FCC Test Report

Report No.:	RF170103C26-3
FCC ID:	ZQAH10
Test Model:	A0024
Received Date:	Jan. 03, 2017
Test Date:	Jan. 21, 2017 ~ Mar. 23, 2017
Issued Date:	Apr. 28, 2017
Applicant:	Nest Labs Inc.
Address:	3400 Hillview Ave. Palo Alto California, United States 94304
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)
Test Location:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan, R.O.C.

Table of Contents

Release Control Record 4

1 Certificate of Conformity 5

2 Summary of Test Results 6

2.1 Measurement Uncertainty 6
2.2 Modification Record 6

3 General Information 7

3.1 General Description of EUT 7
3.2 Description of Test Modes 8
3.2.1 Test Mode Applicability and Tested Channel Detail 9
3.3 Duty Cycle of Test Signal 11
3.4 Description of Support Units 11
3.4.1 Configuration of System under Test 11
3.5 General Description of Applied Standards 11

4 Test Types and Results 12

4.1 Radiated Emission and Bandedge Measurement 12
4.1.1 Limits of Radiated Emission and Bandedge Measurement 12
4.1.2 Test Instruments 13
4.1.3 Test Procedures 14
4.1.4 Deviation from Test Standard 14
4.1.5 Test Set Up 15
4.1.6 EUT Operating Conditions 15
4.1.7 Test Results 16
4.2 Conducted Emission Measurement 27
4.2.1 Limits of Conducted Emission Measurement 27
4.2.2 Test Instruments 27
4.2.3 Test Procedures 28
4.2.4 Deviation from Test Standard 28
4.2.5 Test Setup 28
4.2.6 EUT Operating Conditions 28
4.2.7 Test Results 29
4.3 6 dB Bandwidth Measurement 31
4.3.1 Limits of 6 dB Bandwidth Measurement 31
4.3.2 Test Setup 31
4.3.3 Test Instruments 31
4.3.4 Test Procedure 31
4.3.5 Deviation fromTest Standard 31
4.3.6 EUT Operating Conditions 31
4.3.7 Test Result 32
4.4 Conducted Output Power Measurement 33
4.4.1 Limits of Conducted Output Power Measurement 33
4.4.2 Test Setup 33
4.4.3 Test Instruments 33
4.4.4 Test Procedures 33
4.4.5 Deviation from Test Standard 33
4.4.6 EUT Operating Conditions 33
4.4.7 Test Results 34
4.5 Power Spectral Density Measurement 35
4.5.1 Limits of Power Spectral Density Measurement 35
4.5.2 Test Setup 35
4.5.3 Test Instruments 35
4.5.4 Test Procedure 35
4.5.5 Deviation from Test Standard 35
4.5.6 EUT Operating Condition 35

4.5.7 Test Results 36
4.6 Conducted Out of Band Emission Measurement 37
4.6.1 Limits of Conducted Out of Band Emission Measurement 37
4.6.2 Test Setup 37
4.6.3 Test Instruments 37
4.6.4 Test Procedure 37
4.6.5 Deviation from Test Standard 37
4.6.6 EUT Operating Condition 37
4.6.7 Test Results 38
5 Pictures of Test Arrangements 40
Annex A- Radiated Bandedge Plots 41
Appendix – Information on the Testing Laboratories 42

Release Control Record

Issue No.	Description	Date Issued
RF170103C26-3	Original Release	Apr. 28, 2017

1 Certificate of Conformity

Product:	Home security device
Brand:	Nest Guard
Test Model:	A0024
Sample Status:	Identical Prototype
Applicant:	Nest Labs Inc.
Test Date:	Jan. 21, 2017 ~ Mar. 23, 2017
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 EMC characteristics under the conditions specified in this report.

Prepared by : Rona Chen , **Date:** Apr. 28, 2017

Rona Chen / Specialist

Approved by : David Huang , **Date:** Apr. 28, 2017

David Huang / Project Engineer

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 -11.26 dB at 0.61220 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.02 dB at 2483.52 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	No antenna connector is used.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:
The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	**Frequency**	**Expended Uncertainty (k=2) (±)**
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Home security device
Brand	Nest Guard
Test Model	A0024
Status of EUT	Identical Prototype
Power Supply Rating	5.0 Vdc (adapter or host equipment) 3.7 Vdc (Li-ion battery)
Modulation Type	O-QPSK
Modulation Technology	DSSS
Transfer Rate	250 kbps
Operating Frequency	2405 ~ 2475 MHz
Number of Channel	15
Output Power	85.901 mW
Antenna Type	Monopole Type antenna with 1.45 dBi gain
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Nest	A0017	I/P: 100-240 Vac, 50/60 Hz, 0.35 A O/P: 5 Vdc, 2.5 A
Battery	Nest	N/A	3.7 Vdc, 2850 mAh
USB Cable	Nest	N/A	1.9 meter shielded cable without core

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

15 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		

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

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

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	Available Channel	Tested Channel	Modulation Technology	Modulation Type
-	11 to 25	11, 17, 25	DSSS	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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
-	11 to 25	25	OFDM	O-QPSK

- The Low Frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20 dB lower than the limit line was not reported.

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	Available Channel	Tested Channel	Modulation Technology	Modulation Type
-	11 to 25	25	OFDM	O-QPSK

Bandedge 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	Available Channel	Tested Channel	Modulation Technology	Modulation Type
-	11 to 25	11, 25	OFDM	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.

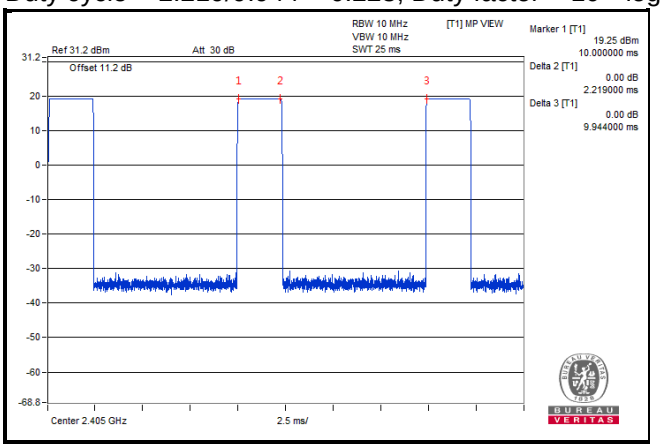
EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
-	11 to 25	11, 17, 25	OFDM	O-QPSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
APCM	25 deg. C, 65 % RH	3.7 Vdc	Taylor Liu

3.3 Duty Cycle of Test Signal

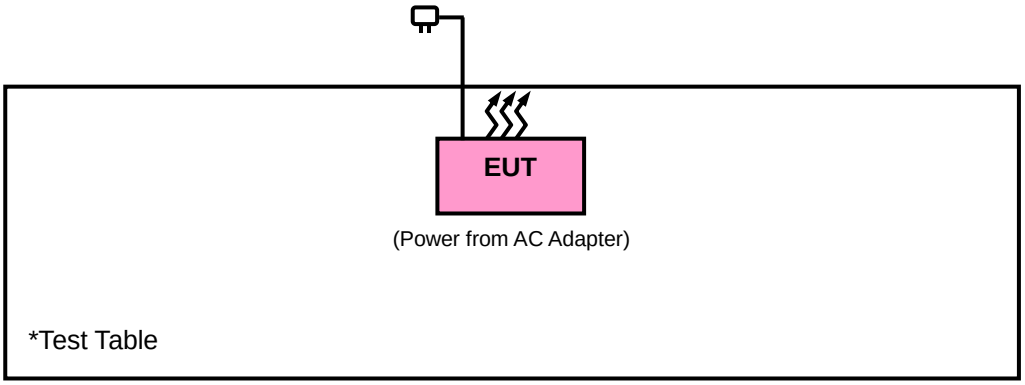
Duty cycle = 2.219/9.944 = 0.223, Duty factor = 10 * log(1/0.223) = 6.51



