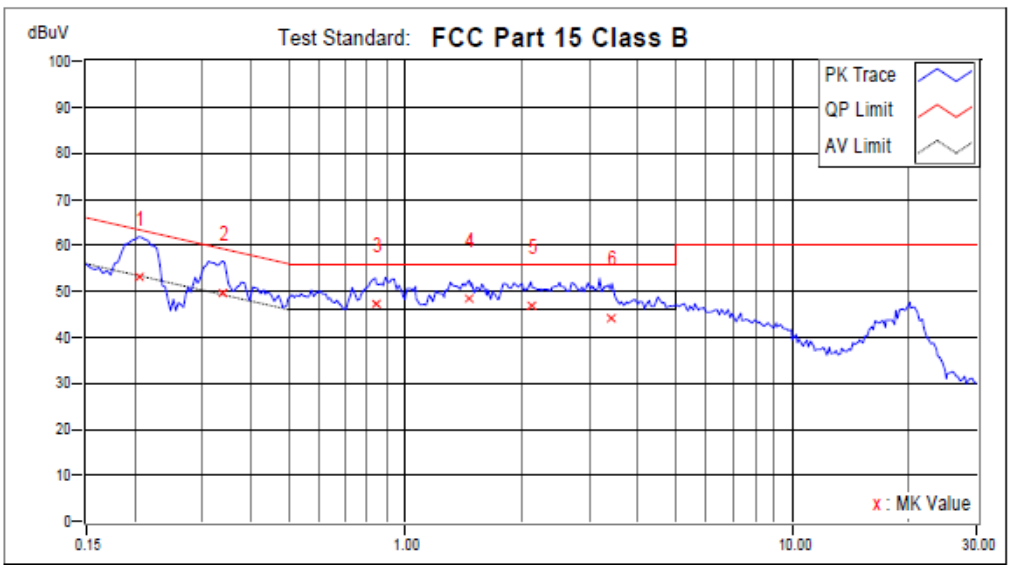
AC 240V 50Hz

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20474	9.85	43.36	36.99	53.21	46.84	63.42	53.42	-10.20	-6.57
2	0.33768	9.71	39.78	37.40	49.49	47.11	59.26	49.26	-9.77	-2.15
3	0.83816	9.59	37.80	33.86	47.39	43.45	56.00	46.00	-8.61	-2.55
4	1.46138	9.67	38.58	33.27	48.25	42.94	56.00	46.00	-7.75	-3.06
5	2.11435	9.79	37.11	32.46	46.90	42.25	56.00	46.00	-9.10	-3.75
6	3.42029	9.90	34.11	28.54	44.01	38.44	56.00	46.00	-11.99	-7.56

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.

