FCC Test Report

(802.15.4)

Report No.:	RFBCKS-WTW-P23010066-1
FCC ID:	2AEM4-2124173
Test Model:	U010001
Received Date:	2023/1/3
Test Date:	2023/2/7 ~ 2023/2/18
Issued Date:	2023/3/28
Applicant:	eero LLC
Address:	660 3RD St FL 4 San Francisco, CA, 94107-1921 United
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended 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. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; 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.

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P23010066-1	Original Release	2023/3/28

1 Certificate of Conformity

Product:	eero router
Brand:	eero
Test Model:	U010001
Sample Status:	Engineering sample
Applicant:	eero LLC
Test Date:	2023/2/7 ~ 2023/2/18
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, 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 RF characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** 2023/3/28

Vivian Huang / Specialist

Approved by : , **Date:** 2023/3/28

May Chen / Manager

2 Summary of Test Results

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. Minimum passing margin is -2.98 dB at 0.61875 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.7 dB at 2483.50 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB 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	Antenna connector is Morlta(MHF) not a standard connector.

Note:

1. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	**Frequency**	**Expanded Uncertainty (k=2) (±)**
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	1.9 dB
Conducted emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.1 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	5.0 dB
	18 GHz ~ 40 GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	eero router
Brand	eero
Test Model	U010001
Status of EUT	Engineering samples
Power Supply Rating	Refer to note 3
Modulation Type	O-QPSK
Modulation Technology	DSSS
Transfer Rate	250 kbps
Operating Frequency	2405 ~ 2480 MHz
Number of Channel	16
Output Power	80.91 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1

Note:

1. There are Bluetooth and Zigbee technology used for the EUT.
2. The antenna information is listed as below.

Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type
WNC	3S.0049F.111	-8.07	2.4~2.4835GHz	PIFA	Murata(MHF)

3. The EUT must be supplied with a power adapter and following below table:

AC Adapter 1		
Brand	Model	Specification
eero	C310011	AC Input : 100-240 VAC, 50-60 Hz DC Output : 5.0V/3A, 15.0W, 9.0V/3A, 27.0W, 15.0V/3A, 45.0W DC Output Cable : 2.0m Plug : USB Type-C plug
AC Adapter 2		
Brand	Model	Specification
eero	C410011	AC Input : 100-240 VAC, 2.5A 50/60 Hz DC Output : 5.0V/3A, 15.0W, 9.0V/3A, 27.0W, 15.0V/3A, 45.0W, 20.0V/5A, 100W, 28.0V/5.0A, 140.0W DC Output Cable : 2.0m Plug : USB Type-C plug

4. The RAM has below models as following table:

Sample	Main	#2-1	#2-2	#2-3
RAM	MICRON MT40A512M16TB-062E	SK HYNIX H5AN8G6NDJR-XNC	SK HYNIX H5AN8G6NDJR-XNC	NANYA NT5AD512M16C4-JR
EMMC	KIOXIA THGBMNG5D1LBAIL	KIOXIA THGBMTG5D1LBAIL	SAMSUNG KLM4G1FETEB041	SKYHIGHMEM S40FC004C1B2I00000
Note: The worst RAMs were found in **Main Source.** Therefore only the test data of the modes were recorded in this report.				

5. The EUT was pre-tested under the following test modes :

Radiated Emissions test	
Pre-test Mode	Description
Mode A	**140W(Behind Port) , RAM:1**
Mode B	140W(Front Port) , RAM:1
Mode C	45W(Behind Port) , RAM:1
Mode D	45W(Front Port) , RAM:1
Mode E	140W(Behind Port) , RAM:2
Mode F	140W(Behind Port) , RAM:3
Mode G	140W(Behind Port) , RAM:4
Conducted Emissions test	
Pre-test Mode	Description
Mode H	**140W(Behind Port) , RAM:1**
Mode I	140W(Front Port) , RAM:1
Mode J	45W(Behind Port) , RAM:1
Mode K	45W(Front Port) , RAM:1
Note: The worst radiated emissions were found in **Mode A** for radiated emissions and found in **Mode H** for conducted emissions. Therefore only the test data of the modes were recorded in this report.	

6. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.
7. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.2 Description of Test Modes

16 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

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

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

Available Channel	Tested Channel	Modulation Type
11 to 26	11, 18, 26	O-QPSK

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.

Available Channel	Tested Channel	Modulation Type
11 to 26	18	O-QPSK

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.

Available Channel	Tested Channel	Modulation Type
11 to 26	18	O-QPSK

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ 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.

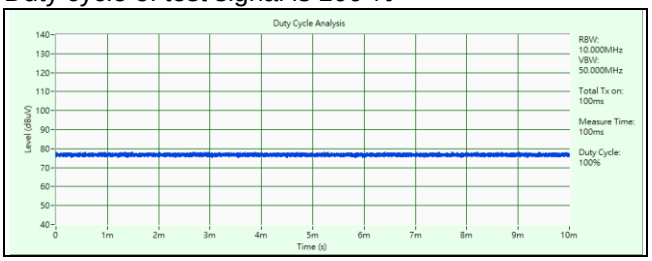
Available Channel	Tested Channel	Modulation Type
11 to 26	11, 18, 26	O-QPSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	23 deg. C, 69 % RH	120 Vac, 60 Hz (System)	Tom Yang
RE<1G	22 deg. C, 65 % RH	120 Vac, 60 Hz (System)	Sampson Chen
PLC	25 deg. C, 66 % RH	120 Vac, 60 Hz (System)	Sampson Chen
APCM	25 deg. C, 60% RH	120 Vac, 60 Hz (System)	Katina Lu

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %



3.4 Description of Support Units

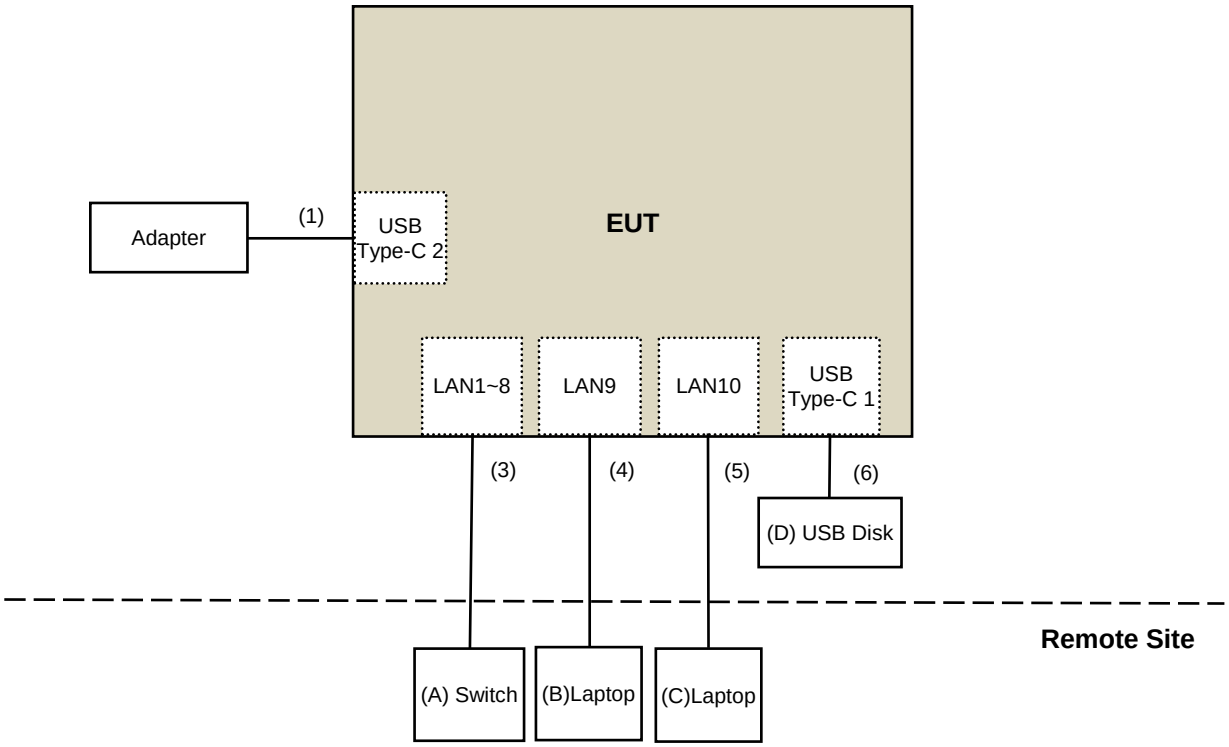
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Switch	D-Link	DGS-1005D	DR8WC92000523	NA	Provided by Lab
B.	Laptop	Lenovo	81A4	YD02YN76	PD93165NGU	Provided by Lab
C.	Laptop	DELL	E6420	482T3R1	DoC	Provided by Lab
D.	USB Disk	USB Disk	SanDisk	SDCZ73-032G-G46	NA	Provided by Lab