3.4 Description of Support Units

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

3.4.1 Configuration of System under Test



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 standards:

FCC Part 15, Subpart C (15.247)
558074 D01 DTS Meas Guidance v04
ANSI C63.10-2013

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

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

Description & Manaufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY52260177	Jun. 21, 2016	Jun. 20, 2017
		MY51210203	Feb. 17, 2017	Feb. 16, 2018
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 16, 2016	Dec. 15, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 13, 2016	Dec. 12, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Dec. 26, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Dec. 12, 2016	Dec. 13, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Dec. 14, 2016	Dec. 13, 2017
Fixed Attenuator Mini-Circuits	BW-N10W5+	NA	Jul. 08, 2016	Jul. 07, 2017
Loop Antenna	EM-6879	269	Aug. 11, 2016	Aug. 10, 2017
Preamplifier EMCI	EMC 012645	980115	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 184045	980116	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 330H	980112	Oct. 21, 2016	Oct. 20, 2017
Power Meter Anritsu	ML2495A	1232002	Sep. 08, 2016	Sep. 07, 2017
Power Sensor Anritsu	MA2411B	1207325	Sep. 08, 2016	Sep. 07, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 21, 2016	Oct. 20, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 21, 2016	Oct. 20, 2017
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 21, 2016	Oct. 20, 2017
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA

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 HwaYa Chamber 10.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
5. The IC Site Registration No. is IC7450F-10.

4.1.3 Test Procedures

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 Average (Duty cycle < 98 %) for Average detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz 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.

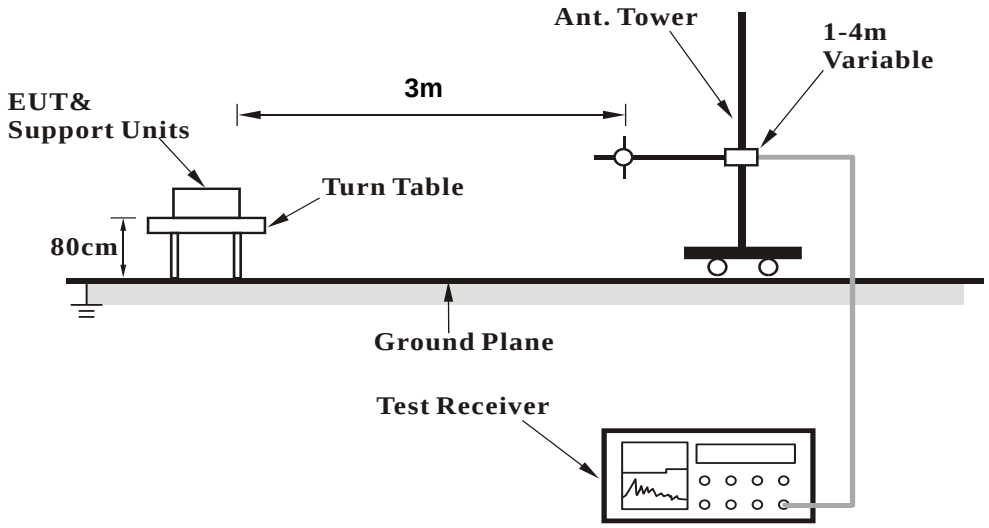
Test Setting	
Bandedge Emissions	RBW / VBW
(Non-restricted Band)	100k / 300k
(Restricted Band)	Peak: 1M / 3M Average: 1M / 1k

4.1.4 Deviation from Test Standard

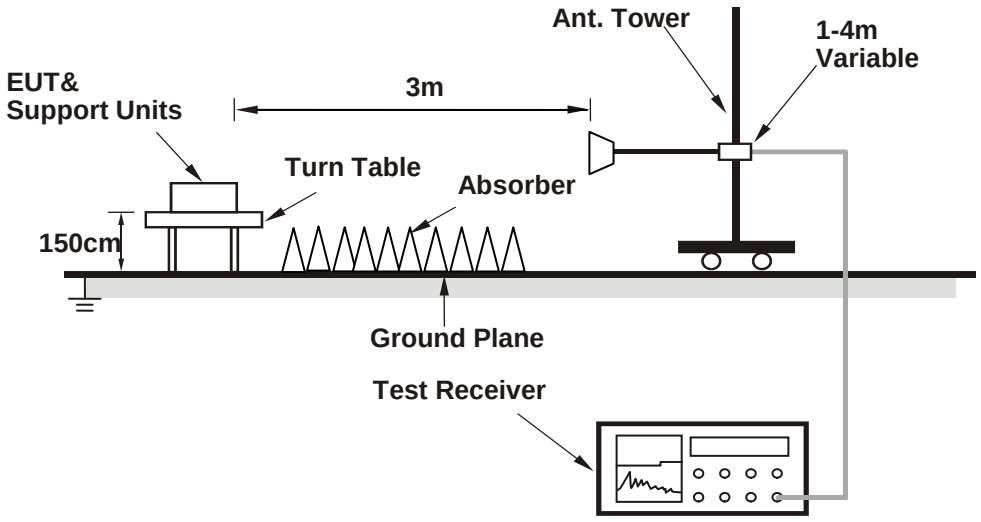
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1 GHz>



<Frequency Range 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 to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

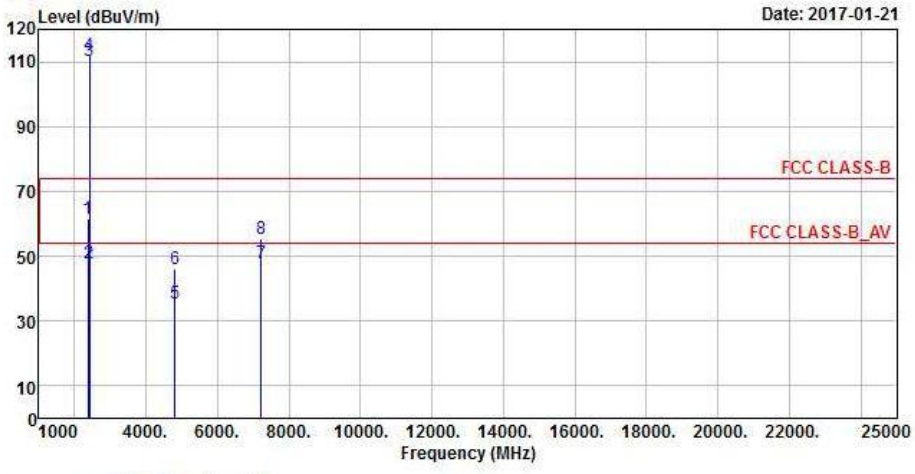
- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

