

Supplemental “Transmit Simultaneously” Test Report

Report No.: RF160810E03D-5

FCC ID: Q87-WHW03

Test Model: WHW03

Received Date: Aug. 10, 2016

Test Date: Oct. 06 to 17, 2016

Issued Date: July 19, 2017

Applicant: Linksys LLC

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Report Issue History Record

Issue No.	Reason for Change	Date Issued
RF160810E03-5	Original	Nov. 03, 2016
RF160810E03D-5	Add DFS band <5.26GHz ~ 5.32GHz, 5.50GHz ~ 5.70GHz>	July 19, 2017

Release Control Record

Issue No.	Description	Date Issued
RF160810E03D-5	Original release.	July 19, 2017

1 Certificate of Conformity

Product: Access Point

Brand: LINKSYS

Test Model: WHW03

Sample Status: ENGINEERING SAMPLE

Applicant: Linksys LLC

Test Date: Oct. 06 to 17, 2016

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 EMC characteristics under the conditions specified in this report.

Prepared by : Wendy Wu , **Date:** July 19, 2017
Wendy Wu / Specialist

Approved by : May Chen , **Date:** July 19, 2017
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C, E (SECTION 15.247, 15.407)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -8.0dB at 0.41172MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -4.9dB at 86.14MHz.

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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.31 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.40 dB
	6GHz ~ 18GHz	3.73 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Access Point
Brand	LINKSYS
Test Model	WHW03
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 12V from power adapter
Driver Version	0.0.19
Modulation Type	WLAN: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz band. BT-EDR: GFSK, $\pi/4$ -DQPSK, 8DPSK BT-LE: GFSK
Modulation Technology	WLAN: DSSS, OFDM BT-EDR: FHSS BT-LE: DTS
Transfer Rate	WLAN: 802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps BT-EDR: Up to 3Mbps BT-LE: Up to 1Mbps
Operating Frequency	2.4GHz: 2.412GHz ~ 2.462GHz 5GHz: 5.26 ~ 5.32GHz, 5.50 ~ 5.70GHz BT-EDR: 2402MHz ~ 2480MHz BT-LE: 2402MHz ~ 2480MHz
Number of Channel	2.4GHz: 802.11b, 802.11g, 802.11n (HT20), VHT20: 11 802.11n (HT40), VHT40: 7 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 15 802.11n (HT40), 802.11ac (VHT40): 7 802.11ac (VHT80): 3 BT-EDR: 79 BT-LE: 40
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF160810E03-5 as the following:
 - ◆ Add DFS band <5.26GHz ~ 5.32GHz, 5.50GHz ~ 5.70GHz>
2. According to above condition, the worst case was found in original report, so there is no addition test has to be performed. All test data were copied from the original test report (Report No.: RF160810E03-5). And all data were verified to meet the requirements.
3. There are WLAN, Bluetooth, Zigbee technology used for the EUT.
4. Simultaneously transmission condition

Condition	Technology			
1	WLAN (Radio 1) (2.4GHz / 5GHz-UNII-1, UNII-2A)	WLAN (Radio 2) (5GHz-UNII-2C, UNII-3)	Bluetooth	Zigbee

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

5. The EUT power needs to be supplied from one power adapter , the information is as below table:

Brand	Model	Spec.
Linksys	MU24A6120200-A1	Input: 100-240Vac, 50/60Hz, 0.7A Output: 12V, 2A DC output cable (Unshielded, 1.5m)

6. The antennas provided to the EUT, please refer to the following table:

BT Antenna Spec.							
Antenna No	Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz)	Antenna Type	Connector Type	
1	galtronics	60-2703-03	3.13	2.4~2.4835	Dipole	i-pex(MHF)	
Zigbee Antenna Spec.							
Antenna No	Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz)	Antenna Type	Connector Type	
2	galtronics	60-2699-03	2.52	2.4~2.4835	Dipole	i-pex(MHF)	
WLAN (Radio 2) Antenna Spec.							
Antenna No	Transmitter Circuit	Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz)	Antenna Type	Connector Type
3	5GHz-Chain (1) (UNII-2C,UNII-3)	galtronics	60-2704-03	3.86	5.5~5.825	Dipole	i-pex(MHF)
4	5GHz-Chain (0) (UNII-2C,UNII-3)	galtronics	60-2708-03	2.36	5.5~5.825	Dipole	i-pex(MHF)
WLAN (Radio 1) Antenna Spec.							
Antenna No	Transmitter Circuit	Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz)	Antenna Type	Connector Type
5	2.4GHz-Chain (0)	galtronics	60-2698-03	3.43	2.4~2.4835	Dipole	i-pex(MHF)
	5GHz-Chain (1) (UNII-1, UNII-2A)			3.62	5.18~5.320		
6	2.4GHz-Chain (1)	galtronics	60-2697-03	1.49	2.4~2.4835	Dipole	i-pex(MHF)
	5GHz-Chain (0) (UNII-1, UNII-2A)			4.35	5.18~5.320		

