

FCC Test Report

(Co-Located)

Report No.: RF180223C02-4 R1

FCC ID: NKR-DHUME997

Test Model: Catapult ERM997-1

Received Date: Feb. 23, 2018

Test Date: May 11, 2018

Issued Date: Jul. 04, 2018

Applicant: Wistron NeWeb Corp.

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**FCC Registration/
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF180223C02-4	Original release	May 14, 2018
RF180223C02-4 R1	Revising Test Model Name.	Jul. 04, 2018

1 Certificate of Conformity

Product: Marvell 88W8997 11ac 2x2 and BT Combo module

Brand: WNC

Test Model: Catapult ERM997-1

Sample Status: Engineering sample

Applicant: Wistron NeWeb Corp.

Test Date: May 11, 2018

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
47 CFR FCC Part 15, Subpart E (Section 15.407)
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 : Polly Chien , **Date:** Jul. 04, 2018
Polly Chien / Specialist

Approved by : Bruce Chen , **Date:** Jul. 04, 2018
Bruce Chen / Project Engineer

2 Summary of Test Results

Applied Standard:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407)		
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -12.60dB at 0.15000MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -1.2dB at 4924.00MHz.

*For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOB test plots were recorded in Annex A.

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	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Marvell 88W8997 11ac 2x2 and BT Combo module	
Brand	WNC	
Test Model	Catapult ERM997-1	
Status of EUT	Engineering sample	
Power Supply Rating	5Vdc (Host equipment)	
Modulation Type	WLAN	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
	Bluetooth EDR	GFSK, $\pi/4$ -DQPSK, 8DPSK
	Bluetooth LE	GFSK
Modulation Technology	WLAN	DSSS, OFDM
Transfer Rate	WLAN	802.11b: 11/5.5/2/1Mbps 802.11a/g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps
	Bluetooth EDR	1/2/3Mbps
	Bluetooth LE	1Mbps
Operating Frequency	WLAN	2.4GHz: 2412 ~ 2462MHz 5.0GHz: 5180~5240MHz, 5260~5320MHz, 5500~5700MHz, 5745~5825MHz
	Bluetooth EDR	2402 ~ 2480MHz
	Bluetooth LE	2402 ~ 2480MHz
Number of Channel	WLAN	2412 ~ 2462MHz: 802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7 5180~5240MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5260~5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5500~5700MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 11 802.11n (HT40), 802.11ac (VHT40): 5 802.11ac (VHT80): 2 5745~5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1

Number of Channel	Bluetooth EDR	79
	Bluetooth LE	40
Output Power	WLAN	2412~2462MHz: 86.909mW 5180~5240MHz: 52.954mW 5260~5320MHz: 53.637mW 5500~5700MHz: 59.382mW 5745~5825MHz: 61.325mW
	Bluetooth EDR	9.078 mW
	Bluetooth LE	9.931 mW
Antenna Type	Refer to note	
Antenna Connector	Refer to note	
Accessory Device	NA	
Data Cable Supplied	0.45m shielded USB cable w/o core attached on EUT	

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function
802.11b	2TX
802.11g	2TX
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

*The modulation and bandwidth are similar for 802.11n mode for HT20/HT40 and 802.11ac mode for VHT20/VHT40, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

2. The following antennas were provided to the EUT.

Ant. Type	PIFA						
Connector Type	NA						
Antenna Gain (dBi)	Frequency (MHz)						
Item	2400	2450	2500	5150	5350	5550	5850
WIFI_Ant. 1	3.51	2.93	2.08	3.79	4.26	4.53	2.77
WIFI_Ant. 2	1.56	2.11	1.73	4.50	6.25	6.22	4.85
BT LE	3.12	3.35	3.79	-	-	-	-

3. The BT could transmit simultaneously either with WLAN 2.4GHz or 5GHz at the same time.

3.2 Description of Test Modes

For 2.4GHz

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

7 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

For 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

5260~5320MHz:

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
58	5290MHz

5500~5700MHz:

11 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz		

5 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz		

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530MHz	122	5610 MHz

For 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

For Bluetooth EDR:

79 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

For Bluetooth LE:

40 channels are provided to this EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	
-	√	√	√	Power from Adapter

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission

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

Radiated Emission Test (Above 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + BT EDR	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11b + BT LE	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11a + BT EDR	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11a + BT LE	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 39		GFSK

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + BT EDR	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11b + BT LE	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11a + BT EDR	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11a + BT LE	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 39		GFSK

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + BT EDR	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11b + BT LE	2412 ~ 2462	1 to 11	11 + 0	DBPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11a + BT EDR	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 78		GFSK
-	802.11a + BT LE	5745 ~ 5825	149 to 165	157 + 0	BPSK
		2402 ~ 2480	0 to 39		GFSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	25deg. C, 66%RH	120Vac, 60Hz	Luis Lee
RE $<$ 1G	25deg. C, 66%RH	120Vac, 60Hz	Luis Lee
PLC	25deg. C, 70%RH	120Vac, 60Hz	Matthew Yang

3.3 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.