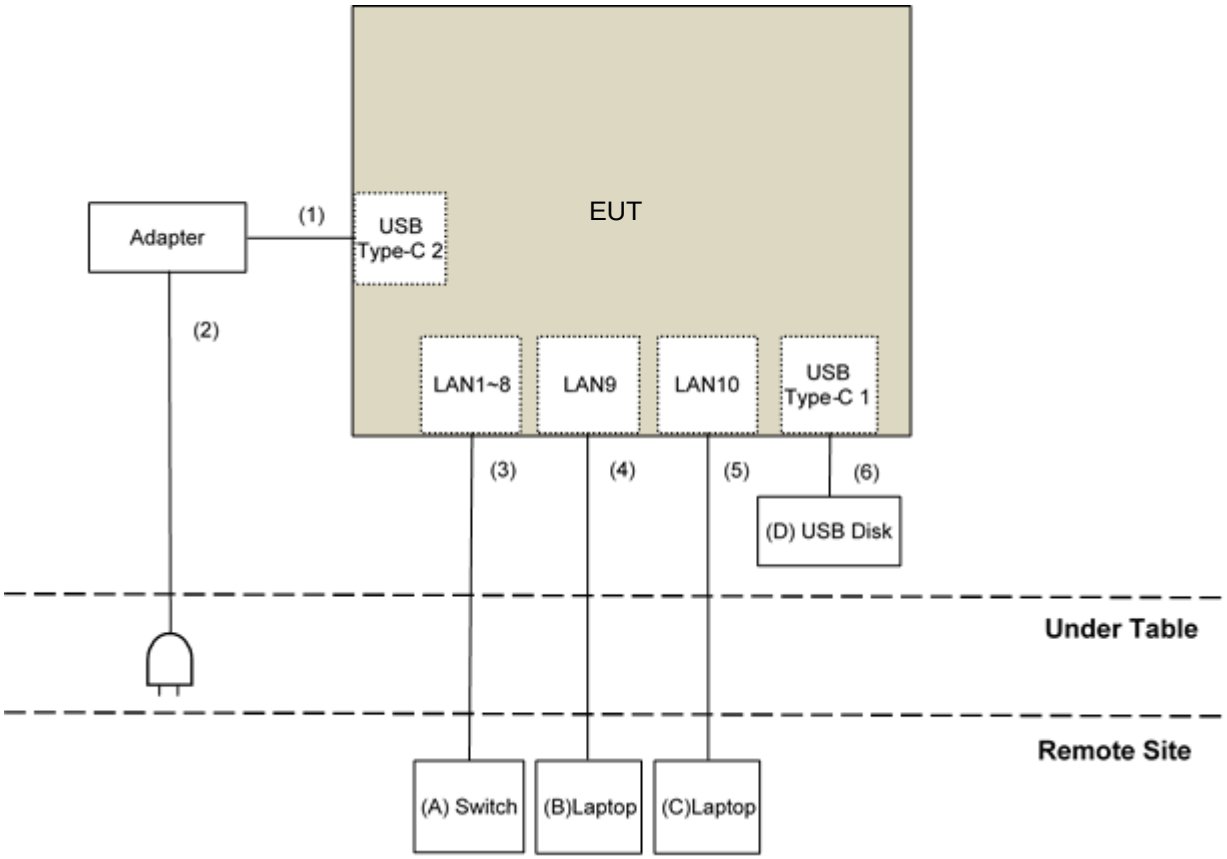
ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	2	No	0	Supplied by applicant
2.	AC Cable	1	1.4	No	0	Supplied by applicant
3.	RJ-45 Cable	8	10	No	0	Provided by Lab
4.	RJ-45 Cable	1	10	No	0	Provided by Lab
5.	RJ-45 Cable	1	10	No	0	Provided by Lab
6.	Type-C to USB	1	0.08	Yes	0	Supplied by applicant

3.4.1 Configuration of System under Test

For AC Power Conducted Emission test



For Radiated Emission test



3.5 General Description of Applied Standards and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

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.

4.1.2 Test Instruments

For Radiated Emission and Band Edge test:

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver R&S	ESR3	102528	2022/2/25	2023/2/24
Spectrum Analyzer Keysight	N9020B	MY60112410	2022/3/13	2023/3/12
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Pre_Amplifier Agilent	8447D	2944A10636	2022/3/19	2023/3/18
LOOP ANTENNA Electro-Metrics	EM-6879	264	2022/3/18	2023/3/17
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/12/19	2023/12/18
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2022/12/19	2023/12/18
Pre_Amplifier EMCI	EMC330N	980538	2022/4/25	2023/4/24
Bilog Antenna Schwarzbeck	VULB 9168	9168-0842	2022/10/24	2023/10/23
RF Coaxial Cable COMMATE/PEWC	8D	966-5-1	2022/4/25	2023/4/24
RF Coaxial Cable COMMATE/PEWC	8D	966-5-2	2022/4/25	2023/4/24
RF Coaxial Cable COMMATE/PEWC	8D	966-5-3	2022/4/25	2023/4/24
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	2022/12/28	2023/12/27
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-1819	2022/11/13	2023/11/12
Pre_Amplifier EMCI	EMC12630SE	980509	2022/4/25	2023/4/24
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180503	2022/4/25	2023/4/24
RF Coaxial Cable EMCI	EMC104-SM-SM-2000	180501	2022/4/25	2023/4/24
RF Coaxial Cable EMCI	EMC104-SM-SM-6000	180506	2022/4/25	2023/4/24
Pre_Amplifier EMCI	EMC184045SE	980387	2022/12/28	2023/12/27
Horn Antenna Schwarzbeck	BBHA 9170	9170-739	2022/11/13	2023/11/12
RF Cable-Frequency range: 1-40GHz EMCI	EMC102-KM-KM-1200	160924	2022/12/28	2023/12/27
RF Coaxial Cable EMCI	EMC-KM-KM-4000	200214	2022/3/8	2023/3/7

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 6.
3. Tested Date: 2023/2/7 ~ 2023/2/18

For the other test items:

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2022/4/5	2023/4/4
Power Meter Anritsu	ML2495A	1529002	2022/6/22	2023/6/21
Pulse Power Sensor Anritsu	MA2411B	1726434	2022/6/22	2023/6/21
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA
Spectrum Analyzer R&S	FSV40	101516	2022/3/7	2023/3/6

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Oven room 2.
3. Tested Date: 2023/2/18

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

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 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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case 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.

Note:

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

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 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 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 (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. KDB 414788 OATS and Chamber Correlation Justification

   -Based on FCC 15.31(f)(2) : measurements may be performed at a distance closer than that specified in the regulations; however, an attempts should be made to avoid making measurements in the near field.