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

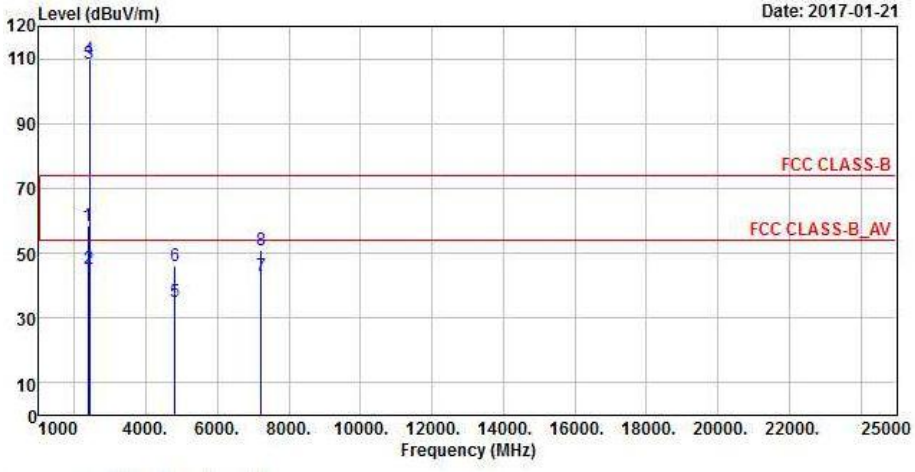
Above 1 GHz Data：

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Getaz Yang

Horizontal



Vertical



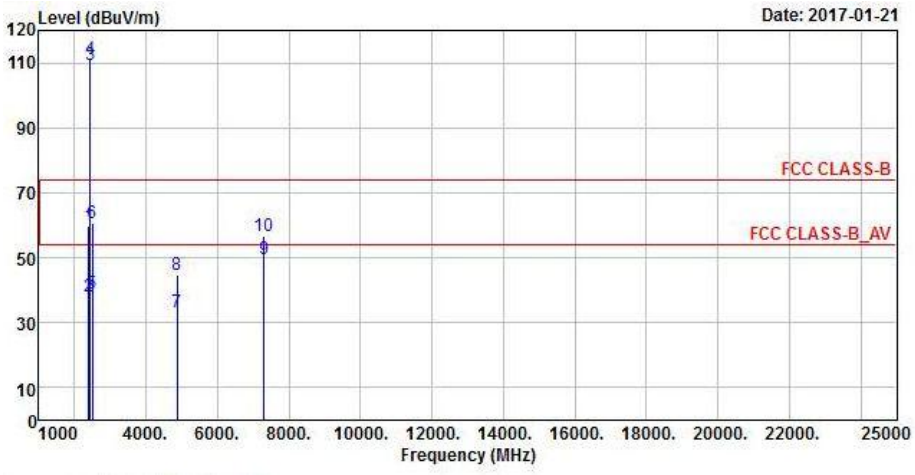
ntennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2383.35	61.49	68.05	74	-12.51	26.86	4.08	37.5	106	131	Peak
2389.92	47.81	54.34	54	-6.19	26.91	4.08	37.52	106	131	Average
2405	110.34	116.81			26.96	4.09	37.52	106	131	Average
2405	112.01	118.48			26.96	4.09	37.52	106	131	Peak
4815	35.54	50.86	54	-18.46	30.97	6.79	53.08	116	245	Average
4815	45.9	61.22	74	-28.1	30.97	6.79	53.08	116	245	Peak
*7215	47.67	55.95	90.34	-42.67	35.64	8.17	52.09	101	12	Average
*7215	55.3	63.58	92.01	-36.71	35.64	8.17	52.09	101	12	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2382.54	58.63	65.19	74	-15.37	26.86	4.08	37.5	100	60	Peak
2389.92	45.04	51.57	54	-8.96	26.91	4.08	37.52	100	60	Average
2405	108.38	114.85			26.96	4.09	37.52	100	60	Average
2405	109.98	116.45			26.96	4.09	37.52	100	60	Peak
4815	34.8	50.12	54	-19.2	30.97	6.79	53.08	102	149	Average
4815	46.24	61.56	74	-27.76	30.97	6.79	53.08	102	149	Peak
*7215	42.8	51.08	88.38	-45.58	35.64	8.17	52.09	101	169	Average
*7215	50.98	59.26	89.98	-39	35.64	8.17	52.09	101	169	Peak

Remarks:

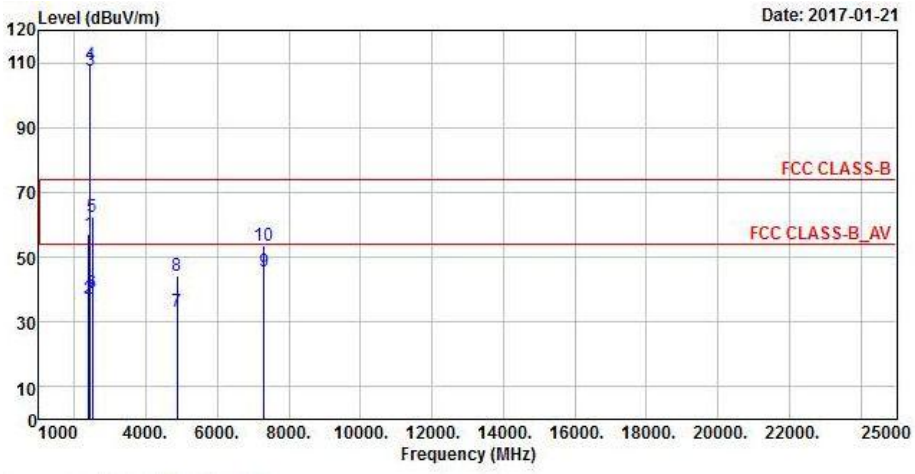
1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2405 MHz: Fundamental frequency.
3. *: Out of Restricted Band

EUT Test Condition		Measurement Detail	
Channel	Channel 17	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Getaz Yang

Horizontal



Vertical



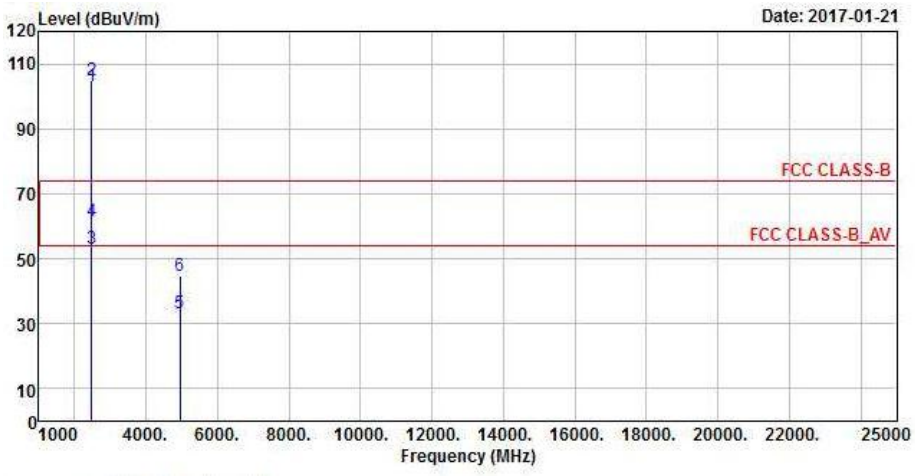
Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2385.24	59.98	66.54	74	-14.02	26.86	4.08	37.5	104	128	Peak
2389.11	38.28	44.79	54	-15.72	26.91	4.08	37.5	104	128	Average
2435	109.54	115.87			27.01	4.12	37.46	104	128	Average
2435	111.21	117.54			27.01	4.12	37.46	104	128	Peak
2490.48	38.92	44.88	54	-15.08	27.2	4.16	37.32	104	128	Average
2494.48	60.79	66.68	74	-13.21	27.2	4.16	37.25	104	128	Peak
4875	33.4	48.54	54	-20.6	31.06	6.85	53.05	109	238	Average
4875	44.54	59.68	74	-29.46	31.06	6.85	53.05	109	238	Peak
7305	49.67	57.44	54	-4.33	35.84	8.24	51.85	100	7	Average
7305	56.83	64.6	74	-17.17	35.84	8.24	51.85	100	7	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2385.6	57.2	63.71	74	-16.8	26.91	4.08	37.5	100	61	Peak
2387.94	37.23	43.74	54	-16.77	26.91	4.08	37.5	100	61	Average
2435	107.57	113.9			27.01	4.12	37.46	100	61	Average
2435	109.36	115.69			27.01	4.12	37.46	100	61	Peak
2493.68	62.45	68.34	74	-11.55	27.2	4.16	37.25	100	61	Peak
2496.08	39.12	45.01	54	-14.88	27.2	4.16	37.25	100	61	Average
4875	33.33	48.47	54	-20.67	31.06	6.85	53.05	102	146	Average
4875	44.49	59.63	74	-29.51	31.06	6.85	53.05	102	146	Peak
7305	45.72	53.49	54	-8.28	35.84	8.24	51.85	101	164	Average
7305	53.76	61.53	74	-20.24	35.84	8.24	51.85	101	164	Peak

Remarks:

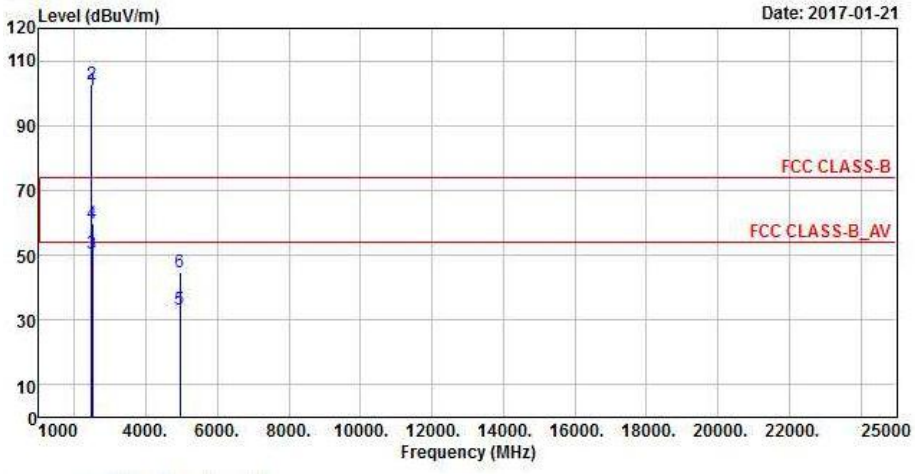
1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2435 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 25	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Getaz Yang

Horizontal



Vertical



Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2475	103.01	109.03			27.15	4.15	37.32	103	121	Average
2475	104.72	110.74			27.15	4.15	37.32	103	121	Peak
2483.52	**52.98**	**59**	**54**	**-1.02**	**27.15**	**4.15**	**37.32**	**103**	**121**	**Average**
2483.64	61.47	67.49	74	-12.53	27.15	4.15	37.32	103	121	Peak
4950	33.42	48.41	54	-20.58	31.14	6.91	53.04	113	230	Average
4950	44.9	59.89	74	-29.1	31.14	6.91	53.04	113	230	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2475	101.01	107.03			27.15	4.15	37.32	100	59	Average
2475	102.78	108.8			27.15	4.15	37.32	100	59	Peak
2483.52	50.53	56.55	54	-3.47	27.15	4.15	37.32	100	59	Average
2484.32	59.71	65.73	74	-14.29	27.15	4.15	37.32	100	59	Peak
4950	33.4	48.39	54	-20.6	31.14	6.91	53.04	106	132	Average
4950	44.75	59.74	74	-29.25	31.14	6.91	53.04	106	132	Peak

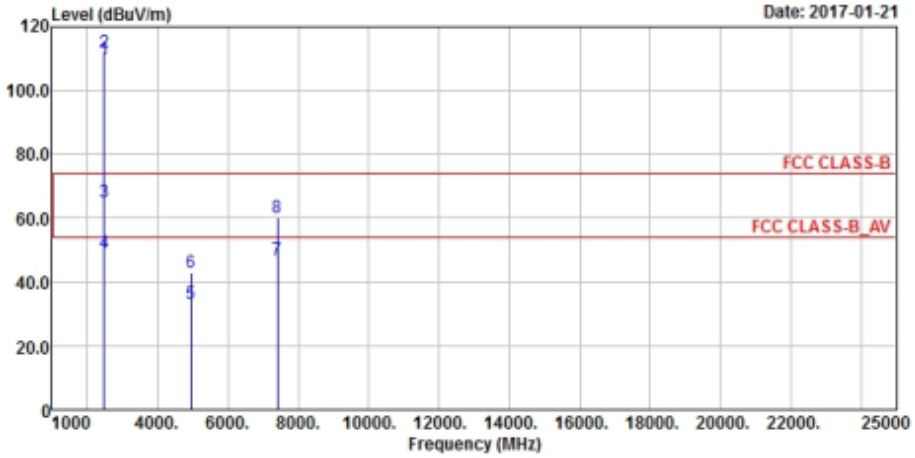
Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2475 MHz: Fundamental frequency.

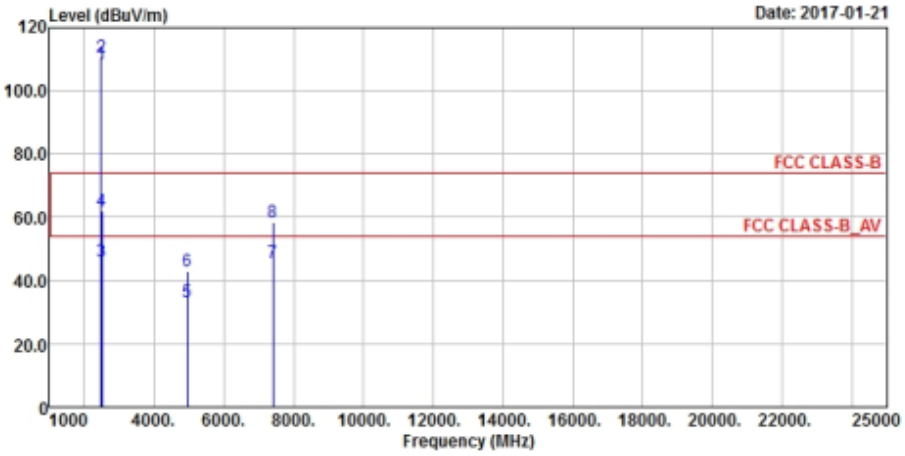
<For Reference>

EUT Test Condition		Measurement Detail	
Channel	Channel 24	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Getaz Yang

Horizontal



Vertical



Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2470	109.88	115.68			27.1	4.42	37.32	117	2	Average
2470	112.07	117.87			27.1	4.42	37.32	117	2	Peak
2483.84	65.21	70.95	74	-8.79	27.15	4.43	37.32	117	2	Peak
2483.96	49.11	54.85	54	-4.89	27.15	4.43	37.32	117	2	Average
4940	33.09	47.98	54	-20.91	31.14	6.89	52.92	113	357	Average
4940	42.96	57.85	74	-31.04	31.14	6.89	52.92	113	357	Peak
7410	47.09	54.11	54	-6.91	36.09	8.54	51.65	112	360	Average
7410	60.09	67.11	74	-13.91	36.09	8.54	51.65	112	360	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2470	108.64	114.44			27.1	4.42	37.32	133	22	Average
2470	110.81	116.61			27.1	4.42	37.32	133	22	Peak
2484	45.9	51.64	54	-8.1	27.15	4.43	37.32	133	22	Average
2491.08	61.87	67.56	74	-12.13	27.2	4.43	37.32	133	22	Peak
4940	32.99	47.88	54	-21.01	31.14	6.89	52.92	117	12	Average
4940	43.13	58.02	74	-30.87	31.14	6.89	52.92	117	12	Peak
7410	45.5	52.52	54	-8.5	36.09	8.54	51.65	115	8	Average
7410	58.23	65.25	74	-15.77	36.09	8.54	51.65	115	8	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2470 MHz: Fundamental frequency.

9 kHz ~ 30 MHz DATA:

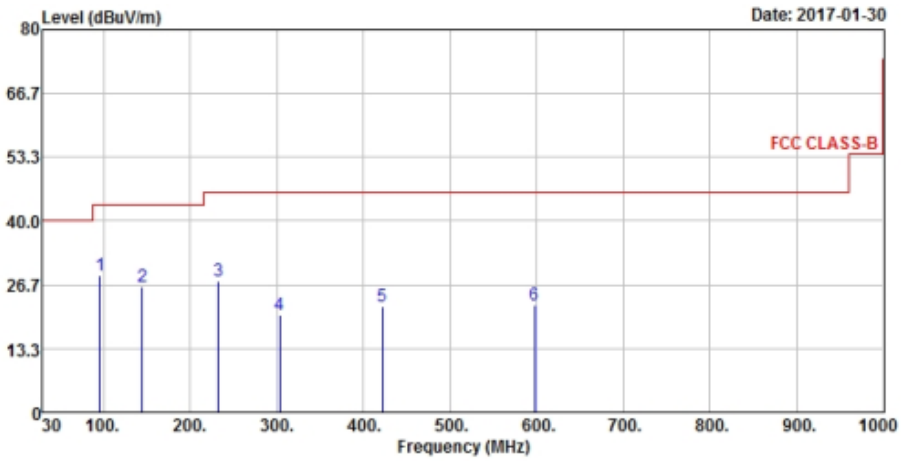
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

The Low Frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20 dB lower than the limit line was not reported.