7. The EUT incorporates a MIMO without beamforming function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	2TX	2RX
802.11g	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
VHT20	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
VHT40	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11ac (VHT20)	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
802.11ac (VHT40)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
802.11ac (VHT80)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX

Note:

1. All of modulation mode support beamforming function except 802.11b modulation mode.

8. 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.

3.1.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **OB**: Conducted Out-Band Emission Measurement

Radiated Emission Test (Above 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT40) + 802.11a + BT-EDR + BT-LE	1 to 11	11	DSSS	DBPSK
	38 to 46	46	OFDM	BPSK
	149, 157, 165	157	OFDM	BPSK
	0 to 78	78	FHSS	GFSK
	0 to 39	19	OFDM	BPSK
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	
Zigbee	11 to 25	18	O-QPSK	

Radiated Emission Test (Below 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT40) + 802.11a + BT-EDR + BT-LE	1 to 11	11	DSSS	DBPSK
	38 to 46	46	OFDM	BPSK
	149, 157, 165	157	OFDM	BPSK
	0 to 78	78	FHSS	GFSK
	0 to 39	19	OFDM	BPSK
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	
Zigbee	11 to 25	18	O-QPSK	

Power Line Conducted Emission Test:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT40) + 802.11a + BT-EDR + BT-LE	1 to 11	11	DSSS	DBPSK
	38 to 46	46	OFDM	BPSK
	149, 157, 165	157	OFDM	BPSK
	0 to 78	78	FHSS	GFSK
	0 to 39	19	OFDM	BPSK
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	
Zigbee	11 to 25	18	O-QPSK	

Conducted Out-Band Emission Measurement:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT40)	1 to 11	11	DSSS	DBPSK
	38 to 46 151 to 159	46	OFDM	BPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	22deg. C, 71%RH	120Vac, 60Hz	Weiwei Lo
RE<1G	23deg. C, 61%RH	120Vac, 60Hz	Jyunchun Lin
PLC	25deg. C, 75%RH	120Vac, 60Hz	Barry Lee
OB	25deg. C, 60%RH	120Vac, 60Hz	Gary Cheng

3.2 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.