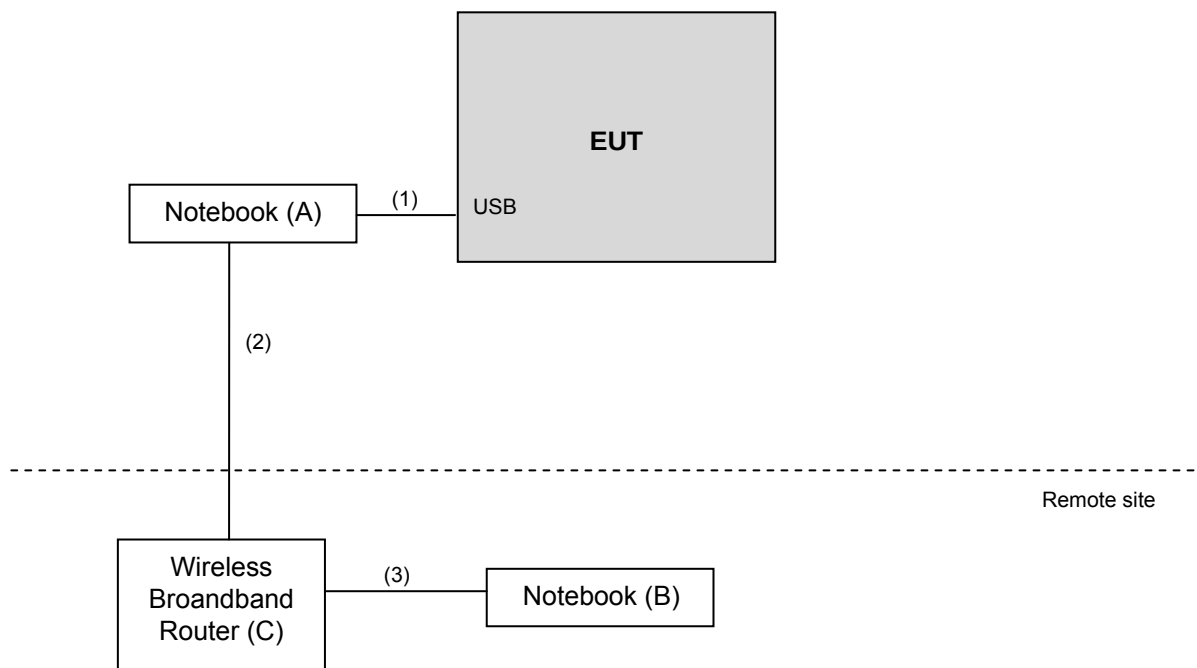
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5520	8Y4DMQ1	FCC DoC Approved	-
B.	Notebook	Lenovo	81A4	YD02TWF5	PPD-QCNFA435	-
C.	Wireless Broadband Router	Netgear	R7800	4H75745C00C5C	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items B~C acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	0.45	Y	0	Accessory of EUT
2.	RJ45 cable	1	6	N	0	Cat5e
3.	RJ45 cable	1	1.5	N	0	Cat5e

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

FCC Part 15, Subpart E (15.407)

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 20dB 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 1000MHz, 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 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To			Limit	
789033 D02 General UNII Test Procedure New Rules v02r01			Field Strength at 3m	
			PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	Applicable To		EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)		PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)			
5470~5725 MHz	15.407(b)(3)			
5725~5850 MHz	☒	15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBµV/m) ^{*1} PK: 105.2(dBµV/m) ^{*2} PK: 110.8(dBµV/m) ^{*3} PK: 122.2(dBµV/m) ^{*4}
	☐	15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
^{*1} beyond 75 MHz or more above of the band edge.			^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.			^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 17, 2017	Oct. 16, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Aug. 18, 2017	Aug. 17, 2018
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 11, 2017	Dec. 10, 2018
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 12, 2017	Dec. 11, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 01, 2017	Nov. 30, 2018
Loop Antenna EMCI	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01638	Feb. 22, 2018	Feb. 21, 2019
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM80 00	CABLE-CH9-02 (248780+171006)	Jan. 15, 2018	Jan. 14, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795 /4)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 01, 2017	Jul. 31, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detect 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:

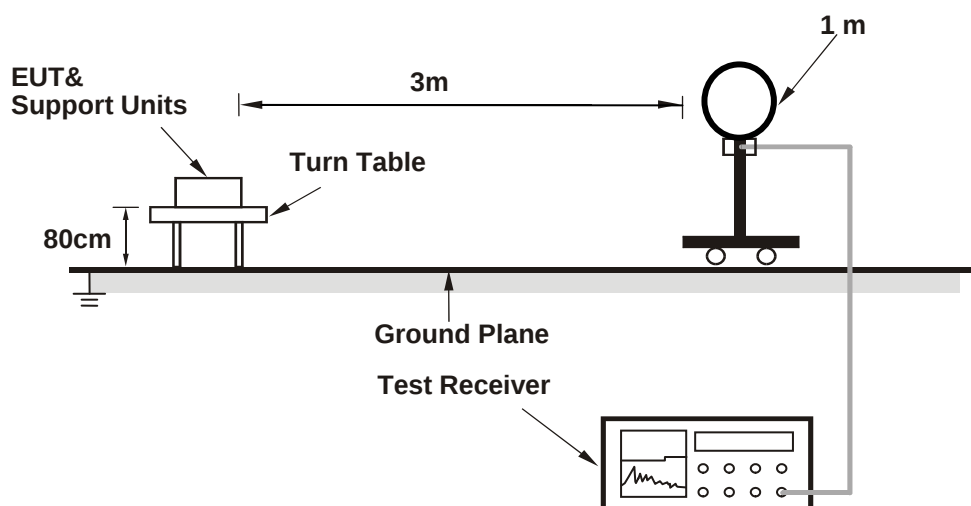
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

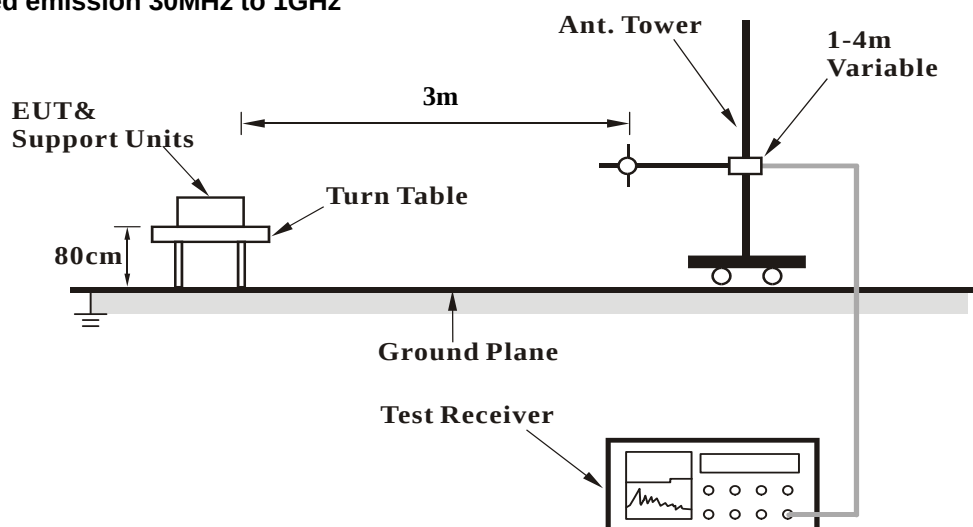
No deviation.