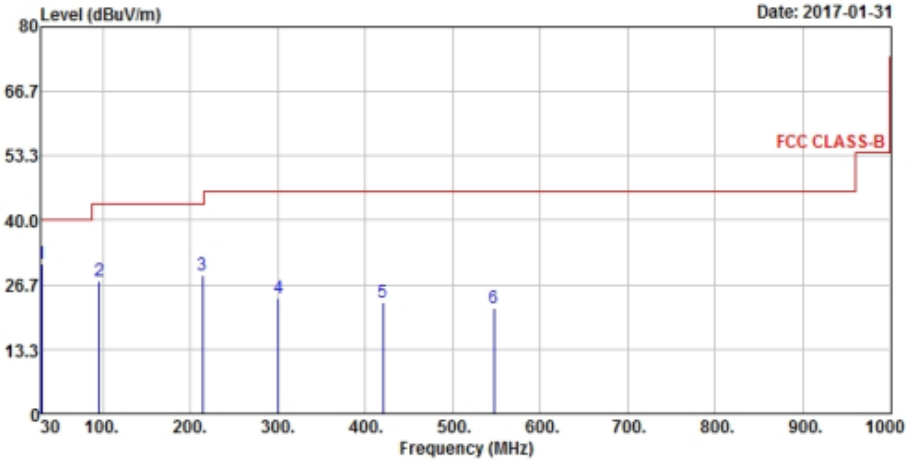
30 MHz ~ 1 GHz WORST-CASE DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 25	**Frequency Range**	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Getaz Yang

Horizontal



Vertical



Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
95.96	28.7	50.88	43.5	-14.8	8.76	1.02	31.96	103	192	Peak
144.46	26.21	44.17	43.5	-17.29	12.51	1.16	31.63	118	102	Peak
232.73	27.57	47.24	46	-18.43	10.75	1.42	31.84	133	119	Peak
303.54	20.46	37.67	46	-25.54	13.03	1.64	31.88	106	244	Peak
421.88	22.15	36.48	46	-23.85	15.77	1.94	32.04	135	235	Peak
597.45	22.53	32.96	46	-23.47	19.54	2.25	32.22	108	325	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
30	30.97	49.55	40	-9.03	11.98	0.58	31.14	122	293	Peak
95.96	27.47	49.65	43.5	-16.03	8.76	1.02	31.96	102	324	Peak
214.3	28.5	48.82	43.5	-15	9.97	1.35	31.64	107	245	Peak
300.63	24	41.26	46	-22	12.96	1.63	31.85	129	234	Peak
419.94	22.98	37.36	46	-23.02	15.73	1.94	32.05	132	124	Peak
547.01	21.71	33.03	46	-24.29	18.39	2.17	31.88	112	329	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value

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.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 21, 2016	Nov. 20, 2017
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 28, 2016	Jul. 27, 2017
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

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 HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

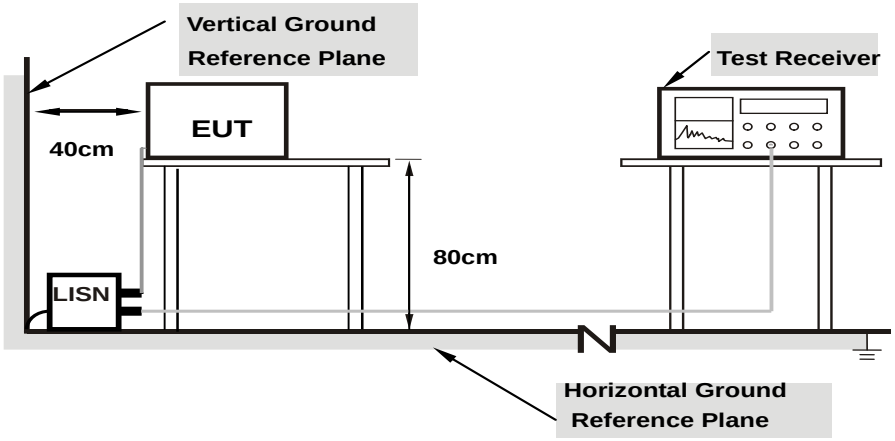
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling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

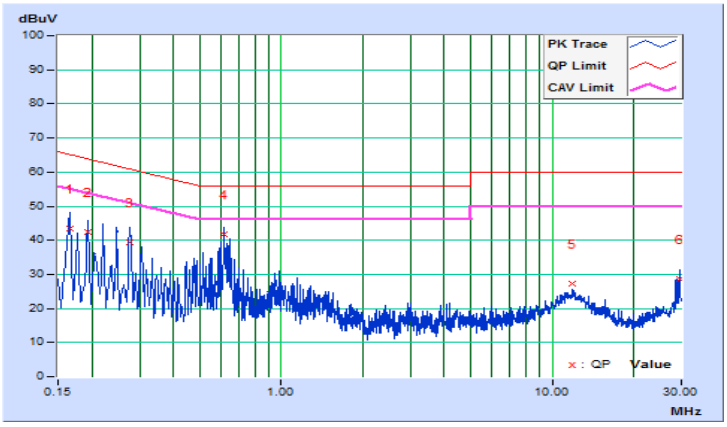
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Getaz Yang	Test Date	2017/3/23

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	0.16564	10.35	33.11	17.71	43.46	28.06	65.18	55.18	-21.72	-27.12
2	0.19301	10.37	31.89	16.54	42.26	26.91	63.91	53.91	-21.65	-27.00
3	0.27512	10.38	28.90	14.09	39.28	24.47	60.96	50.96	-21.68	-26.49
4	0.61529	10.40	31.26	18.90	41.66	29.30	56.00	46.00	-14.34	-16.70
5	11.86827	10.93	16.45	11.96	27.38	22.89	60.00	50.00	-32.62	-27.11
6	29.51019	11.66	16.84	10.30	28.50	21.96	60.00	50.00	-31.50	-28.04

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

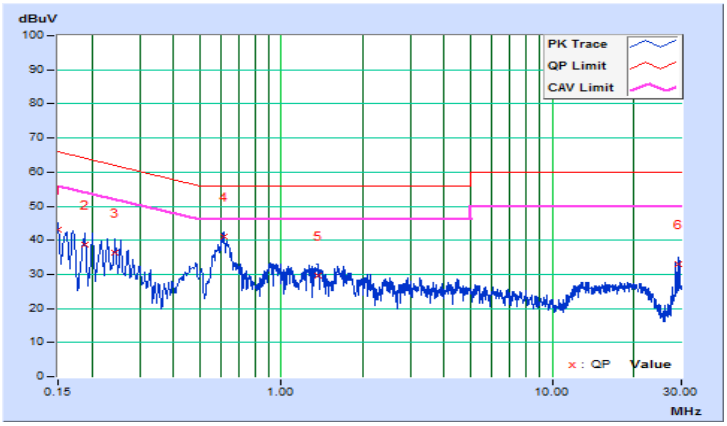


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Getaz Yang	Test Date	2017/3/23

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	0.15000	10.10	32.96	20.76	43.06	30.86	66.00	56.00	-22.94	-25.14
2	0.18903	10.13	28.43	16.34	38.56	26.47	64.08	54.08	-25.52	-27.61
3	0.24384	10.14	26.29	16.41	36.43	26.55	61.96	51.96	-25.53	-25.41
4	**0.61220**	**10.16**	**30.94**	**24.58**	**41.10**	**34.74**	**56.00**	**46.00**	**-14.90**	**-11.26**
5	1.37383	10.19	19.32	12.08	29.51	22.27	56.00	46.00	-26.49	-23.73
6	29.43199	11.18	21.72	12.62	32.90	23.80	60.00	50.00	-27.10	-26.20

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

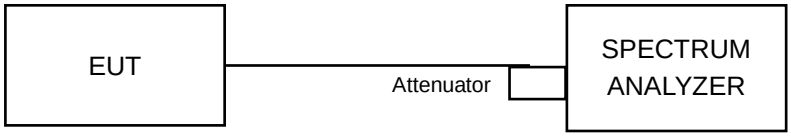


4.3 6 dB Bandwidth Measurement

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 fromTest Standard

No deviation.