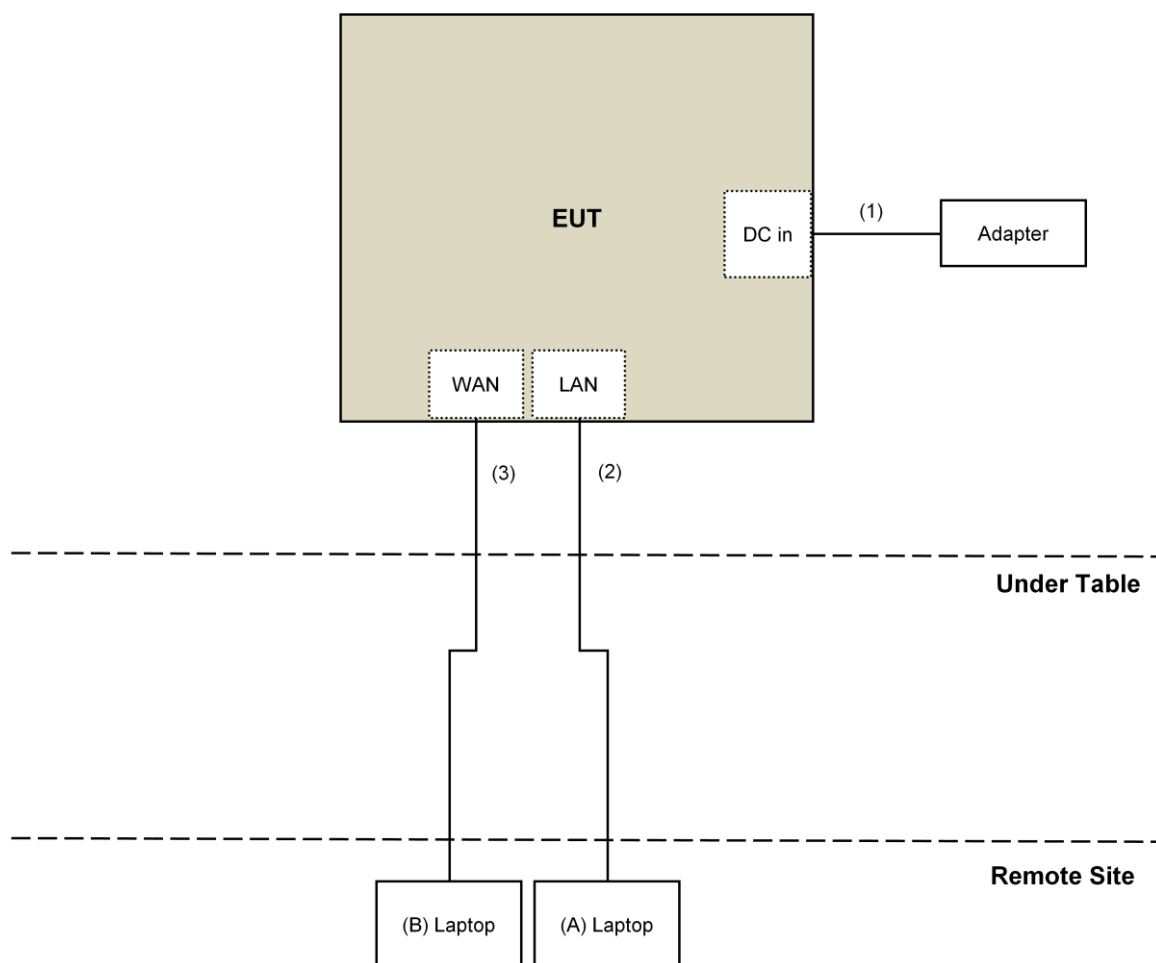
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	HP	Pavilion 14-ab023TU	5CD5340WXZ	NA	Provided by Lab
B.	Laptop	DELL	E6440	F9LYQ32	FCC DoC	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.5	No	0	Supplied by client
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	1	10	No	0	Provided by Lab

3.2.1 Configuration of System under Test



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.

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 v01r03		Field Strength at 3m	
		PK:74 (dBuV/m)	AV:54 (dBuV/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(dBuV/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(dBuV/m) ^{*1} PK:105.2 (dBuV/m) ^{*2} PK: 110.8(dBuV/m) ^{*3} PK:122.2 (dBuV/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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
Pre-Amplifier ^(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4. The FCC Site Registration No. is 147459
5. The CANADA Site Registration No. is 20331-1
6. Loop antenna was used for all emissions below 30 MHz
7. Tested Date: Oct. 06 to 17, 2016

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. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the 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:

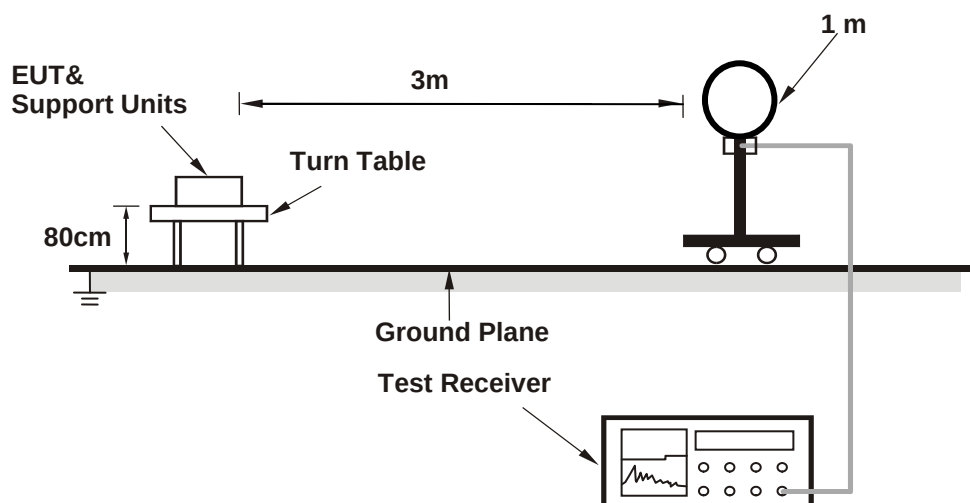
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