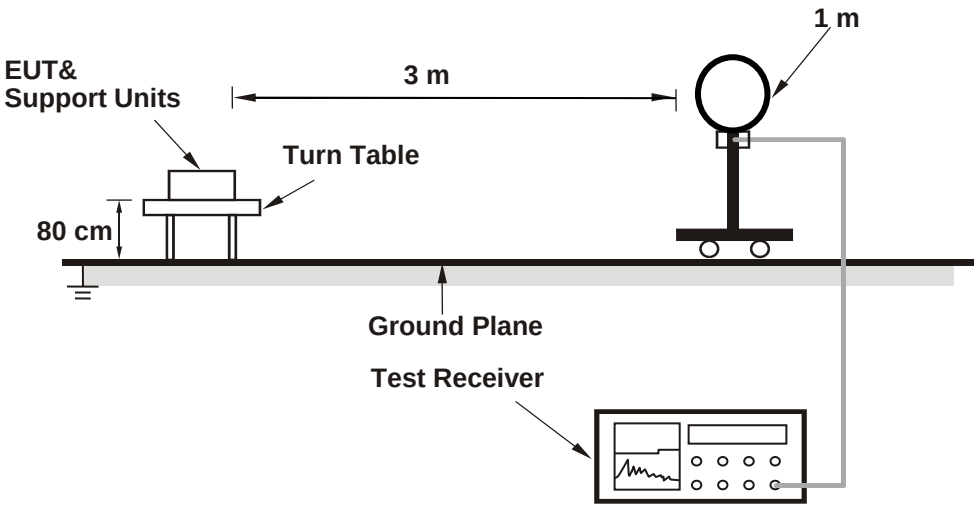
   -OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

4.1.4 Deviation from Test Standard

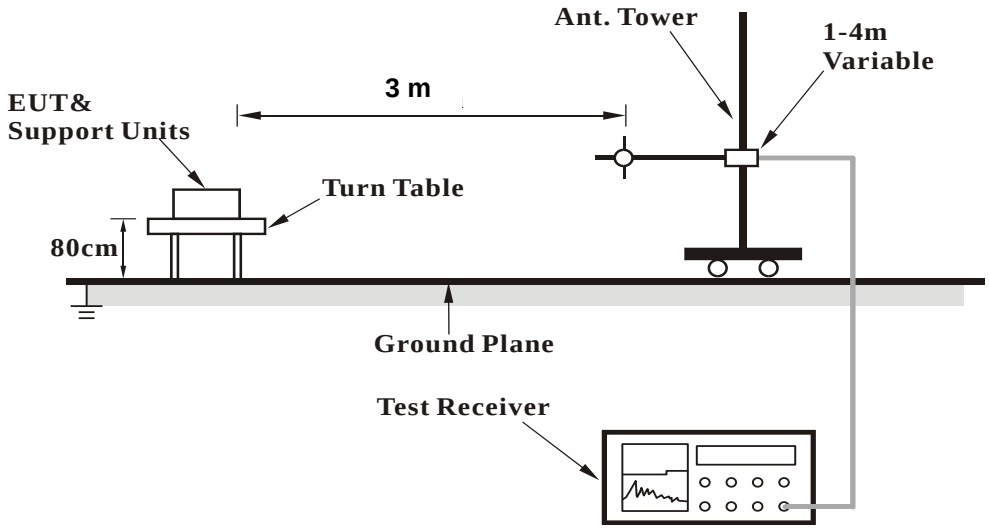
No deviation.

4.1.5 Test Set Up

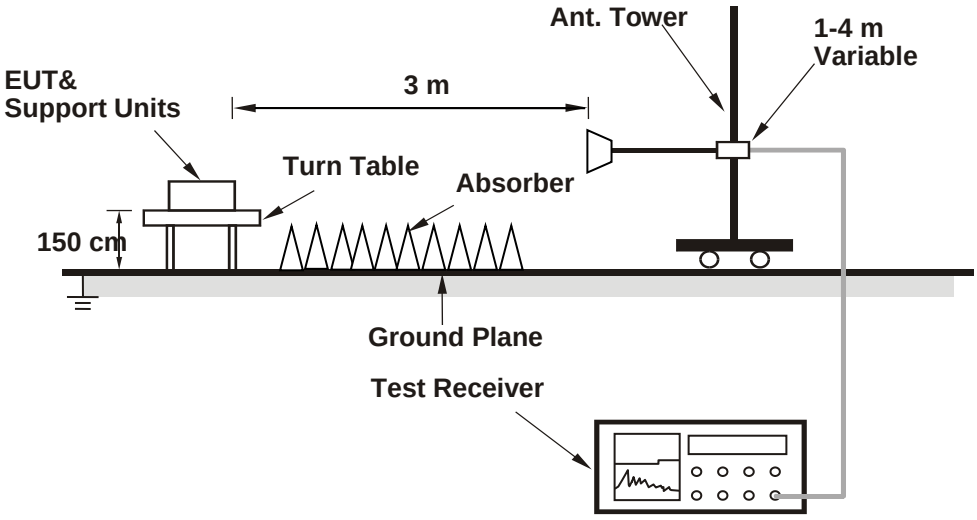
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software (HyperTerminal paste RF Command.txt command) to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

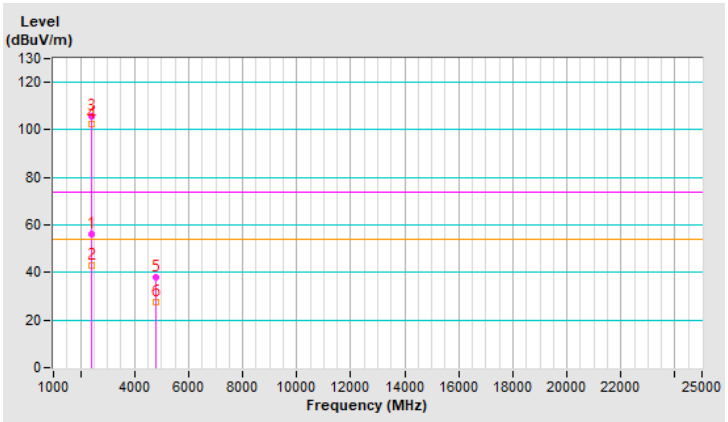
Above 1 GHz Data：

RF Mode	Zigbee	Channel	CH 11：2405 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Horizontal at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	56.1 PK	74.0	-17.9	1.50 H	338	57.1	-1.0
2	2390.00	43.0 AV	54.0	-11.0	1.50 H	338	44.0	-1.0
3	*2405.00	105.8 PK			1.50 H	338	106.8	-1.0
4	*2405.00	102.3 AV			1.50 H	338	103.3	-1.0
5	4810.00	38.0 PK	74.0	-36.0	1.66 H	317	33.6	4.4
6	4810.00	27.3 AV	54.0	-26.7	1.66 H	317	22.9	4.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

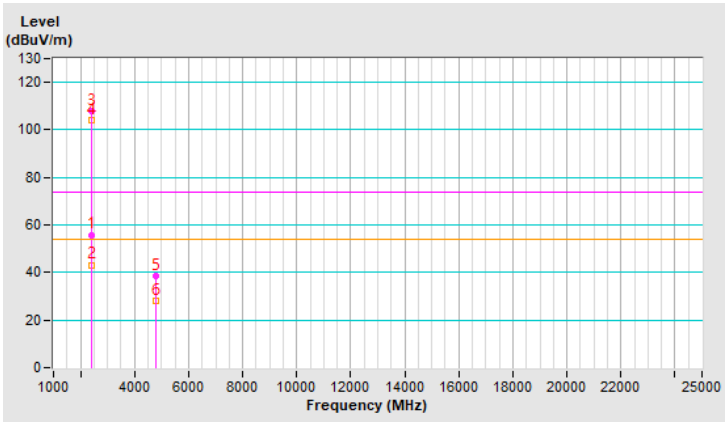


RF Mode	Zigbee	**Channel**	CH 11：2405 MHz
Frequency Range	1 GHz ~ 25 GHz	**Detector Function & Bandwidth**	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	**Environmental Conditions**	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Vertical at								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	2390.00	55.9 PK	74.0	-18.1	1.99 V	190	56.9	-1.0
2	2390.00	43.2 AV	54.0	-10.8	1.99 V	190	44.2	-1.0
3	*2405.00	107.8 PK			1.99 V	190	108.8	-1.0
4	*2405.00	104.2 AV			1.99 V	190	105.2	-1.0
5	4810.00	38.6 PK	74.0	-35.4	1.53 V	254	34.2	4.4
6	4810.00	28.0 AV	54.0	-26.0	1.53 V	254	23.6	4.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