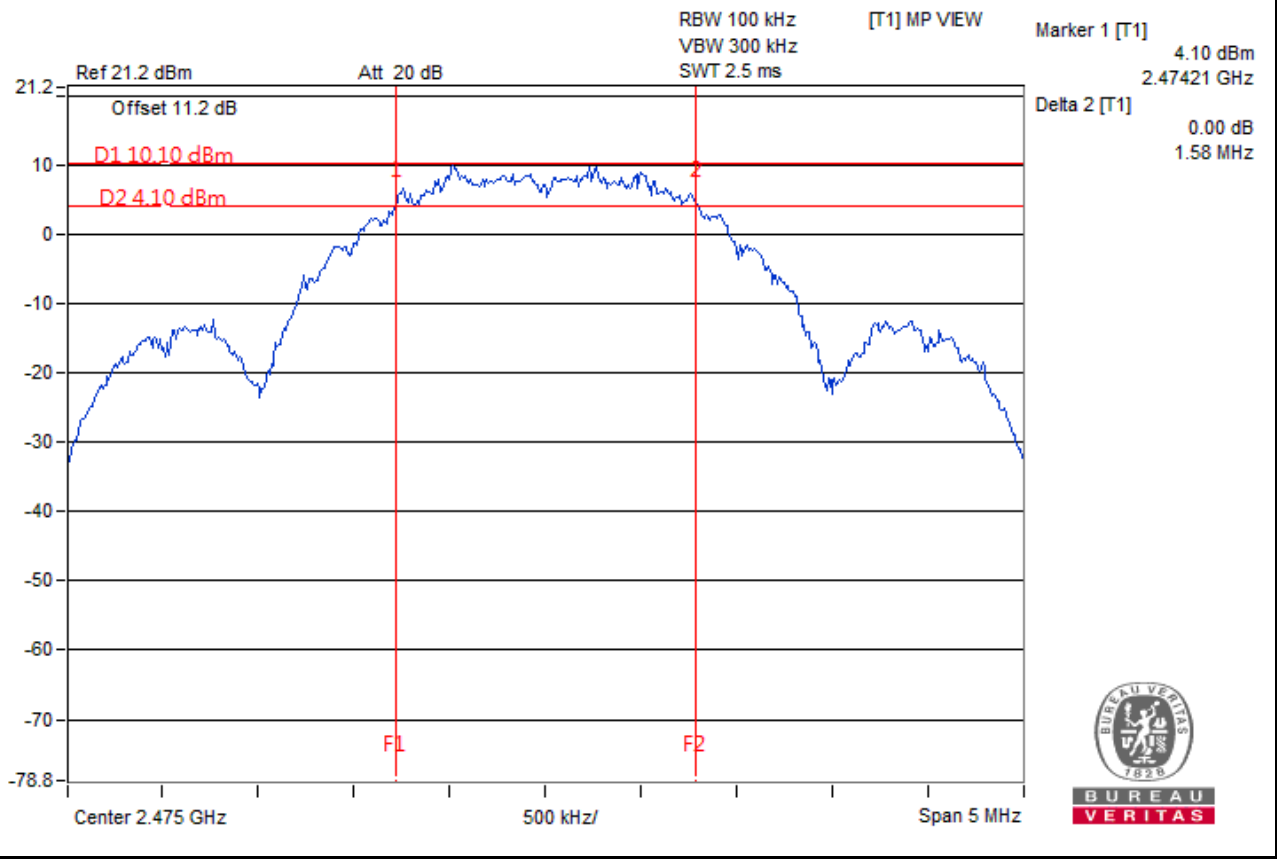
4.3.6 EUT Operating Conditions

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	1.17	0.5	Pass
17	2435	1.13	0.5	Pass
25	2475	1.58	0.5	Pass

Spectrum Plot of Worst Value

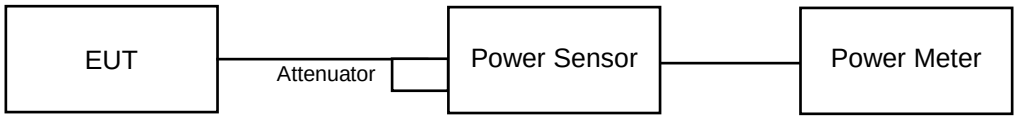


4.4 Conducted Output Power Measurement

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.

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

<Peak Power>

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
11	2405	85.901	19.34	30	Pass
17	2435	82.224	19.15	30	Pass
25	2475	23.714	13.75	30	Pass

For Reference

<Peak Power>

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
24	2470	82.604	19.17	30	Pass

<Average Power>

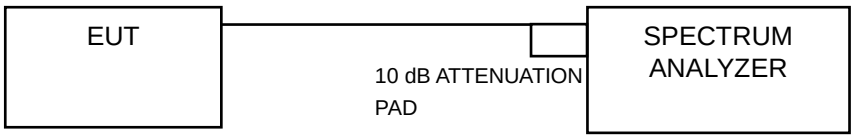
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
11	2405	84.528	19.27	30	Pass
17	2435	80.353	19.05	30	Pass
24	2470	81.10	19.09	30	Pass
25	2475	22.491	13.52	30	Pass

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.

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.