4.1.5 Test Set Up

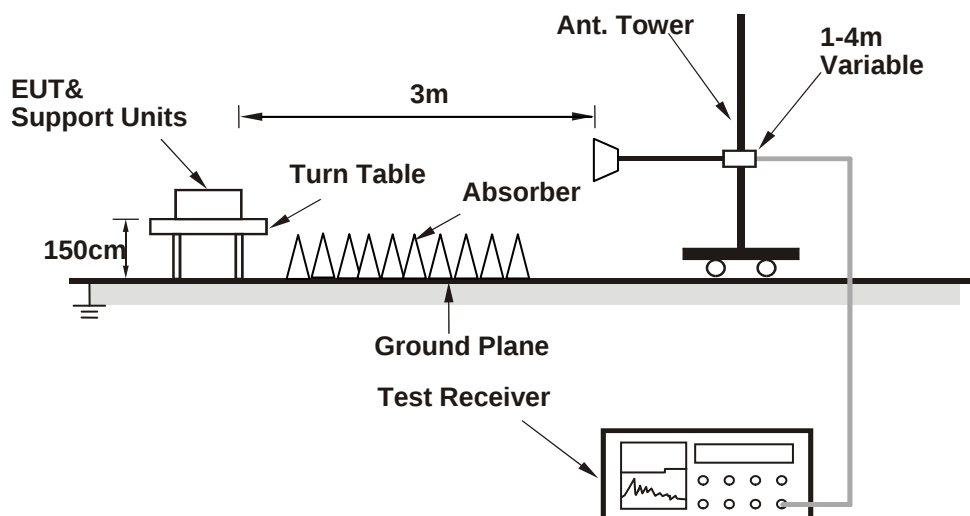
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Prepared a notebook & Wireless Broadband Router to act as a communication partners and placed them outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz Data:

802.11b + BT EDR

CHANNEL	CH 11 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (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	57.8 PK	74.0	-16.2	2.93 H	189	25.60	32.20
2	2390.00	45.8 AV	54.0	-8.2	2.93 H	189	13.60	32.20
3	*2402.00	105.0 PK			2.87 H	185	72.80	32.20
4	*2402.00	74.9 AV			2.87 H	185	42.70	32.20
5	*2462.00	106.1 PK			2.73 H	214	74.00	32.10
6	*2462.00	102.5 AV			2.73 H	214	70.40	32.10
7	2483.50	57.1 PK	74.0	-16.9	2.99 H	220	25.00	32.10
8	2483.50	48.4 AV	54.0	-5.6	2.99 H	220	16.30	32.10
9	4804.00	52.0 PK	74.0	-22.0	3.79 H	80	50.20	1.80
10	4804.00	21.9 AV	54.0	-32.1	3.79 H	80	20.10	1.80
11	4924.00	55.1 PK	74.0	-18.9	3.12 H	198	53.00	2.10
12	4924.00	52.8 AV	54.0	-1.2	3.12 H	198	50.70	2.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	58.5 PK	74.0	-15.5	1.35 V	242	26.30	32.20
2	2390.00	46.0 AV	54.0	-8.0	1.35 V	242	13.80	32.20
3	*2402.00	105.7 PK			1.12 V	269	73.50	32.20
4	*2402.00	75.6 AV			1.12 V	269	43.40	32.20
5	*2462.00	105.2 PK			1.10 V	215	73.10	32.10
6	*2462.00	101.4 AV			1.10 V	215	69.30	32.10
7	2483.50	58.7 PK	74.0	-15.3	1.49 V	188	26.60	32.10
8	2483.50	47.5 AV	54.0	-6.5	1.49 V	188	15.40	32.10
9	4804.00	54.2 PK	74.0	-19.8	1.26 V	290	52.40	1.80
10	4804.00	24.1 AV	54.0	-29.9	1.26 V	290	22.30	1.80
11	4924.00	52.4 PK	74.0	-21.6	1.15 V	325	50.30	2.10
12	4924.00	50.1 AV	54.0	-3.9	1.15 V	325	48.00	2.10

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11b + BT LE

CHANNEL	CH 11 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (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	56.8 PK	74.0	-17.2	2.14 H	216	24.60	32.20
2	2390.00	44.4 AV	54.0	-9.6	2.14 H	216	12.20	32.20
3	*2402.00	103.6 PK			2.32 H	220	71.40	32.20
4	*2402.00	98.7 AV			2.32 H	220	66.50	32.20
5	*2462.00	106.3 PK			2.80 H	235	74.20	32.10
6	*2462.00	102.6 AV			2.80 H	235	70.50	32.10
7	2483.50	56.9 PK	74.0	-17.1	2.87 H	214	24.80	32.10
8	2483.50	48.2 AV	54.0	-5.8	2.87 H	214	16.10	32.10
9	4804.00	50.8 PK	74.0	-23.2	2.63 H	152	49.70	1.10
10	4804.00	45.4 AV	54.0	-8.6	2.63 H	152	44.30	1.10
11	4924.00	54.2 PK	74.0	-19.8	2.99 H	208	52.60	1.60
12	4924.00	51.8 AV	54.0	-2.2	2.99 H	208	50.20	1.60
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	59.2 PK	74.0	-14.8	1.55 V	291	27.00	32.20
2	2390.00	45.4 AV	54.0	-8.6	1.55 V	291	13.20	32.20
3	*2402.00	105.6 PK			1.28 V	243	73.40	32.20
4	*2402.00	101.5 AV			1.28 V	243	69.30	32.20
5	*2462.00	105.0 PK			1.19 V	211	72.90	32.10
6	*2462.00	101.2 AV			1.19 V	211	69.10	32.10
7	2483.50	58.5 PK	74.0	-15.5	1.52 V	179	26.40	32.10
8	2483.50	47.3 AV	54.0	-6.7	1.52 V	179	15.20	32.10
9	4804.00	53.9 PK	74.0	-20.1	1.33 V	274	52.80	1.10
10	4804.00	48.9 AV	54.0	-5.1	1.33 V	274	47.80	1.10
11	4924.00	51.8 PK	74.0	-22.2	1.35 V	310	50.20	1.60
12	4924.00	49.4 AV	54.0	-4.6	1.35 V	310	47.80	1.60