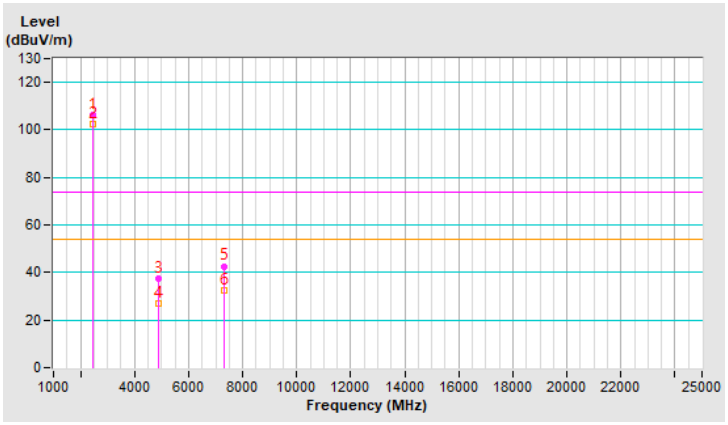


RF Mode	Zigbee	Channel	CH 18：2440 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Horizontal at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	106.3 PK			1.65 H	37	107.2	-0.9
2	*2440.00	102.5 AV			1.65 H	37	103.4	-0.9
3	4880.00	37.6 PK	74.0	-36.4	1.67 H	313	33.3	4.3
4	4880.00	27.1 AV	54.0	-26.9	1.67 H	313	22.8	4.3
5	7320.00	42.7 PK	74.0	-31.3	1.56 H	111	32.4	10.3
6	7320.00	32.6 AV	54.0	-21.4	1.56 H	111	22.3	10.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

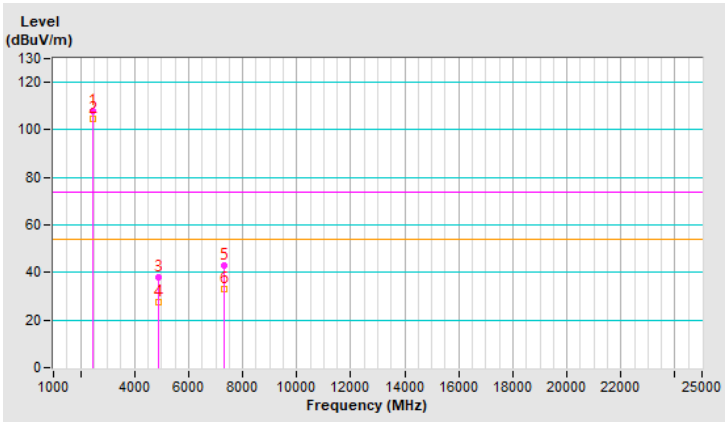


RF Mode	Zigbee	Channel	CH 18：2440 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Vertical at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	108.1 PK			2.00 V	195	109.0	-0.9
2	*2440.00	104.6 AV			2.00 V	195	105.5	-0.9
3	4880.00	38.1 PK	74.0	-35.9	1.55 V	267	33.8	4.3
4	4880.00	27.5 AV	54.0	-26.5	1.55 V	267	23.2	4.3
5	7320.00	42.7 PK	74.0	-31.3	2.00 V	153	32.4	10.3
6	7320.00	32.8 AV	54.0	-21.2	2.00 V	153	22.5	10.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

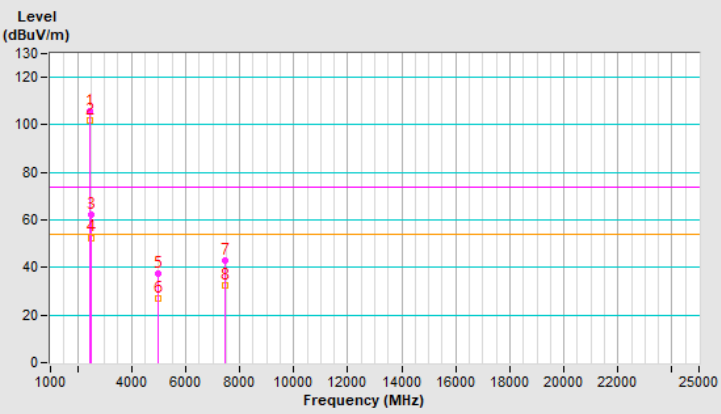


RF Mode	Zigbee	Channel	CH 26：2480 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Horizontal at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	105.5 PK			1.73 H	27	106.4	-0.9
2	*2480.00	102.0 AV			1.73 H	27	102.9	-0.9
3	2483.50	62.3 PK	74.0	-11.7	1.73 H	27	63.2	-0.9
4	2483.50	52.6 AV	54.0	-1.4	1.73 H	27	53.5	-0.9
5	4960.00	37.6 PK	74.0	-36.4	1.69 H	327	33.1	4.5
6	4960.00	27.1 AV	54.0	-26.9	1.69 H	327	22.6	4.5
7	7440.00	43.0 PK	74.0	-31.0	1.54 H	117	32.4	10.6
8	7440.00	32.7 AV	54.0	-21.3	1.54 H	117	22.1	10.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

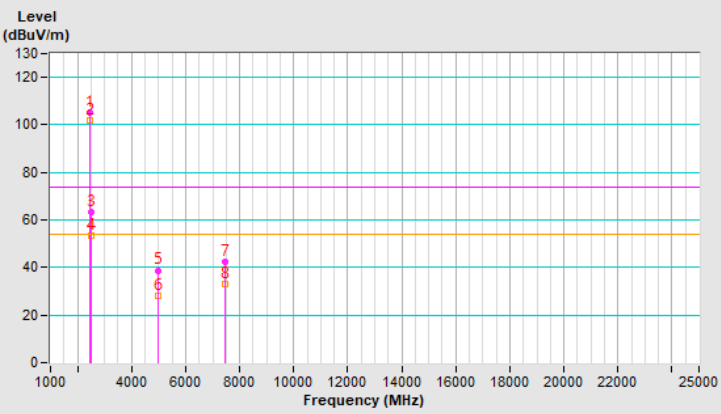


RF Mode	Zigbee	Channel	CH 26：2480 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 69% RH
Tested By	Tom Yang		

Antenna Polarity & Test Distance : Vertical at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	105.3 PK			2.12 V	207	106.2	-0.9
2	*2480.00	101.8 AV			2.12 V	207	102.7	-0.9
3	2483.50	63.5 PK	74.0	-10.5	2.12 V	207	64.4	-0.9
4	**2483.50**	**53.3 AV**	**54.0**	**-0.7**	**2.12 V**	**207**	**54.2**	**-0.9**
5	4960.00	38.8 PK	74.0	-35.2	1.49 V	280	34.3	4.5
6	4960.00	28.0 AV	54.0	-26.0	1.49 V	280	23.5	4.5
7	7440.00	42.6 PK	74.0	-31.4	2.06 V	154	32.0	10.6
8	7440.00	32.8 AV	54.0	-21.2	2.06 V	154	22.2	10.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.