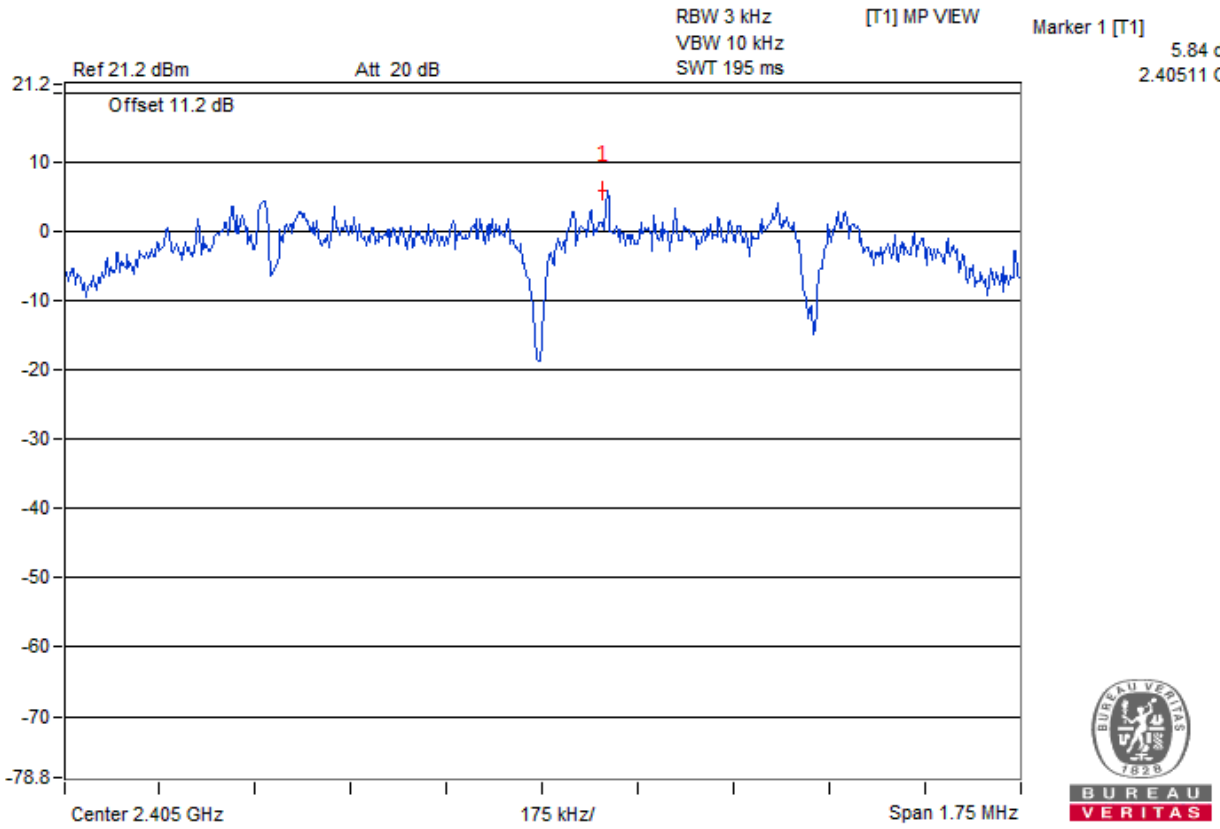
4.5.6 EUT Operating Condition

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/3kHz)	Limit (dBm/3kHz)	Pass / Fail
11	2405	5.84	8	Pass
17	2435	4.71	8	Pass
25	2475	-0.80	8	Pass

Spectrum Plot of Worst Value

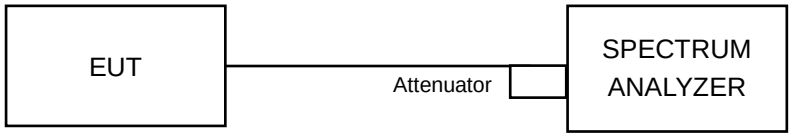


4.6 Conducted Out of Band Emission Measurement

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

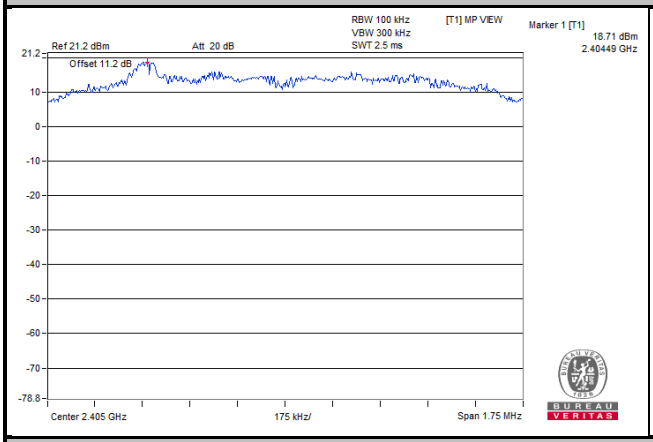
No deviation.