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11a + BT EDR

CHANNEL	CH 157 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (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	57.5 PK	74.0	-16.5	2.95 H	184	25.30	32.20
2	2390.00	45.4 AV	54.0	-8.6	2.95 H	184	13.20	32.20
3	*2402.00	104.8 PK			2.88 H	190	72.60	32.20
4	*2402.00	74.7 AV			2.88 H	190	42.50	32.20
5	4804.00	51.5 PK	74.0	-22.5	3.89 H	72	50.40	1.10
6	4804.00	21.4 AV	54.0	-32.6	3.89 H	72	20.30	1.10
7	#5606.40	52.7 PK	68.2	-15.5	3.11 H	185	50.20	2.50
8	*5785.00	101.6 PK			3.11 H	185	61.60	40.00
9	*5785.00	91.8 AV			3.11 H	185	51.80	40.00
10	#5996.00	53.8 PK	68.2	-14.4	3.11 H	185	50.10	3.70
11	11570.00	53.6 PK	74.0	-20.4	1.48 H	254	38.60	15.00
12	11570.00	41.4 AV	54.0	-12.6	1.48 H	254	26.40	15.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	58.3 PK	74.0	-15.7	1.23 V	249	26.10	32.20
2	2390.00	45.9 AV	54.0	-8.1	1.23 V	249	13.70	32.20
3	*2402.00	105.5 PK			1.08 V	272	73.30	32.20
4	*2402.00	75.4 AV			1.08 V	272	43.20	32.20
5	4804.00	53.8 PK	74.0	-20.2	1.15 V	286	52.70	1.10
6	4804.00	23.7 AV	54.0	-30.3	1.15 V	286	22.60	1.10
7	#5604.00	53.4 PK	68.2	-14.8	2.09 V	243	50.90	2.50
8	*5785.00	103.9 PK			2.09 V	243	63.90	40.00
9	*5785.00	93.9 AV			2.09 V	243	53.90	40.00
10	#5958.40	53.4 PK	68.2	-14.8	2.09 V	243	49.70	3.70
11	11570.00	55.5 PK	74.0	-18.5	1.77 V	154	40.50	15.00
12	11570.00	42.8 AV	54.0	-11.2	1.77 V	154	27.80	15.00

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11a + BT LE

CHANNEL	CH 157 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (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	56.9 PK	74.0	-17.1	2.20 H	204	24.70	32.20
2	2390.00	44.6 AV	54.0	-9.4	2.20 H	204	12.40	32.20
3	*2402.00	103.8 PK			2.38 H	219	71.60	32.20
4	*2402.00	98.9 AV			2.38 H	219	66.70	32.20
5	4804.00	50.9 PK	74.0	-23.1	2.57 H	146	49.80	1.10
6	4804.00	45.6 AV	54.0	-8.4	2.57 H	146	44.50	1.10
7	#5644.00	53.3 PK	68.2	-14.9	3.08 H	194	50.70	2.60
8	*5785.00	101.5 PK			3.08 H	194	61.50	40.00
9	*5785.00	91.9 AV			3.08 H	194	51.90	40.00
10	#5938.40	53.9 PK	68.2	-14.3	3.08 H	194	50.20	3.70
11	11570.00	53.3 PK	74.0	-20.7	1.52 H	260	38.30	15.00
12	11570.00	41.8 AV	54.0	-12.2	1.52 H	260	26.80	15.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	59.1 PK	74.0	-14.9	1.43 V	288	26.90	32.20
2	2390.00	45.2 AV	54.0	-8.8	1.43 V	288	13.00	32.20
3	*2402.00	105.4 PK			1.16 V	258	73.20	32.20
4	*2402.00	101.3 AV			1.16 V	258	69.10	32.20
5	4804.00	53.8 PK	74.0	-20.2	1.29 V	284	52.70	1.10
6	4804.00	48.8 AV	54.0	-5.2	1.29 V	284	47.70	1.10
7	#5644.00	54.1 PK	68.2	-14.1	1.89 V	248	51.50	2.60
8	*5785.00	103.4 PK			1.89 V	248	63.40	40.00
9	*5785.00	93.4 AV			1.89 V	248	53.40	40.00
10	#5930.40	54.0 PK	68.2	-14.2	1.89 V	248	50.20	3.80
11	11570.00	55.3 PK	74.0	-18.7	1.82 V	161	40.30	15.00
12	11570.00	42.7 AV	54.0	-11.3	1.82 V	161	27.70	15.00