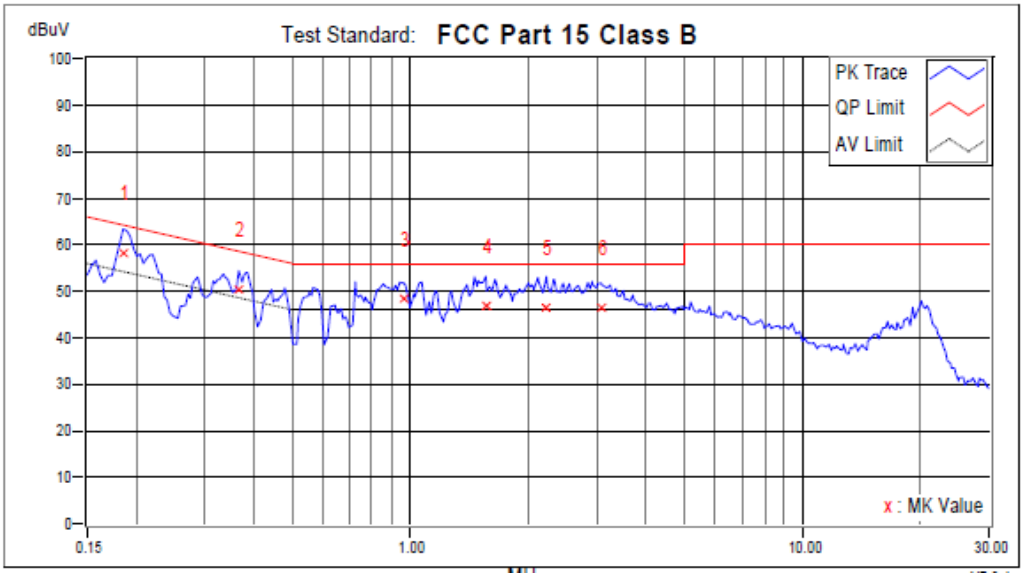


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18519	9.81	48.26	42.43	58.07	52.24	64.25	54.25	-6.18	-2.01
2	0.36505	9.87	40.50	34.49	50.37	44.36	58.61	48.61	-8.24	-4.25
3	0.95937	9.89	38.48	33.66	48.37	43.55	56.00	46.00	-7.63	-2.45
4	1.55913	9.91	37.05	32.41	46.96	42.32	56.00	46.00	-9.04	-3.68
5	2.22383	9.96	36.61	31.95	46.57	41.91	56.00	46.00	-9.43	-4.09
6	3.06448	10.02	36.40	30.50	46.40	40.50	56.00	46.00	-9.60	-5.50

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.



4.7 Radiated Restricted Band Edge Measurement

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

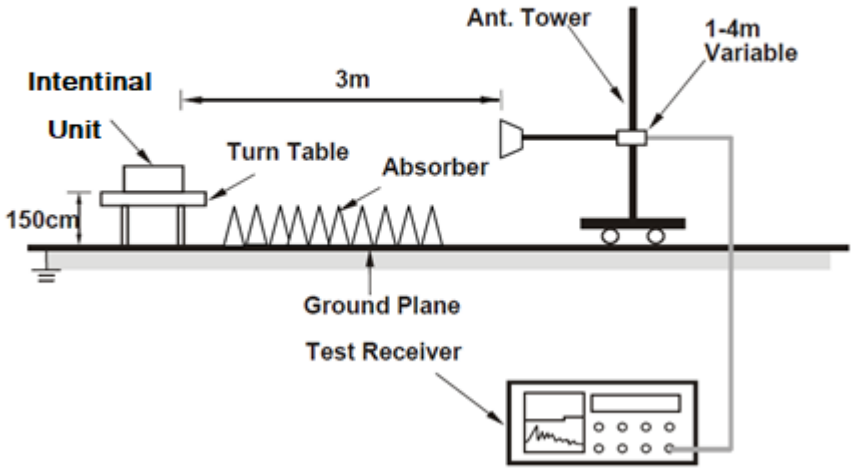
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

8. 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
9. 2. RBW = 1MHz
10. 3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.
11. If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
12. 4. Detector = Peak
13. 5. Sweep time = auto
14. 6. Trace mode = max hold
15. 7. Trace was allowed to stabilize