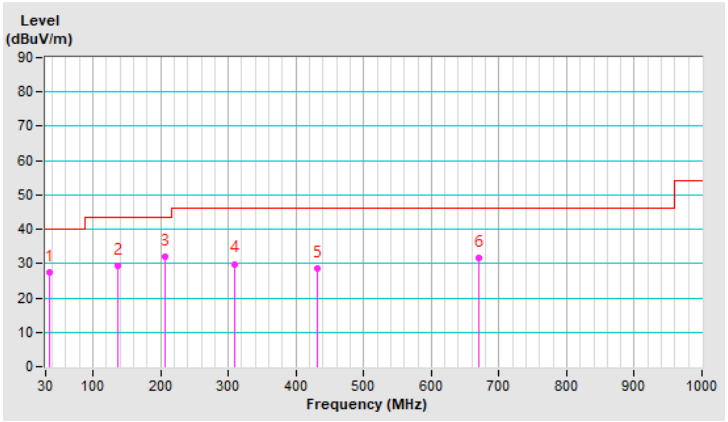
Below 1 GHz Data：

RF Mode	Zigbee	Channel	CH 18：2440 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	120 Vac,60 Hz	Environmental Conditions	22°C, 65% RH
Tested By	Sampson Chen		

Antenna Polarity & Test Distance : Horizontal at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	35.14	27.4 QP	40.0	-12.6	1.00 H	115	41.0	-13.6
2	137.34	29.2 QP	43.5	-14.3	1.50 H	105	42.2	-13.0
3	205.72	32.1 QP	43.5	-11.4	1.00 H	81	48.3	-16.2
4	308.74	29.9 QP	46.0	-16.1	2.00 H	278	41.8	-11.9
5	431.94	28.7 QP	46.0	-17.3	1.50 H	360	37.4	-8.7
6	669.46	31.6 QP	46.0	-14.4	1.00 H	68	35.7	-4.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

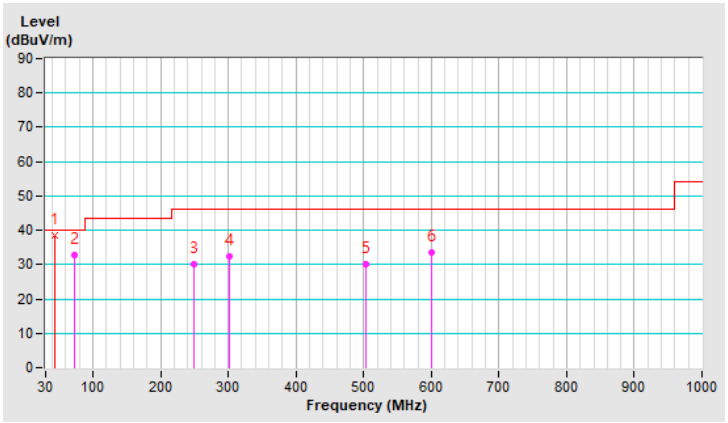


RF Mode	Zigbee	Channel	CH 18：2440 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	120 Vac,60 Hz	Environmental Conditions	22°C, 65% RH
Tested By	Sampson Chen		

Antenna Polarity & Test Distance : Vertical at								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	43.01	38.4 QP	40.0	-1.6	1.00 V	135	51.1	-12.7
2	73.53	32.7 QP	40.0	-7.3	1.00 V	347	48.3	-15.6
3	250.06	30.2 QP	46.0	-15.8	3.00 V	354	44.2	-14.0
4	301.54	32.5 QP	46.0	-13.5	1.00 V	350	44.6	-12.1
5	502.84	30.2 QP	46.0	-15.8	1.00 V	205	37.5	-7.3
6	600.04	33.7 QP	46.0	-12.3	1.00 V	60	38.6	-4.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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 0.50 MHz.

4.2.2 Test Instruments

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
TEST RECEIVER R&S	ESCS 30	847124/029	2022/10/14	2023/10/13
LISN R&S	ESH3-Z5	848773/004	2022/10/18	2023/10/17
50 ohm terminal resistance NA	NA	EMC-01	2022/9/27	2023/9/26
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2022/8/24	2023/8/23
Fixed attenuator STI	STI02-2200-10	005	2022/8/24	2023/8/23
Software BVADT	BVADT_Cond_V7.3.7.4	NA	NA	NA

Notes:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1
3. Tested Date: 2023/2/18

4.2.3 Test Procedures

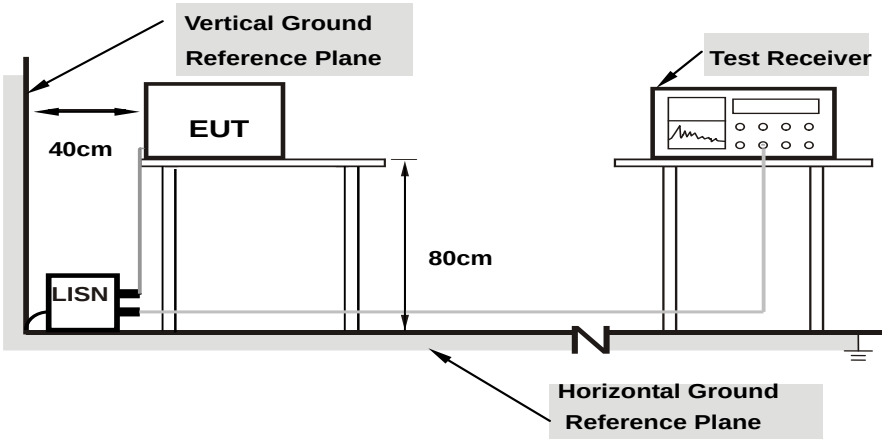
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling 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 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 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).

4.2.6 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.

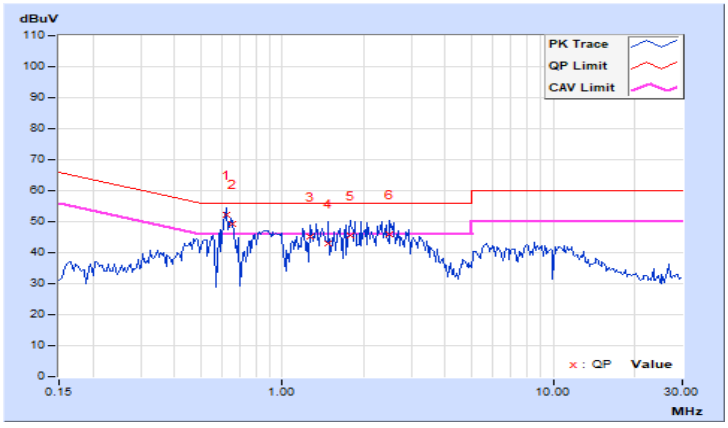
4.2.7 Test Results

RF Mode	Zigbee	**Channel**	CH 18：2440 MHz
Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	**Environmental Conditions**	25°C, 66% RH
Tested By	Sampsopn Chen		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	**0.61875**	**9.97**	**42.40**	**33.05**	**52.37**	**43.02**	**56.00**	**46.00**	**-3.63**	**-2.98**
2	0.65391	9.98	39.33	32.56	49.31	42.54	56.00	46.00	-6.69	-3.46
3	1.26563	10.02	35.34	20.21	45.36	30.23	56.00	46.00	-10.64	-15.77
4	1.48438	10.03	33.00	23.27	43.03	33.30	56.00	46.00	-12.97	-12.70
5	1.78516	10.05	35.55	22.79	45.60	32.84	56.00	46.00	-10.40	-13.16
6	2.50000	10.10	35.93	23.45	46.03	33.55	56.00	46.00	-9.97	-12.45