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz data

802.11b + BT EDR

CHANNEL	CH 11 + CH 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	70.74	28.5 QP	40.0	-11.5	1.49 H	115	43.80	-15.30
2	99.84	34.5 QP	43.5	-9.0	1.99 H	78	52.30	-17.80
3	233.70	34.0 QP	46.0	-12.0	1.00 H	53	49.30	-15.30
4	365.62	30.9 QP	46.0	-15.1	1.00 H	283	42.30	-11.40
5	666.32	30.3 QP	46.0	-15.7	1.49 H	219	36.70	-6.40
6	751.68	29.8 QP	46.0	-16.2	1.99 H	169	34.30	-4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	97.90	33.6 QP	43.5	-9.9	1.00 V	55	51.70	-18.10
2	142.52	31.1 QP	43.5	-12.4	1.00 V	315	44.80	-13.70
3	222.06	33.8 QP	46.0	-12.2	1.49 V	240	49.90	-16.10
4	365.62	30.2 QP	46.0	-15.8	1.49 V	211	41.60	-11.40
5	666.32	30.5 QP	46.0	-15.5	1.00 V	15	36.90	-6.40
6	914.64	33.4 QP	46.0	-12.6	1.00 V	186	35.50	-2.10

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

802.11b + BT LE

CHANNEL	CH 11 + CH 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	70.74	29.3 QP	40.0	-10.7	1.50 H	119	44.60	-15.30
2	208.48	35.0 QP	43.5	-8.5	1.50 H	15	51.20	-16.20
3	297.72	35.3 QP	46.0	-10.7	1.01 H	71	47.70	-12.40
4	365.62	31.0 QP	46.0	-15.0	1.01 H	287	42.40	-11.40
5	627.52	27.8 QP	46.0	-18.2	1.50 H	231	34.60	-6.80
6	790.48	31.3 QP	46.0	-14.7	1.01 H	113	35.40	-4.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.84	32.7 QP	43.5	-10.8	1.00 V	68	50.50	-17.80
2	138.64	30.8 QP	43.5	-12.7	1.00 V	74	44.90	-14.10
3	299.66	29.4 QP	46.0	-16.6	1.49 V	15	41.70	-12.30
4	332.64	28.6 QP	46.0	-17.4	1.49 V	212	40.30	-11.70
5	431.58	31.3 QP	46.0	-14.7	1.49 V	226	41.40	-10.10
6	664.38	31.5 QP	46.0	-14.5	1.49 V	13	37.90	-6.40

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

802.11a + BT EDR

CHANNEL	CH 157 + CH 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	31.94	30.8 QP	40.0	-9.2	2.00 H	204	45.70	-14.90
2	208.48	34.5 QP	43.5	-9.0	1.01 H	15	50.70	-16.20
3	266.68	34.9 QP	46.0	-11.1	1.01 H	49	48.30	-13.40
4	431.58	31.4 QP	46.0	-14.6	2.00 H	136	41.50	-10.10
5	584.84	26.6 QP	46.0	-19.4	1.01 H	88	34.40	-7.80
6	776.90	27.3 QP	46.0	-18.7	1.01 H	233	31.60	-4.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	68.80	28.6 QP	40.0	-11.4	1.00 V	127	43.30	-14.70
2	233.70	27.7 QP	46.0	-18.3	1.00 V	228	43.00	-15.30
3	431.58	31.1 QP	46.0	-14.9	1.49 V	222	41.20	-10.10
4	623.64	28.1 QP	46.0	-17.9	1.49 V	182	35.00	-6.90
5	794.36	33.1 QP	46.0	-12.9	1.00 V	136	37.30	-4.20
6	877.78	34.1 QP	46.0	-11.9	1.49 V	13	37.00	-2.90

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

802.11a + BT LE

CHANNEL	CH 157 + CH 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	142.52	33.7 QP	43.5	-9.8	1.01 H	86	47.40	-13.70
2	208.48	35.0 QP	43.5	-8.5	1.50 H	15	51.20	-16.20
3	365.62	31.0 QP	46.0	-15.0	1.01 H	287	42.40	-11.40
4	489.78	30.0 QP	46.0	-16.0	1.50 H	284	39.40	-9.40
5	749.74	28.6 QP	46.0	-17.4	1.01 H	265	33.30	-4.70
6	866.14	29.3 QP	46.0	-16.7	1.50 H	86	32.30	-3.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.84	32.1 QP	43.5	-11.4	1.01 V	69	49.90	-17.80
2	138.64	29.9 QP	43.5	-13.6	1.01 V	103	44.00	-14.10
3	222.06	31.4 QP	46.0	-14.6	1.01 V	6	47.50	-16.10
4	431.58	30.2 QP	46.0	-15.8	1.50 V	216	40.30	-10.10
5	666.32	30.8 QP	46.0	-15.2	1.01 V	22	37.20	-6.40
6	951.50	29.5 QP	46.0	-16.5	1.01 V	202	30.90	-1.40

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. The other emission levels were very low against the limit.
4. 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 0.50MHz.

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. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 06, 2018	Mar. 05, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
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

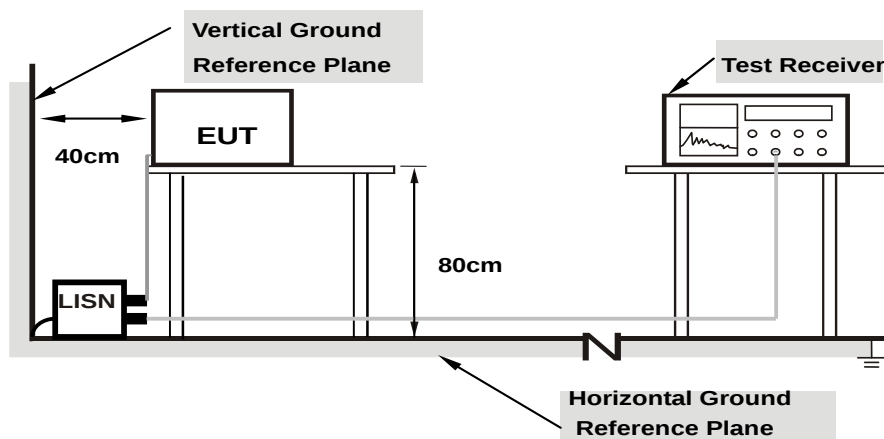
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

4.2.4 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

Same as 4.1.6.