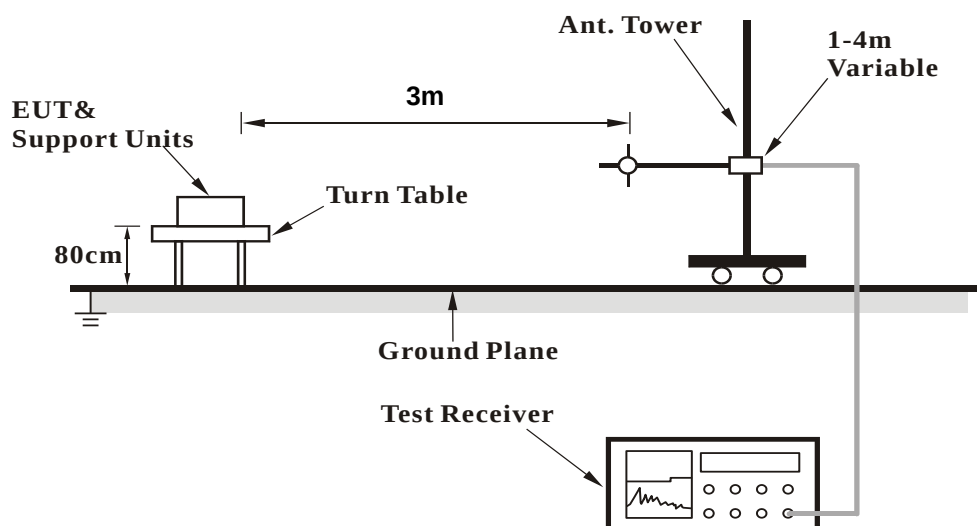
No deviation.

4.1.5 Test Setup

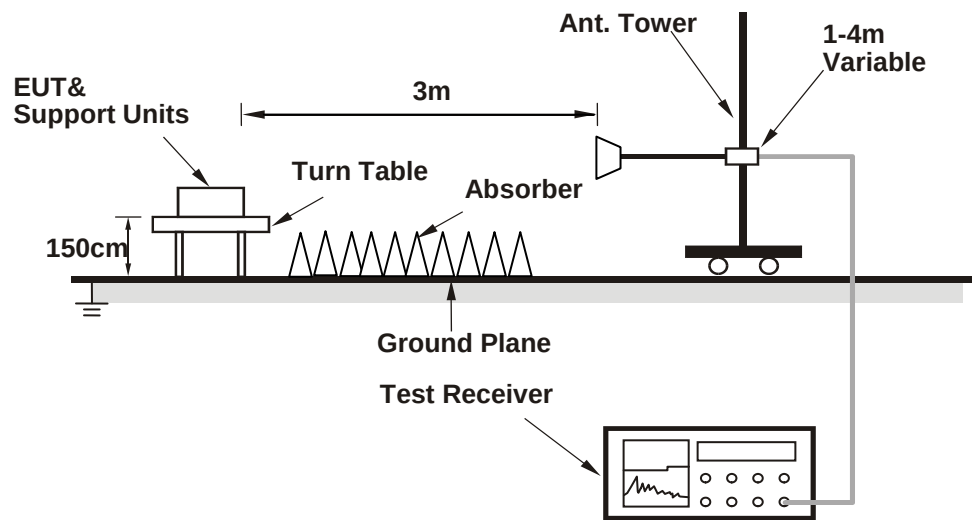
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- Connected the EUT with the laptop which is placed on remote site.
- Contorlling software (nodes QCA9886 power command band 3-4.txt) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data

FREQUENCY RANGE	1GHz ~ 40GHz	DETECTOR FUNCTION	Peak (PK) Average (AV)
------------------------	--------------	--------------------------	---------------------------