4.7.4 Test Setup

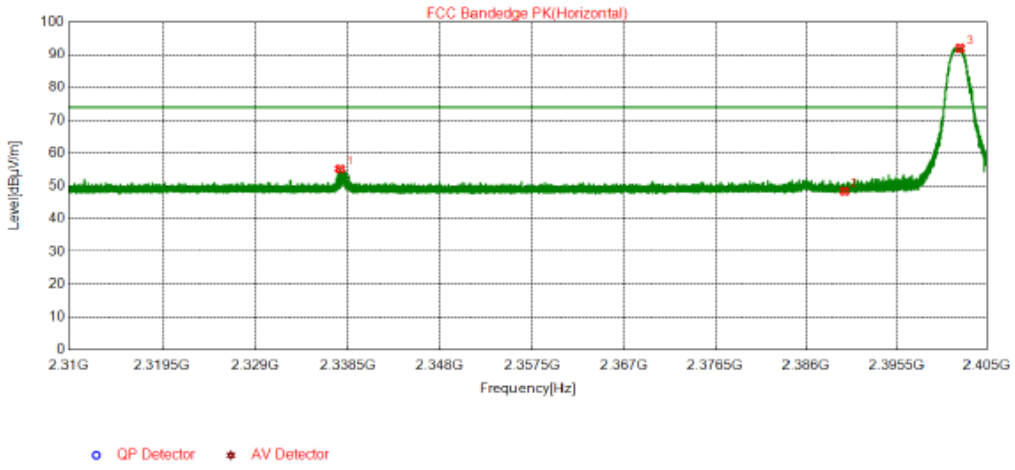
For Radiated emission above 1GHz



4.7.5 Test Results

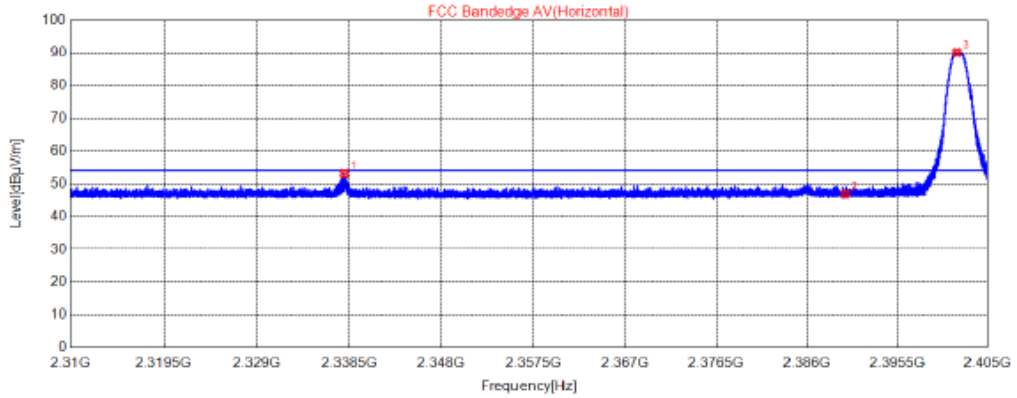
Test Plot
BLE-2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2337.6973	50.36	55.17	74.00	18.83	155	259	Horizontal	PK
2	2390.0043	43.46	48.38	74.00	25.62	175	108	Horizontal	PK
3	2402.2023	87.06	92.01	74.00	-18.01	155	343	Horizontal	PK

Test Graph

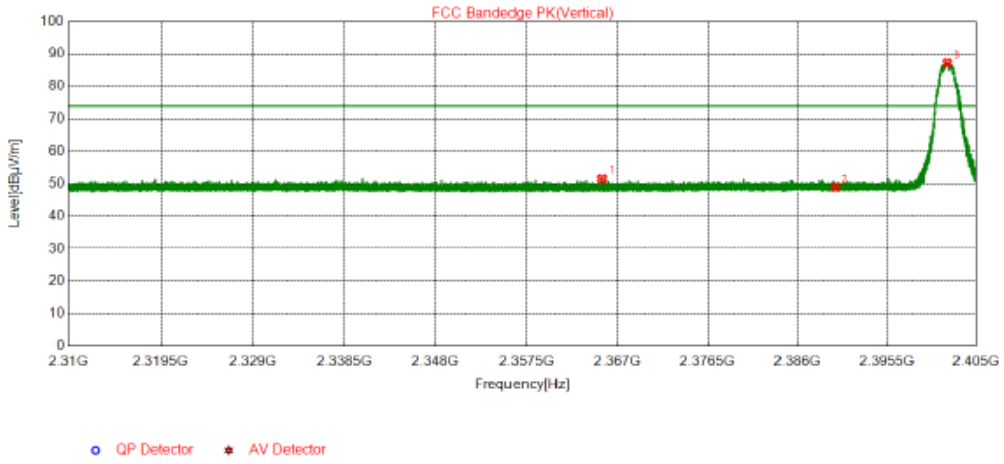


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2337.9585	48.25	53.06	54.00	0.94	155	270	Horizontal	AV
2	2390.0043	41.98	46.90	54.00	7.10	175	319	Horizontal	AV
3	2401.7890	85.14	90.09	54.00	-36.09	155	288	Horizontal	AV

Test Plot

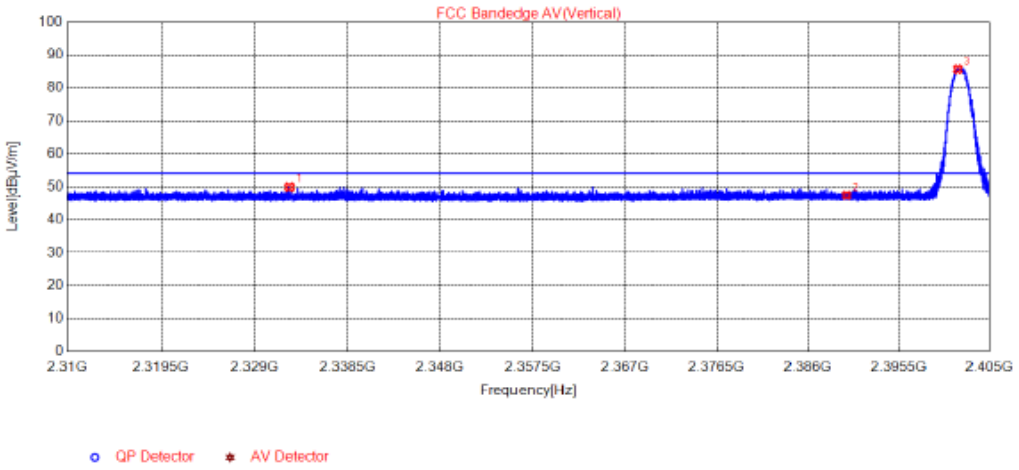
BLE-2402MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2365.3993	46.62	51.49	74.00	22.51	165	42	Vertical	PK
2	2390.0043	44.10	49.02	74.00	24.98	175	168	Vertical	PK
3	2401.9410	82.20	87.15	74.00	-13.15	155	268	Vertical	PK