4.2.7 Test Results

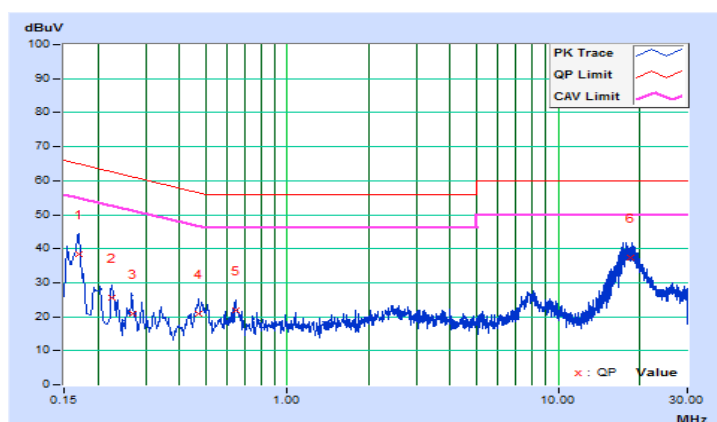
802.11b + BT EDR

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 11 + CH 0		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16967	10.10	28.39	14.35	38.49	24.45	64.98	54.98	-26.49	-30.53
2	0.22434	10.11	15.44	5.83	25.55	15.94	62.66	52.66	-37.11	-36.72
3	0.26765	10.11	10.91	4.32	21.02	14.43	61.19	51.19	-40.17	-36.76
4	0.46792	10.12	10.64	2.36	20.76	12.48	56.55	46.55	-35.79	-34.07
5	0.64362	10.13	11.70	2.66	21.83	12.79	56.00	46.00	-34.17	-33.21
6	18.44880	11.12	26.36	24.55	37.48	35.67	60.00	50.00	-22.52	-14.33

Remarks:

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

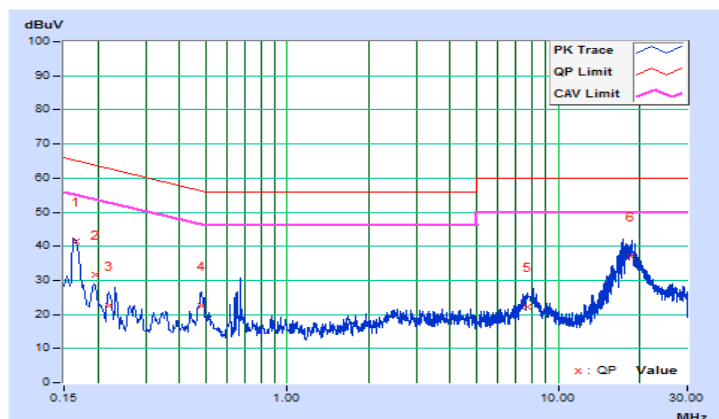


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 11 + CH 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16564	10.10	31.28	21.46	41.38	31.56	65.18	55.18	-23.80	-23.62
2	0.19692	10.10	21.46	10.26	31.56	20.36	63.74	53.74	-32.18	-33.38
3	0.21851	10.11	12.36	0.99	22.47	11.10	62.88	52.88	-40.41	-41.78
4	0.48041	10.12	12.55	5.96	22.67	16.08	56.33	46.33	-33.66	-30.25
5	7.66112	10.42	11.91	5.80	22.33	16.22	60.00	50.00	-37.67	-33.78
6	18.44880	10.88	26.25	24.51	37.13	35.39	60.00	50.00	-22.87	-14.61

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



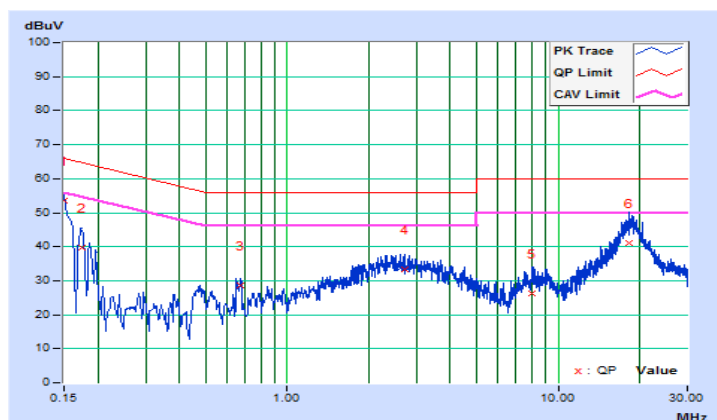
802.11b + BT LE

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 11 + CH 0		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.10	43.30	22.01	53.40	32.11	66.00	56.00	-12.60	-23.89
2	0.17374	10.10	29.58	7.19	39.68	17.29	64.78	54.78	-25.10	-37.49
3	0.67394	10.13	18.42	6.63	28.55	16.76	56.00	46.00	-27.45	-29.24
4	2.71887	10.22	23.16	13.36	33.38	23.58	56.00	46.00	-22.62	-22.42
5	8.02474	10.51	15.70	8.27	26.21	18.78	60.00	50.00	-33.79	-31.22
6	18.35496	11.11	30.05	22.96	41.16	34.07	60.00	50.00	-18.84	-15.93

Remarks:

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

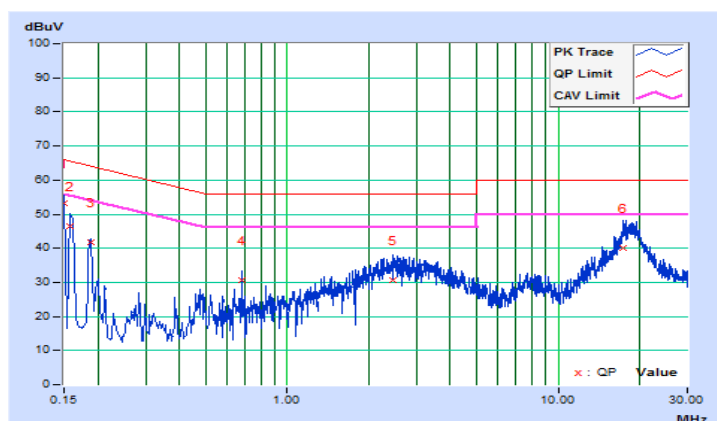


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 11 + CH 0		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.10	42.95	22.10	53.05	32.20	66.00	56.00	-12.95	-23.80
2	0.15802	10.10	36.46	13.18	46.56	23.28	65.57	55.57	-19.01	-32.29
3	0.18853	10.10	31.57	16.63	41.67	26.73	64.10	54.10	-22.43	-27.37
4	0.67785	10.12	20.55	6.31	30.67	16.43	56.00	46.00	-25.33	-29.57
5	2.45299	10.20	20.60	10.79	30.80	20.99	56.00	46.00	-25.20	-25.01
6	17.47130	10.84	29.30	21.56	40.14	32.40	60.00	50.00	-19.86	-17.60

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



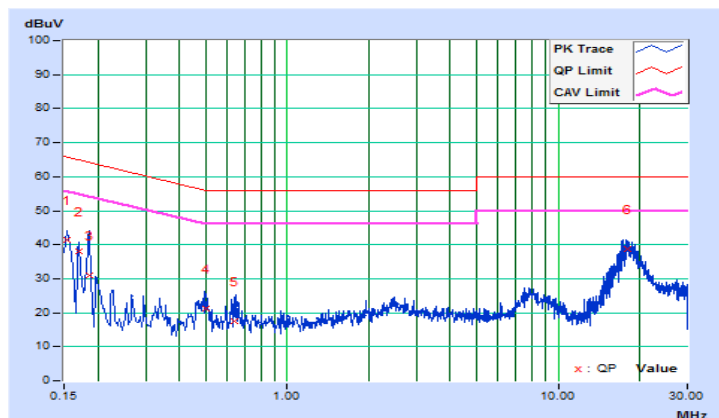
802.11a + BT EDR

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 157 + CH 0		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.10	31.38	17.65	41.48	27.75	65.79	55.79	-24.31	-28.04
2	0.16967	10.10	28.02	14.15	38.12	24.25	64.98	54.98	-26.86	-30.73
3	0.18508	10.10	20.78	6.03	30.88	16.13	64.25	54.25	-33.37	-38.12
4	0.49846	10.12	11.06	2.29	21.18	12.41	56.03	46.03	-34.85	-33.62
5	0.63520	10.13	7.33	1.59	17.46	11.72	56.00	46.00	-38.54	-34.28
6	17.95223	11.09	27.56	25.34	38.65	36.43	60.00	50.00	-21.35	-13.57

Remarks:

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

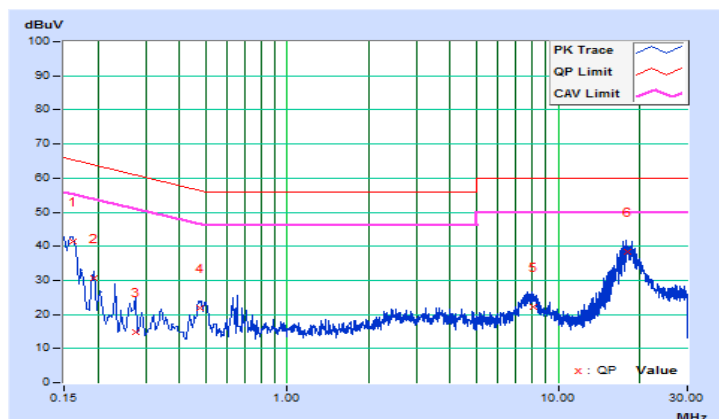


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 157 + CH 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	10.10	31.43	23.15	41.53	33.25	65.37	55.37	-23.84	-22.12
2	0.19255	10.10	20.46	10.24	30.56	20.34	63.93	53.93	-33.37	-33.59
3	0.27480	10.11	4.77	1.54	14.88	11.65	60.97	50.97	-46.09	-39.32
4	0.47663	10.12	11.85	3.92	21.97	14.04	56.40	46.40	-34.43	-32.36
5	8.07567	10.44	11.83	5.72	22.27	16.16	60.00	50.00	-37.73	-33.84
6	17.95223	10.86	27.50	25.30	38.36	36.16	60.00	50.00	-21.64	-13.84

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



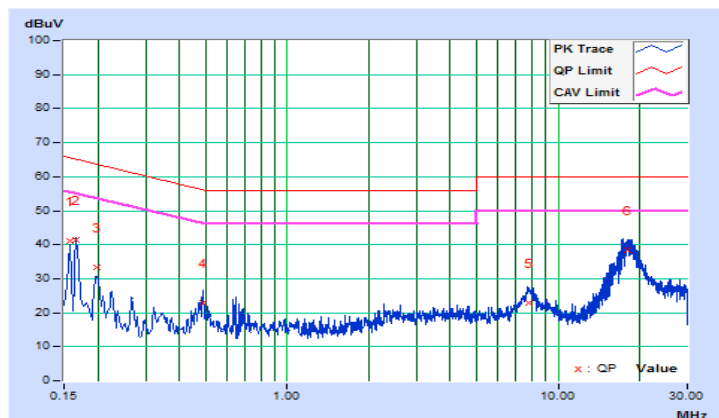
802.11a + BT LE

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 157 + CH 0		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15719	10.10	30.89	19.93	40.99	30.03	65.61	55.61	-24.62	-25.58
2	0.16526	10.10	31.38	21.87	41.48	31.97	65.20	55.20	-23.72	-23.23
3	0.19717	10.10	23.33	9.88	33.43	19.98	63.73	53.73	-30.30	-33.75
4	0.48678	10.12	12.71	6.54	22.83	16.66	56.22	46.22	-33.39	-29.56
5	7.77841	10.50	12.47	6.35	22.97	16.85	60.00	50.00	-37.03	-33.15
6	17.95223	11.09	27.37	25.15	38.46	36.24	60.00	50.00	-21.54	-13.76