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

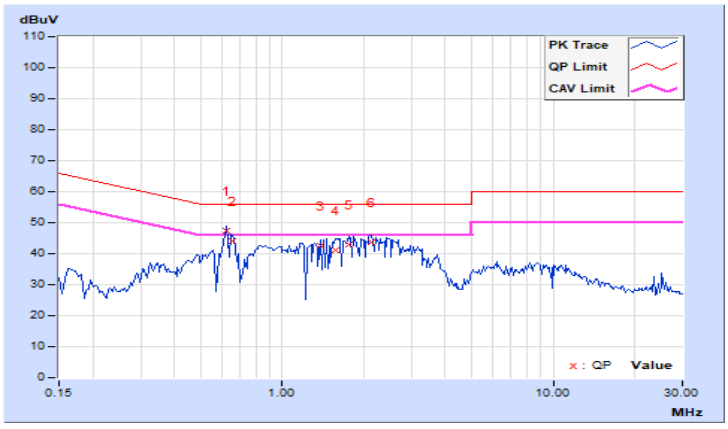


RF Mode	Zigbee	**Channel**	CH 18：2440 MHz
Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	**Environmental Conditions**	25°C, 66% RH
Tested By	Sampsopn Chen		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.62266	9.97	37.34	28.48	47.31	38.45	56.00	46.00	-8.69	-7.55
2	0.65391	9.98	34.09	25.94	44.07	35.92	56.00	46.00	-11.93	-10.08
3	1.37891	10.02	32.40	22.39	42.42	32.41	56.00	46.00	-13.58	-13.59
4	1.56641	10.03	31.08	21.45	41.11	31.48	56.00	46.00	-14.89	-14.52
5	1.75391	10.05	32.88	19.66	42.93	29.71	56.00	46.00	-13.07	-16.29
6	2.13672	10.07	33.45	22.29	43.52	32.36	56.00	46.00	-12.48	-13.64

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

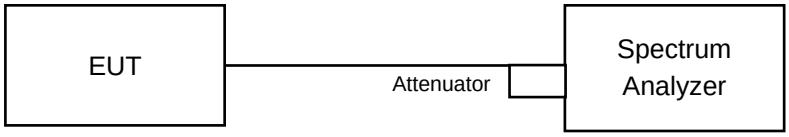


4.3 6 dB Bandwidth Measurement

4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100 kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

No deviation.

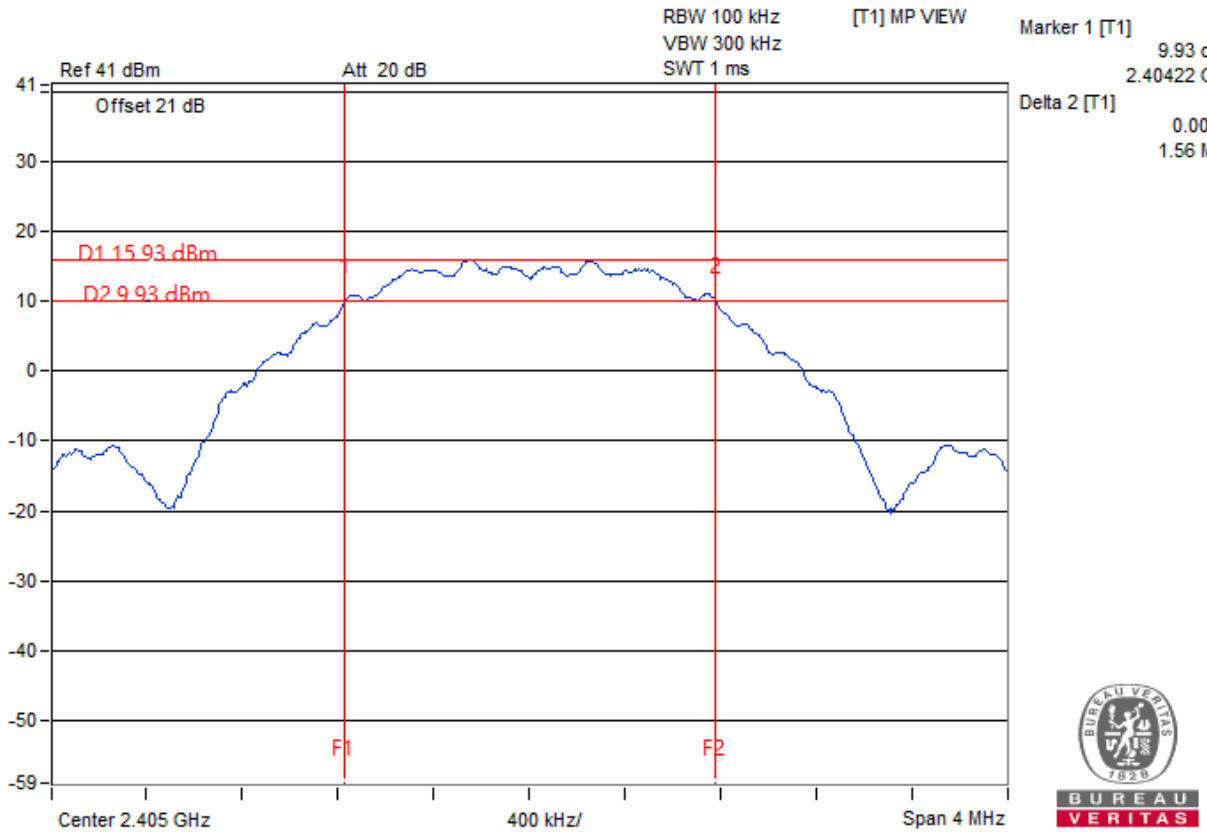
4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.56	0.5	Pass
18	2440	1.57	0.5	Pass
26	2480	1.57	0.5	Pass

Spectrum Plot of Worst Value

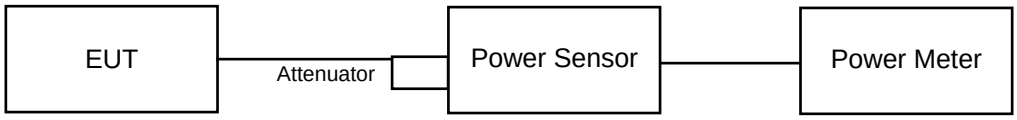


4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 Test Results

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
11	2405	80.724	19.07	30	Pass
18	2440	80.91	19.08	30	Pass
26	2480	38.994	15.91	30	Pass

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
11	2405	79.433	19.00
18	2440	79.616	19.01
26	2480	38.194	15.82

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.5.2 Test Setup

4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Set the RBW = 3 kHz, VBW = 10 kHz, Detector = peak.
b. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
c. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

4.5.5 Deviation from Test Standard

No deviation.

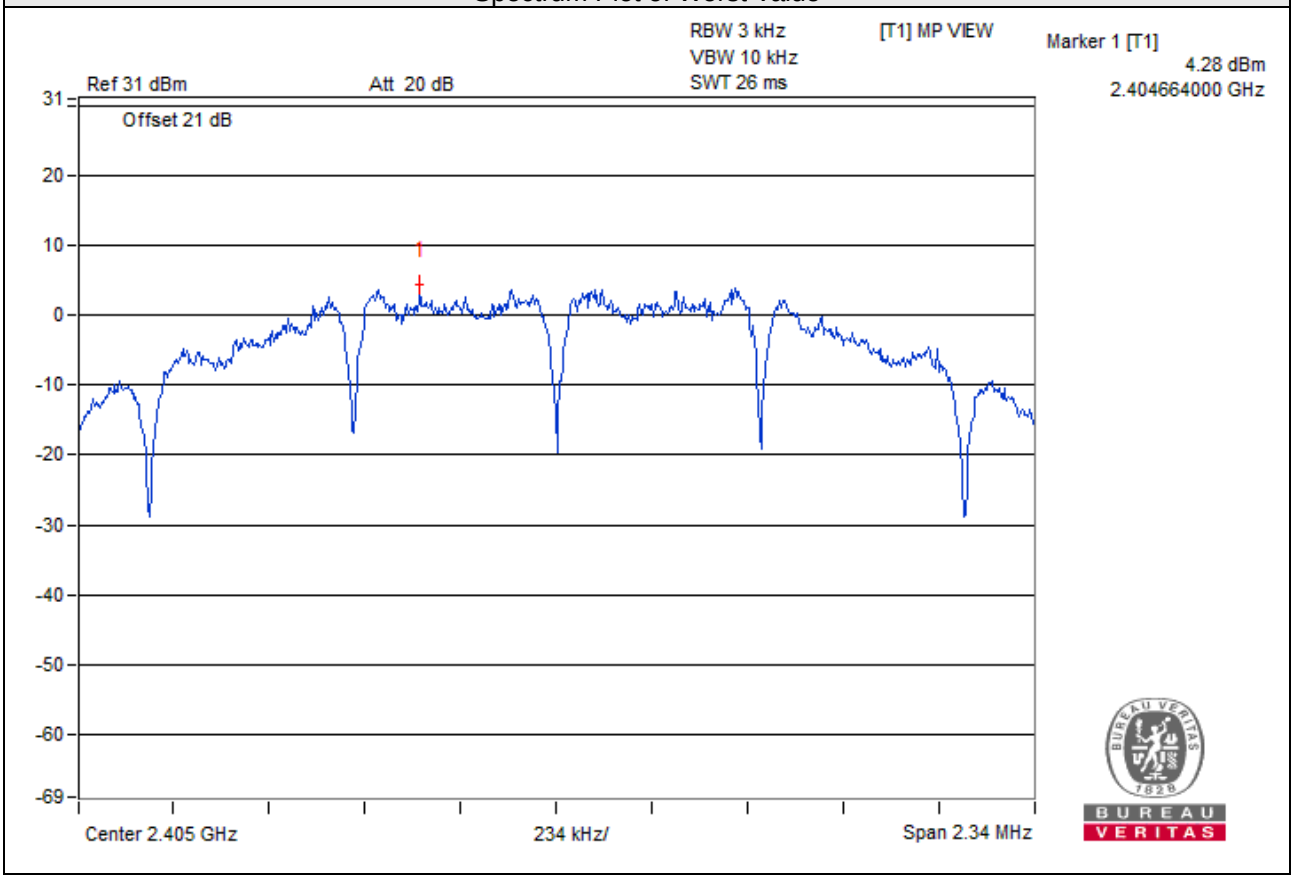
4.5.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
11	2405	4.28	8	Pass
18	2440	4.10	8	Pass
26	2480	1.02	8	Pass