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	4880.00	50.4 PK	74.0	-23.6	1.57 H	216	47.9	2.5
2	4880.00	40.7 AV	54.0	-13.3	1.57 H	216	38.2	2.5
3	4924.00	48.6 PK	74.0	-25.4	2.04 H	164	46.1	2.5
4	4924.00	42.8 AV	54.0	-11.2	2.04 H	164	40.3	2.5
5	4960.00	46.0 PK	74.0	-28.0	1.57 H	255	43.5	2.5
6	4960.00	34.4 AV	54.0	-19.6	1.57 H	255	31.9	2.5
7	7320.00	49.2 PK	74.0	-24.8	1.15 H	237	40.3	8.9
8	7320.00	42.3 AV	54.0	-11.7	1.15 H	237	33.4	8.9
9	7386.00	56.0 PK	74.0	-18.0	1.63 H	239	46.7	9.3
10	7386.00	47.7 AV	54.0	-6.3	1.63 H	239	38.4	9.3
11	7440.00	50.2 PK	74.0	-23.8	1.75 H	193	40.7	9.5
12	7440.00	38.2 AV	54.0	-15.8	1.75 H	193	28.7	9.5
13	10460.00	51.8 PK	74.0	-22.2	2.84 H	127	37.9	13.9
14	10460.00	40.9 AV	54.0	-13.1	2.84 H	127	27.0	13.9
15	11570.00	56.3 PK	74.0	-17.7	1.43 H	230	41.2	15.1
16	11570.00	43.9 AV	54.0	-10.1	1.43 H	230	28.8	15.1
17	15690.00	53.8 PK	74.0	-20.2	1.62 H	305	38.2	15.6
18	15690.00	41.6 AV	54.0	-12.4	1.62 H	305	26.0	15.6
19	17355.00	57.9 PK	74.0	-16.1	1.98 H	289	37.4	20.5
20	17355.00	45.8 AV	54.0	-8.2	1.98 H	289	25.3	20.5
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	4880.00	49.9 PK	74.0	-24.1	1.49 V	202	47.4	2.5
2	4880.00	40.4 AV	54.0	-13.6	1.49 V	202	37.9	2.5
3	4924.00	50.0 PK	74.0	-24.0	3.27 V	175	47.5	2.5
4	4924.00	45.4 AV	54.0	-8.6	3.27 V	175	42.9	2.5
5	4960.00	47.3 PK	74.0	-26.7	1.42 V	119	44.8	2.5
6	4960.00	35.1 AV	54.0	-18.9	1.42 V	119	32.6	2.5
7	7320.00	55.7 PK	74.0	-18.3	1.57 V	354	46.8	8.9
8	7320.00	46.2 AV	54.0	-7.8	1.57 V	354	37.3	8.9
9	7386.00	52.3 PK	74.0	-21.7	3.44 V	177	43.0	9.3
10	7386.00	42.6 AV	54.0	-11.4	3.44 V	177	33.3	9.3
11	7440.00	51.6 PK	74.0	-22.4	1.26 V	160	42.1	9.5
12	7440.00	39.7 AV	54.0	-14.3	1.26 V	160	30.2	9.5
13	10460.00	50.4 PK	74.0	-23.6	2.82 V	135	36.5	13.9
14	10460.00	39.9 AV	54.0	-14.1	2.82 V	135	26.0	13.9
15	11570.00	53.3 PK	74.0	-20.7	1.34 V	316	38.2	15.1
16	11570.00	41.7 AV	54.0	-12.3	1.34 V	316	26.6	15.1
17	15690.00	52.6 PK	74.0	-21.4	1.70 V	325	37.0	15.6
18	15690.00	40.7 AV	54.0	-13.3	1.70 V	325	25.1	15.6
19	17355.00	58.5 PK	74.0	-15.5	1.36 V	231	38.0	20.5
20	17355.00	47.1 AV	54.0	-6.9	1.36 V	231	26.6	20.5

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

Below 1GHz Data:

FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
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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	87.11	27.3 QP	40.0	-12.7	2.50 H	274	41.3	-14.0
2	103.84	28.3 QP	43.5	-15.2	1.50 H	111	40.6	-12.3
3	299.42	29.7 QP	46.0	-16.3	1.00 H	63	37.2	-7.5
4	384.00	30.5 QP	46.0	-15.5	1.00 H	55	35.8	-5.3
5	570.85	31.4 QP	46.0	-14.6	1.50 H	84	32.5	-1.1
6	951.45	40.8 QP	46.0	-5.2	1.00 H	0	36.0	4.8
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	35.97	32.8 QP	40.0	-7.2	1.00 V	88	42.5	-9.7
2	47.80	30.7 QP	40.0	-9.3	1.50 V	357	39.0	-8.3
3	86.14	35.1 QP	40.0	-4.9	1.50 V	0	48.9	-13.8
4	341.05	29.6 QP	46.0	-16.4	1.50 V	333	36.0	-6.4
5	384.00	32.1 QP	46.0	-13.9	1.00 V	360	37.4	-5.3
6	570.87	34.3 QP	46.0	-11.7	1.00 V	211	35.4	-1.1

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 09, 2016	May 08, 2017
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Aug. 31, 2016	Aug. 30, 2017
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 13, 2016	June 12, 2017
RF Cable	5D-FB	COACAB-002	Mar. 04, 2016	Mar. 03, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-003	Sep. 13, 2016	Sep. 12, 2017
50 ohms Terminator	N/A	04	Nov. 18, 2015	Nov. 17, 2016
50 ohms Terminator	50	3	Oct. 21, 2015	Oct. 20, 2016
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: Oct, 06, 2016

4.2.3 Test Procedures

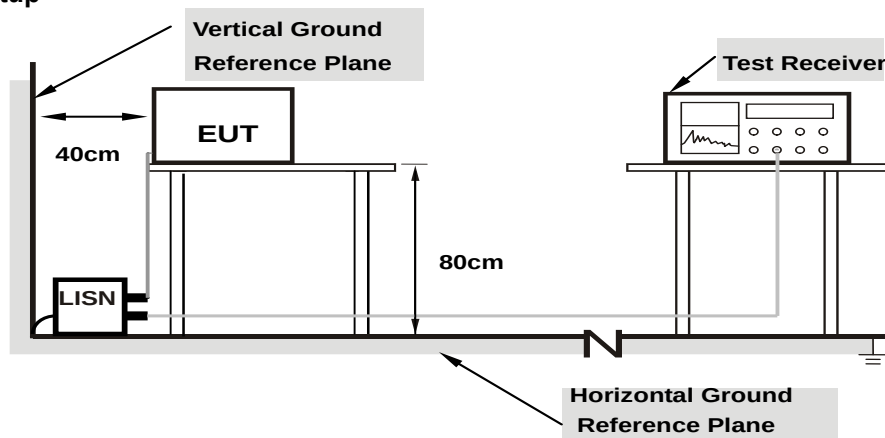
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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) was not recorded.

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

4.2.4 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.

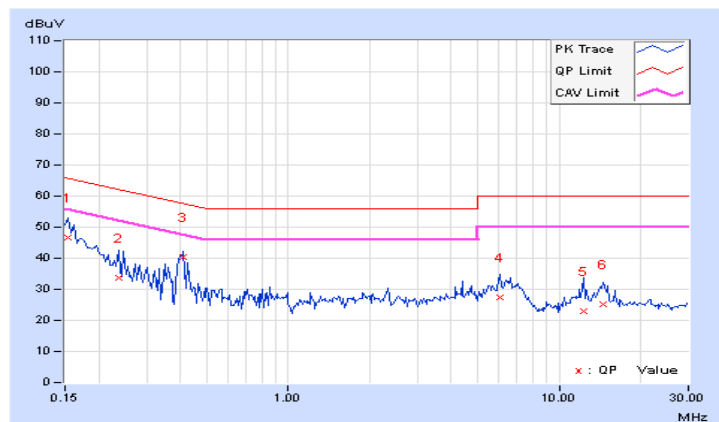
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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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	0.15391	10.14	36.59	24.20	46.73	34.34	65.79	55.79	-19.06	-21.45
2	0.23594	10.12	23.44	15.42	33.56	25.54	62.24	52.24	-28.68	-26.70
3	0.41172	10.11	30.13	29.50	40.24	39.61	57.61	47.61	-17.37	-8.00
4	6.03125	10.35	16.94	11.06	27.29	21.41	60.00	50.00	-32.71	-28.59
5	12.28125	10.52	12.45	7.26	22.97	17.78	60.00	50.00	-37.03	-32.22
6	14.56641	10.62	14.54	6.80	25.16	17.42	60.00	50.00	-34.84	-32.58