Test Graph

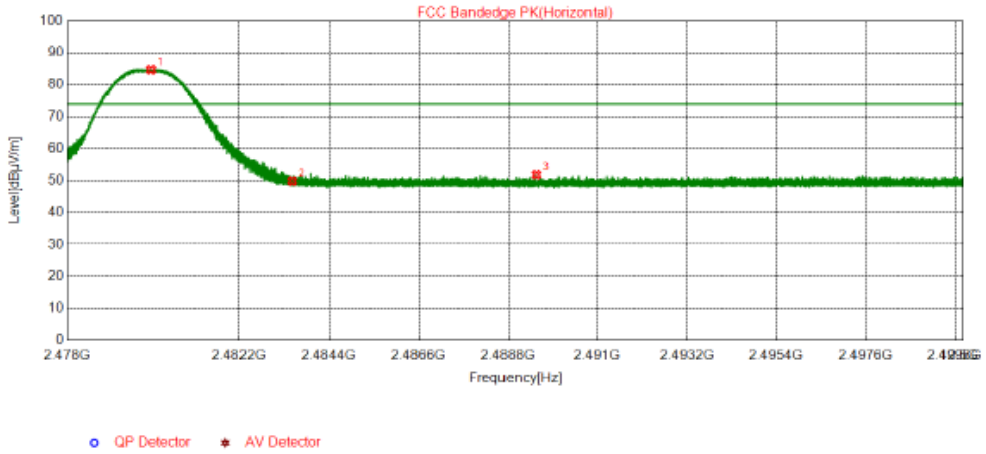


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2332.5673	45.12	49.92	54.00	4.08	175	105	Vertical	AV
2	2390.0043	42.49	47.41	54.00	6.59	165	84	Vertical	AV
3	2401.6940	80.71	85.66	54.00	-31.66	155	258	Vertical	AV

Test Plot

BLE-2480MHz/ Horizontal

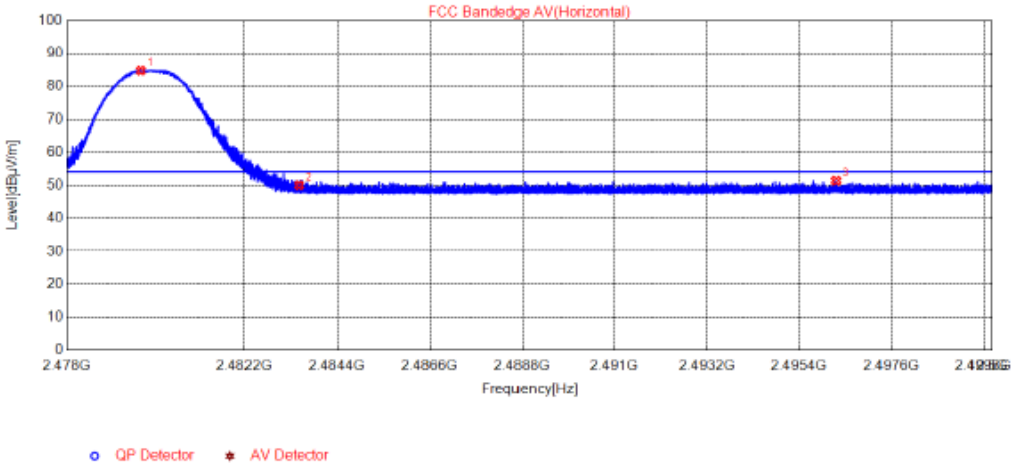
Test Graph



QP Detector AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.0493	79.61	84.69	74.00	-10.69	165	343	Horizontal	PK
2	2483.5000	44.77	49.86	74.00	24.14	155	268	Horizontal	PK
3	2489.5027	46.70	51.80	74.00	22.20	155	134	Horizontal	PK