Spectrum Plot of Worst Value

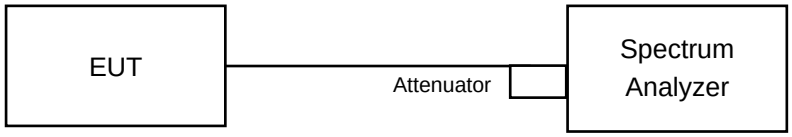


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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 Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

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.

4.6.5 Deviation from Test Standard

No deviation.

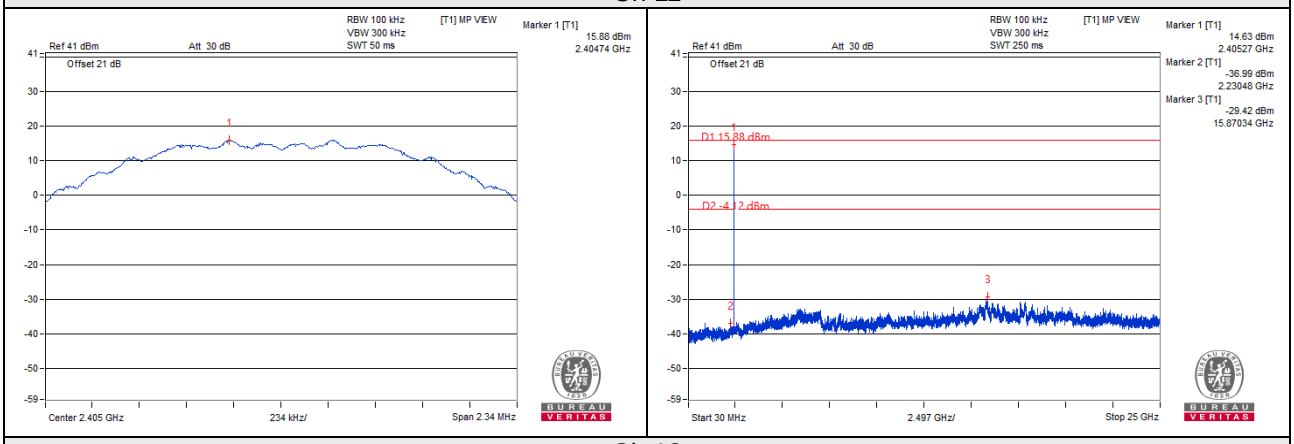
4.6.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

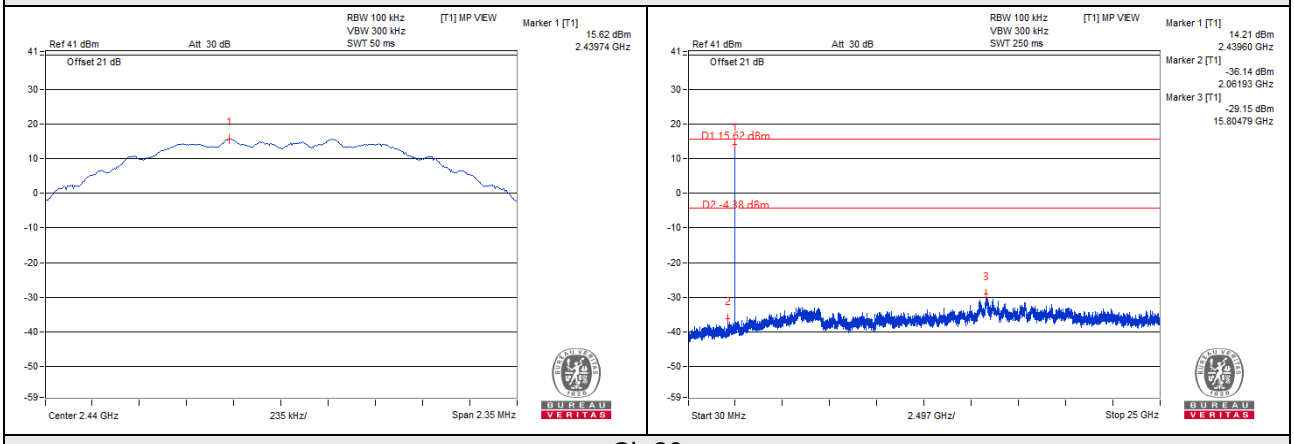
4.6.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement.