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

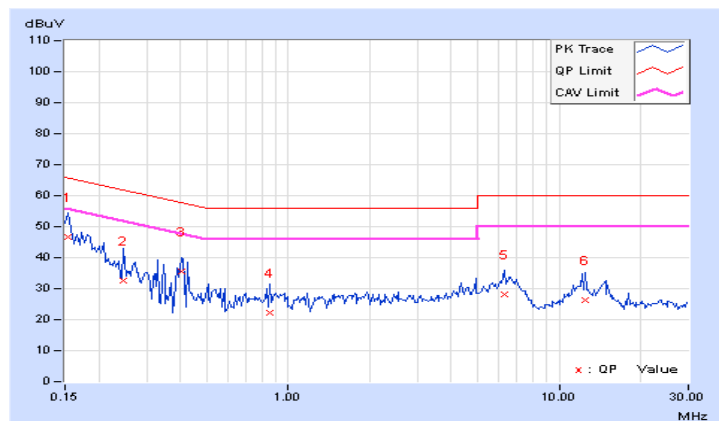


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.18	36.51	24.98	46.69	35.16	65.79	55.79	-19.10	-20.63
2	0.24766	10.07	22.45	11.78	32.52	21.85	61.84	51.84	-29.32	-29.99
3	0.40391	10.09	25.30	18.53	35.39	28.62	57.77	47.77	-22.38	-19.15
4	0.85703	10.18	12.18	4.11	22.36	14.29	56.00	46.00	-33.64	-31.71
5	6.27344	10.38	17.77	11.98	28.15	22.36	60.00	50.00	-31.85	-27.64
6	12.40625	10.57	15.59	10.47	26.16	21.04	60.00	50.00	-33.84	-28.96

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

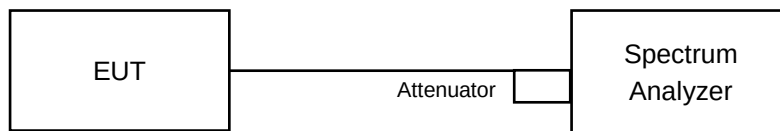


4.3 Conducted Out of Band Emission Measurement

4.3.1 Limits of Conducted Out of Band Emission Measurement

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

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 Procedures

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 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 OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

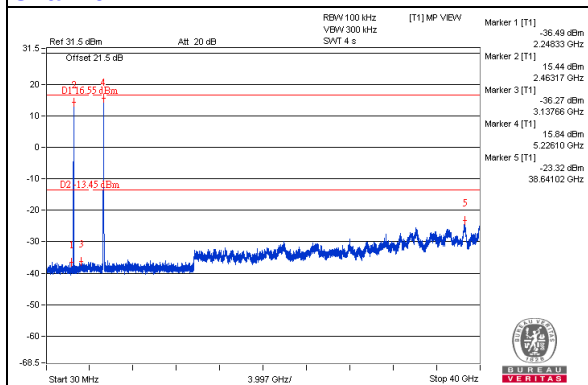
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Results

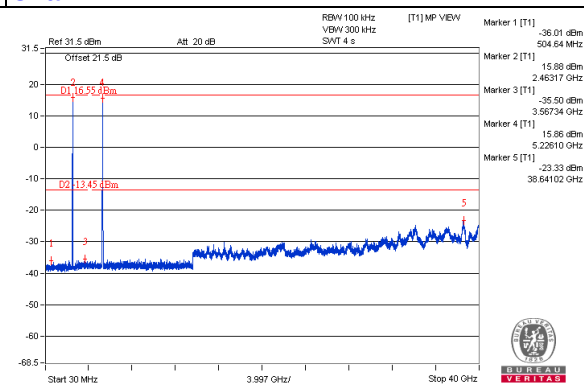
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

2.4GHz_802.11b CH11 + 5GHz_802.11ac (VHT40) CH46

Chain 0



Chain 1



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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