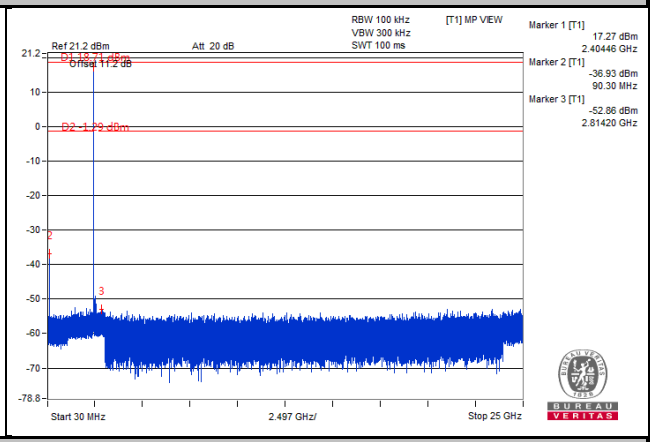
4.6.6 EUT Operating Condition

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

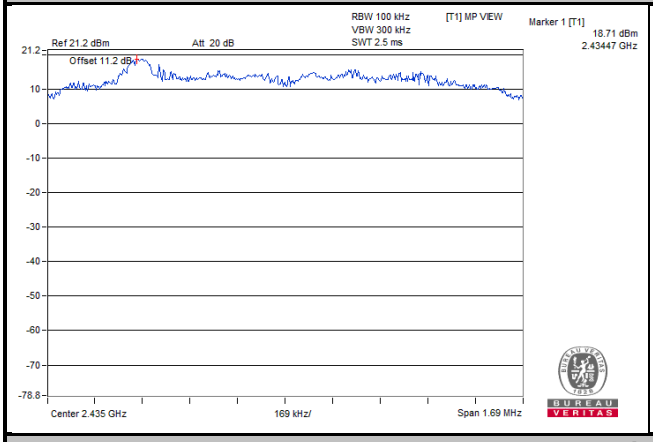
4.6.7 Test Results

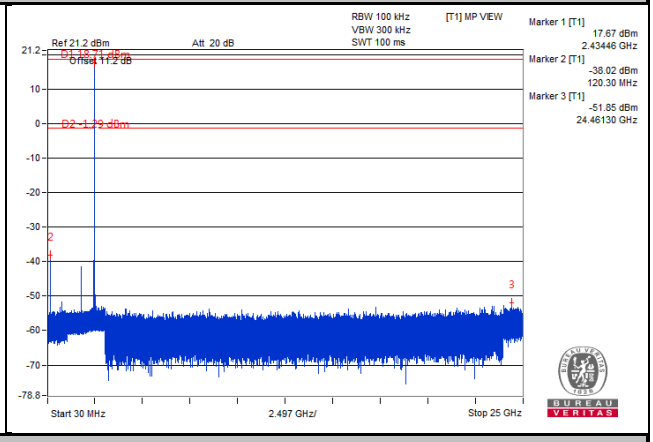
Ch 11



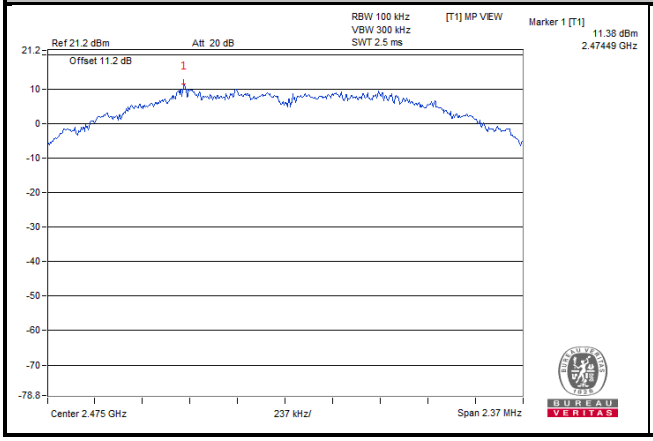


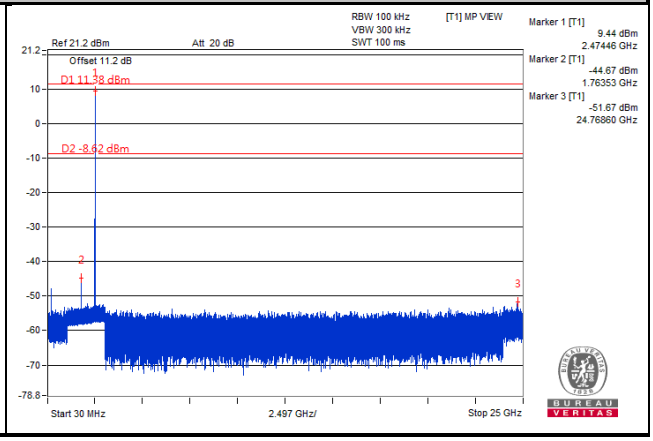
Ch 17

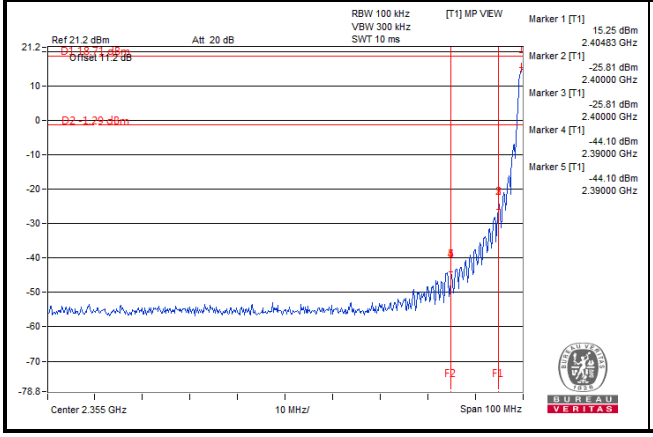
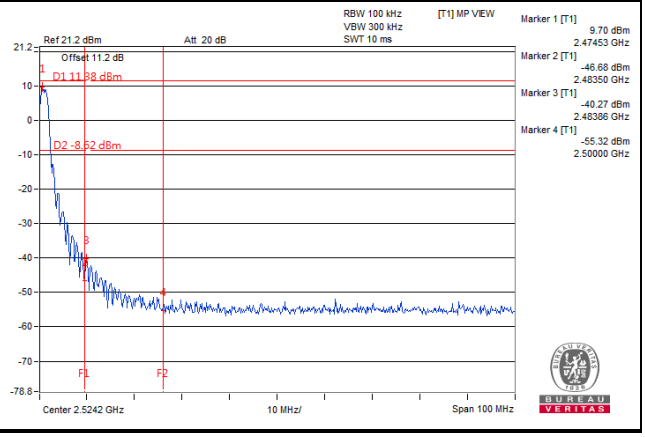




Ch 25





Ch 11 Band Edge	Ch 25 Band Edge
	

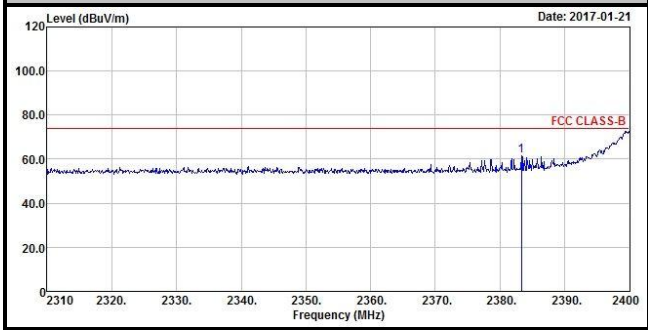
5 Pictures of Test Arrangements

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

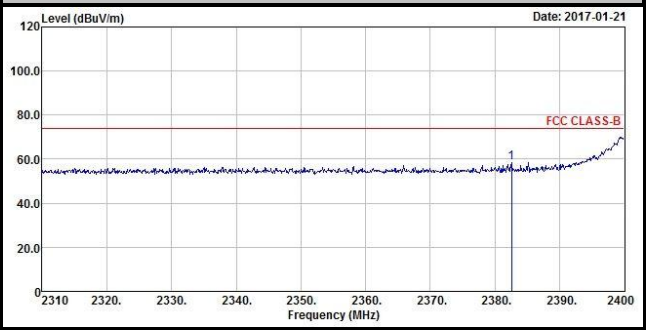
Annex A- Radiated Bandedge Plots

Ch 11 (Peak)

Horizontal

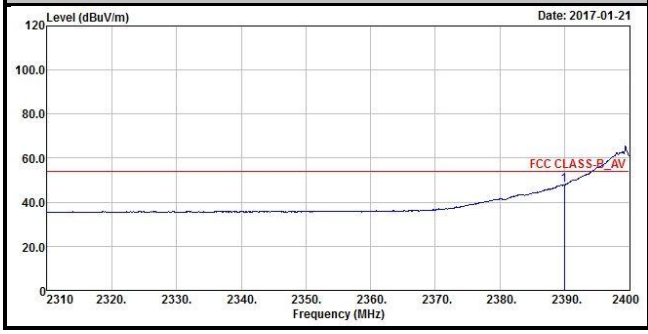


Vertical

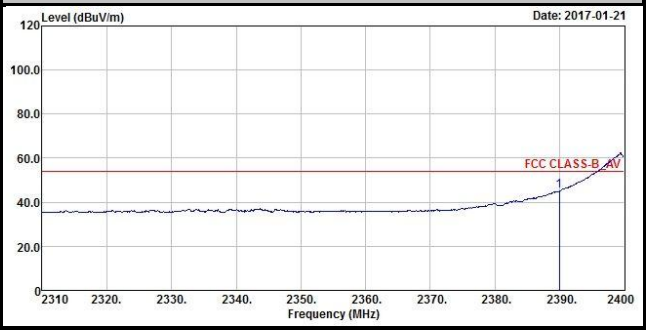


Ch 11 (Average)

Horizontal

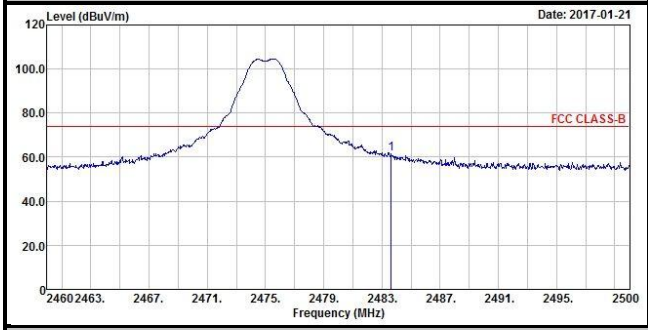


Vertical

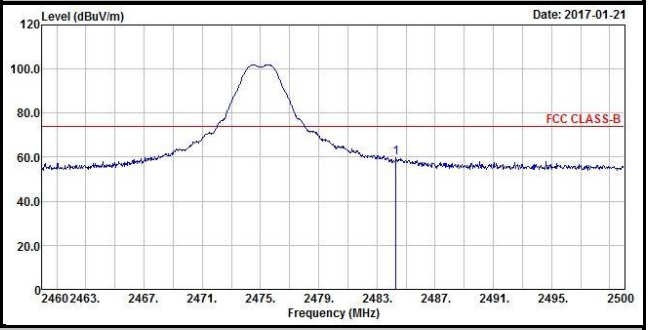


Ch 25 (Peak)

Horizontal

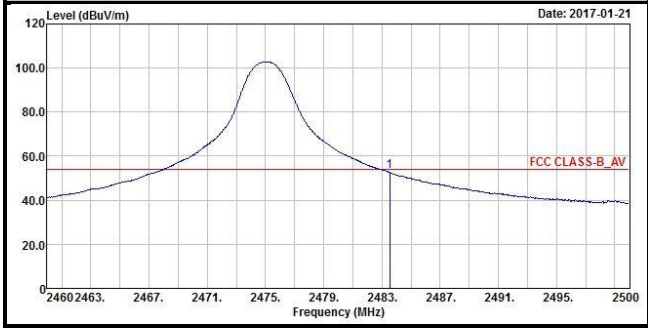


Vertical

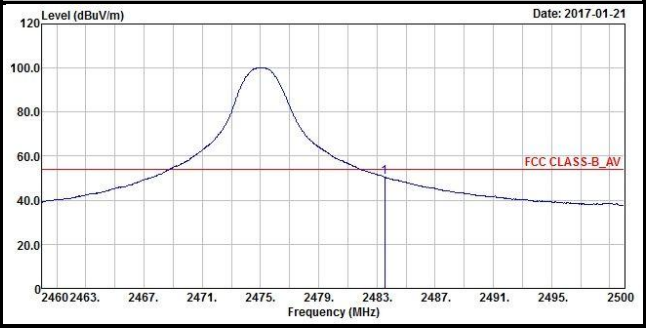


Ch 25 (Average)

Horizontal



Vertical



Appendix – Information on 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 accredited and approved according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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