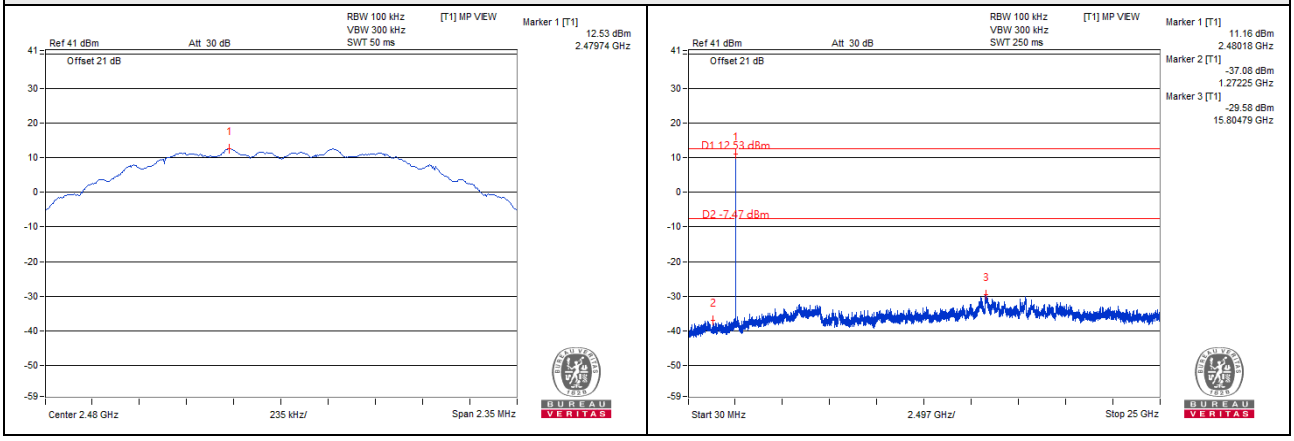
Ch 11

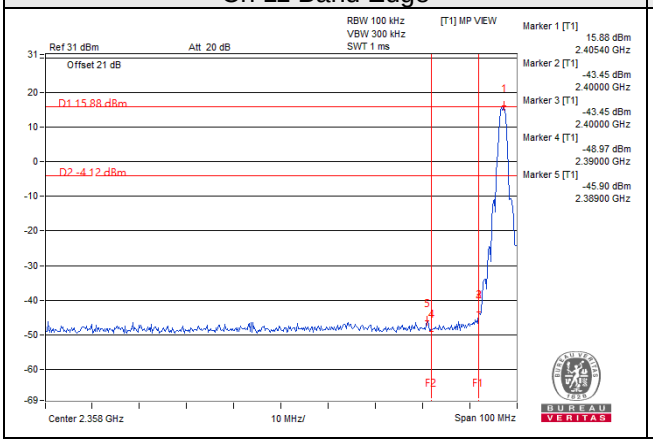
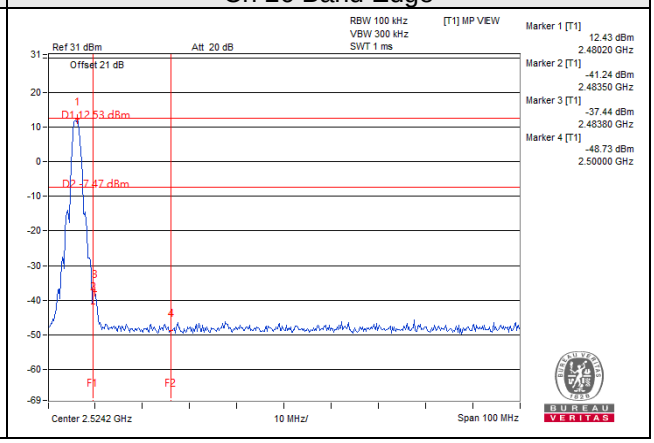


Ch 18



Ch 26

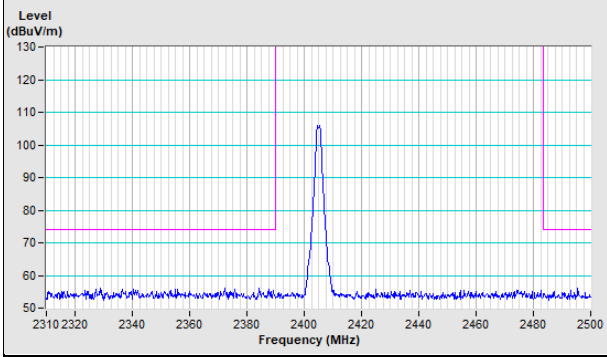


Ch 11 Band Edge	Ch 26 Band Edge
	

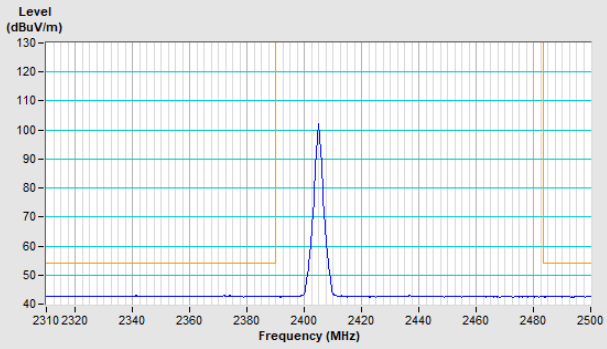
Annex A- Band Edge Measurement

Zigbee Channel 11

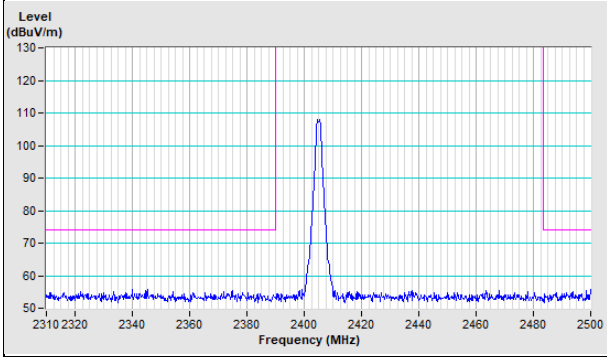
Horizontal (Peak)



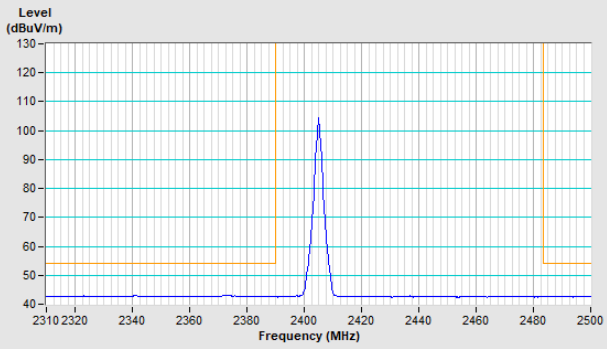
Horizontal (Average)



Vertical (Peak)

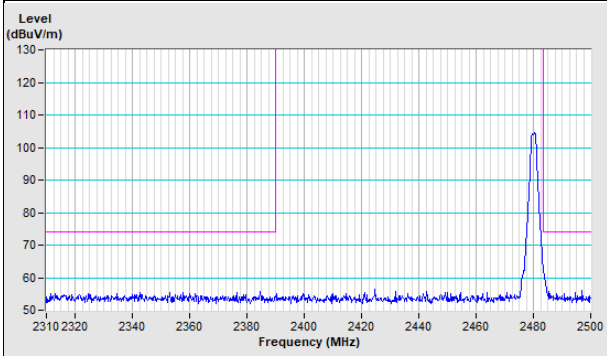


Vertical (Average)

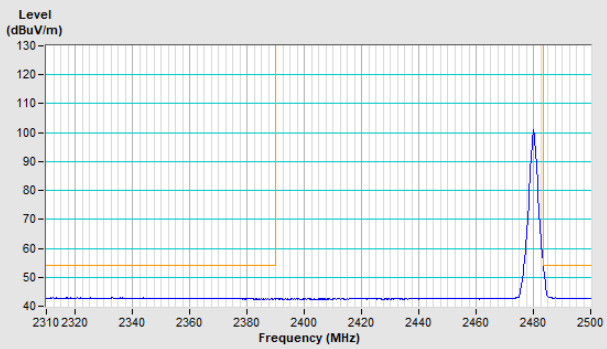


Zigbee Channel 26

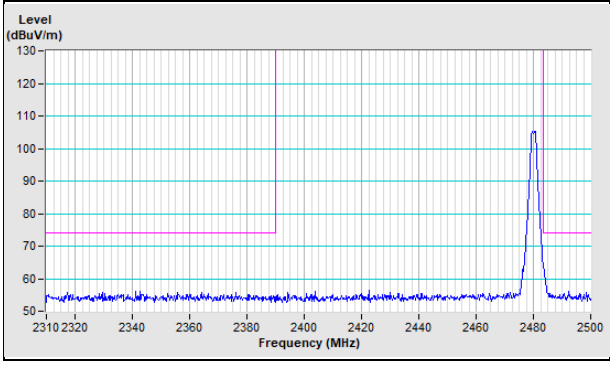
Horizontal (Peak)



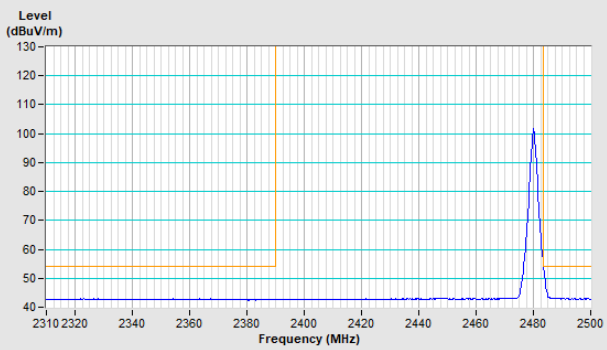
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---