Remarks:

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

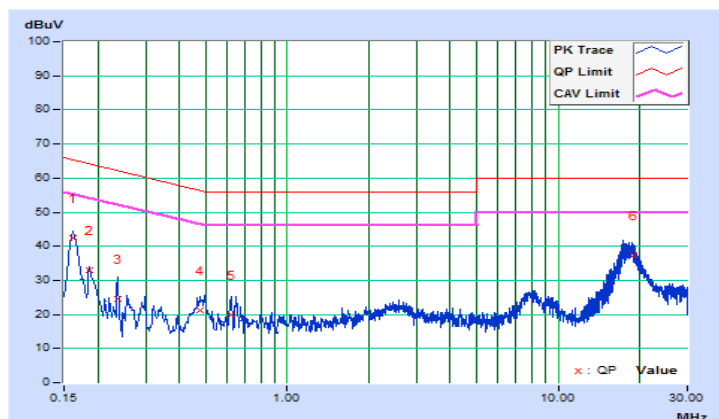


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 157 + CH 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16096	10.10	32.35	22.99	42.45	33.09	65.41	55.41	-22.96	-22.32
2	0.18508	10.10	22.77	7.61	32.87	17.71	64.25	54.25	-31.38	-36.54
3	0.23586	10.11	14.53	1.71	24.64	11.82	62.24	52.24	-37.60	-40.42
4	0.47412	10.12	11.12	2.59	21.24	12.71	56.44	46.44	-35.20	-33.73
5	0.61868	10.12	9.84	0.38	19.96	10.50	56.00	46.00	-36.04	-35.50
6	18.91018	10.90	26.64	23.84	37.54	34.74	60.00	50.00	-22.46	-15.26

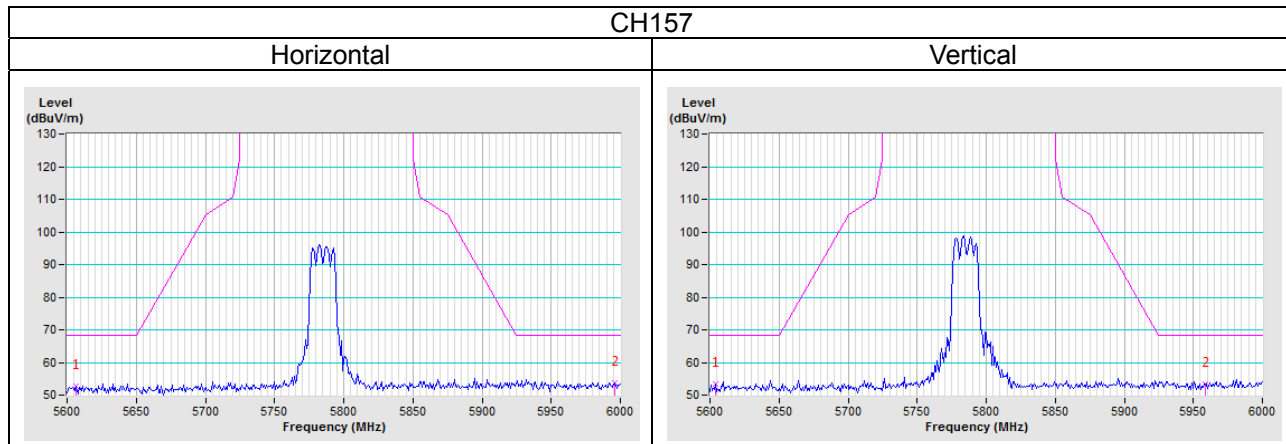
Remarks:

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

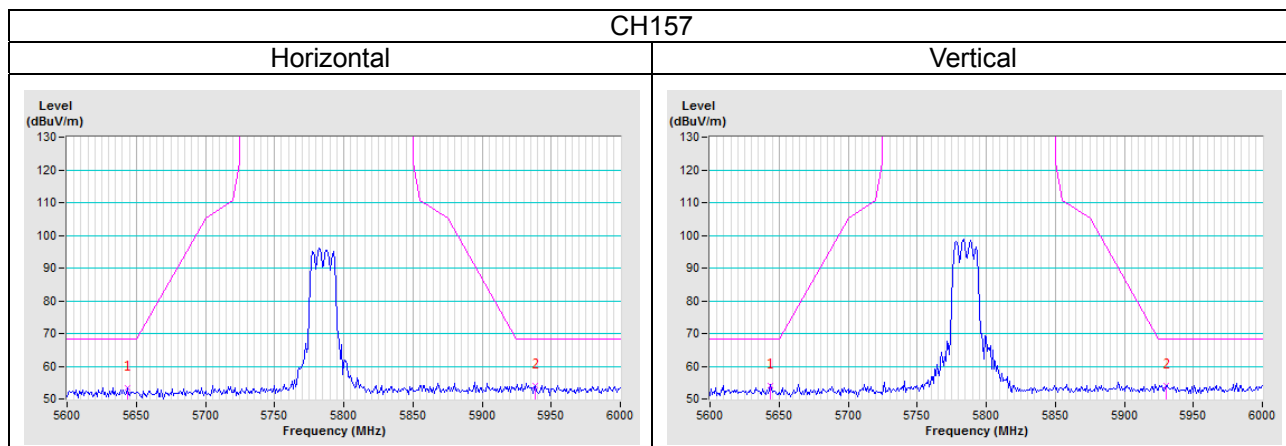


Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

802.11a + BT EDR



802.11a + BT LE



5 Pictures of Test Arrangements

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

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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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.

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