Test Graph

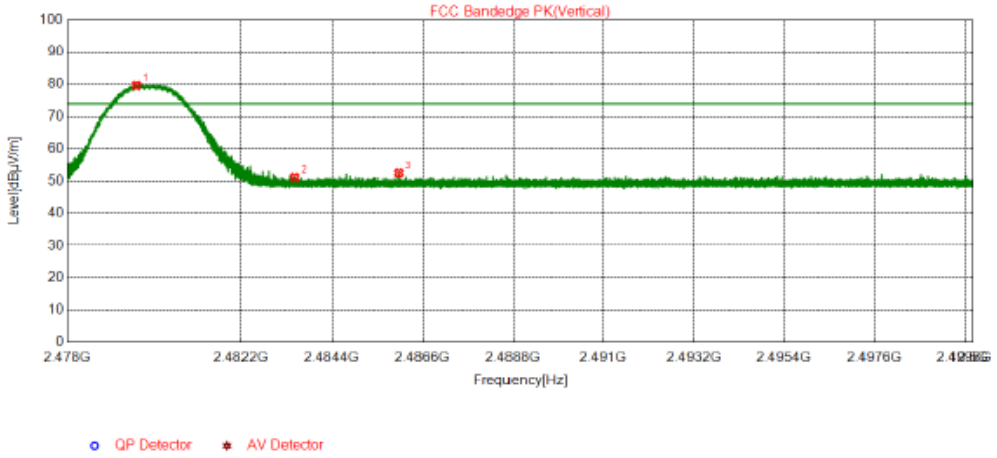


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.7589	79.73	84.81	54.00	-30.81	165	353	Horizontal	AV
2	2483.5000	44.98	50.07	54.00	3.93	165	17	Horizontal	AV
3	2496.2754	46.27	51.38	54.00	2.62	175	310	Horizontal	AV

Test Plot

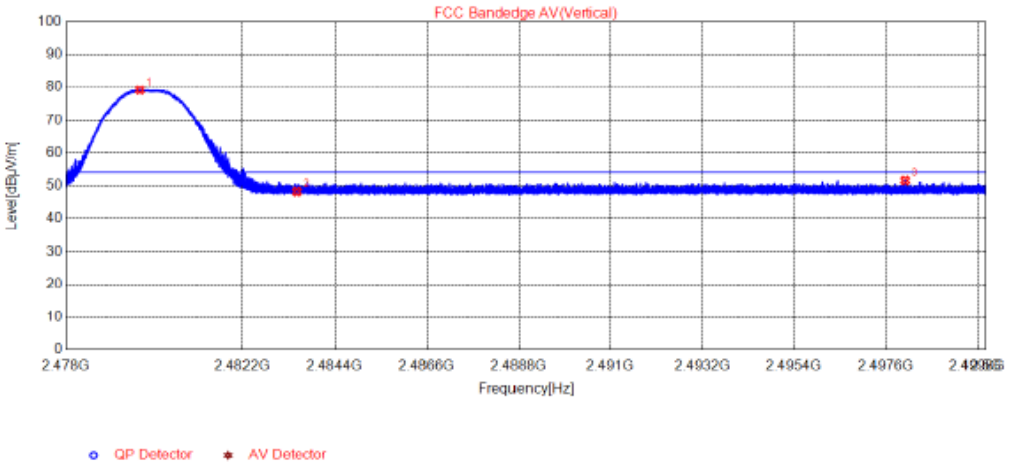
BLE-2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.6764	74.52	79.60	74.00	-5.60	175	159	Vertical	PK
2	2483.5000	45.98	51.07	74.00	22.93	165	353	Vertical	PK
3	2486.0322	47.36	52.46	74.00	21.54	165	185	Vertical	PK

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.7666	74.08	79.16	54.00	-25.16	175	168	Vertical	AV
2	2483.5000	43.14	48.23	54.00	5.77	165	141	Vertical	AV
3	2498.0640	46.42	51.54	54.00	2.46	155	101	Vertical	AV

5 Pictures of Test Arrangements

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

--- END ---