

Supplemental “Transmit Simultaneously” Test Report

Report No.: RF180830E03-2

FCC ID: 2APLE18300394

Test Model: VMB5000

Received Date: Sep. 04, 2018

Test Date: Oct. 08 to 10, 2018

Issued Date: Nov. 01, 2018

Applicant: Arlo Technologies, Inc.

Address: 2200 Faraday Ave. Suite 150, Carlsbad, CA 92008, United States

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF180830E03-2	Original release.	Nov. 01, 2018

1 Certificate of Conformity

Product: Alro Gen5 Entry Hub

Brand: Arlo

Test Model: VMB5000

Sample Status: ENGINEERING SAMPLE

Applicant: Arlo Technologies, Inc.

Test Date: Oct. 08 to 10, 2018

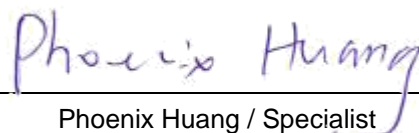
Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)

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 EMC characteristics under the conditions specified in this report.

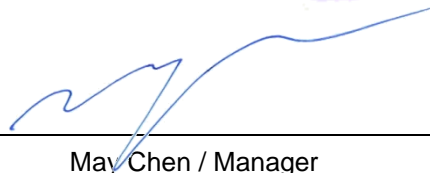
Prepared by :


Phoenix Huang / Specialist

Date:

Nov. 01, 2018

Approved by :


May Chen / Manager

Date:

Nov. 01, 2018

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 15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.49dB at 0.15000MHz.
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 -6.7dB at 3660.00MHz.

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	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.53 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.08 dB
	6GHz ~ 18GHz	4.98 dB
	18GHz ~ 40GHz	5.19 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Alro Gen5 Entry Hub
Brand	Arlo
Test Model	VMB5000
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter
Modulation Type	WLAN: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only Zigbee: O-QPSK Z-Wave: FSK Sub-GHz: O-QPSK
Modulation Technology	WLAN: DSSS, OFDM Zigbee: DSSS Sub-GHz: DSSS
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 Zigbee: 250kbps Z-Wave: 100kbps Sub-GHz: 100kbps
Operating Frequency	WLAN: 2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.18~ 5.24GHz, 5.745 ~ 5.825GHz Zigbee: 2.405 ~ 2.480GHz Z-Wave: 908.4 ~ 916.0MHz Sub-GHz: 915MHz
Number of Channel	WLAN: 2.4GHz: 802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 9 802.11n (HT40), 802.11ac (VHT40): 4 802.11ac (VHT80): 2 Zigbee: 16 Z-Wave: 3 Sub-GHz: 1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1
Data Cable Supplied	NA

Note:

- There are WLAN, Z-Wave, Zigbee and Sub-GHz technology used for the EUT. The EUT has below radios as following table:

Radio 1	Radio 2	Radio 3	Radio 4
WLAN (2.4GHz+5GHz band)	Z-Wave	Zigbee	Sub-GHz

- Simultaneously transmission condition.

Condition	Technology				
1	WLAN 2.4GHz	WLAN 5GHz	Z-Wave	Zigbee	Sub-GHz

- The EUT must be supplied with a power adapter and following different models could be chosen as following table:

No.	Brand	Model No.	P/N No.	Spec.
1	NETGEAR	AD2076F10	332-10993-01	Input: 100-120Vac, 0.56A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m)
2	NETGEAR	AD2067M20	332-11074-01	Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m)
3	NETGEAR	2ABB018F 1 NJ	332-10927-01	Input: 100-120Vac, 0.6A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m)
4	NETGEAR	P030WM120B	332-10345-02	Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m)

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

Sub-GHz							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	NA	902P00214N0	1.5	860~930	PIFA	NA	
Z-Wave							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	NA	902P00213N0	2.5	860~930	PIFA	NA	
Zigbee							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	
1	INPAQ TECHNOLOGY CO., LTD.	ACA-5036-A2-CC-S	3.5	2.4~2.4835	CHIP	NA	
WLAN							
Ant No.	Brand	Model	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	Cable Length (mm)
1	NA	9 07X01052X0	2.5	2.4~2.4835	Dipole	i-pex	75
			1.8	5.15~5.25			
			2	5.25~5.35			
			2.2	5.47~5.725			
			1.6	5.725~5.85			
2	NA	9 07X00747X19	2.5	2.4~2.4835	Dipole	i-pex	90
			2.2	5.15~5.25			
			1.2	5.25~5.35			
			3.2	5.47~5.725			
			3.5	5.725~5.85			

5. The EUT incorporates a MIMO 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
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

6. 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
802.11g + 802.11ac (VHT20) + Zigbee + Z-Wave + Sub-GHz	1 to 11	6	OFDM	BPSK
	36 to 48 149 to 165	40	OFDM	BPSK
	11 to 26	18	DSSS	O-QPSK
	1 to 3	3	-	FSK
	1	1	DSSS	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
802.11g + 802.11ac (VHT20) + Zigbee + Z-Wave + Sub-GHz	1 to 11	6	OFDM	BPSK
	36 to 48 149 to 165	40	OFDM	BPSK
	11 to 26	18	DSSS	O-QPSK
	1 to 3	3	-	FSK
	1	1	DSSS	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
802.11g + 802.11ac (VHT20) + Zigbee + Z-Wave + Sub-GHz	1 to 11	6	OFDM	BPSK
	36 to 48 149 to 165	40	OFDM	BPSK
	11 to 26	18	DSSS	O-QPSK
	1 to 3	3	-	FSK
	1	1	DSSS	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
802.11g + 802.11ac (VHT20)	1 to 11	6	OFDM	BPSK
	36 to 48 149 to 165	40	OFDM	BPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	25deg. C, 72%RH	120Vac, 60Hz	Andy Ho
RE<1G	23deg. C, 68%RH	120Vac, 60Hz	Rey Chen
PLC	25deg. C, 75%RH	120Vac, 60Hz	Andy Ho
OB	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

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.

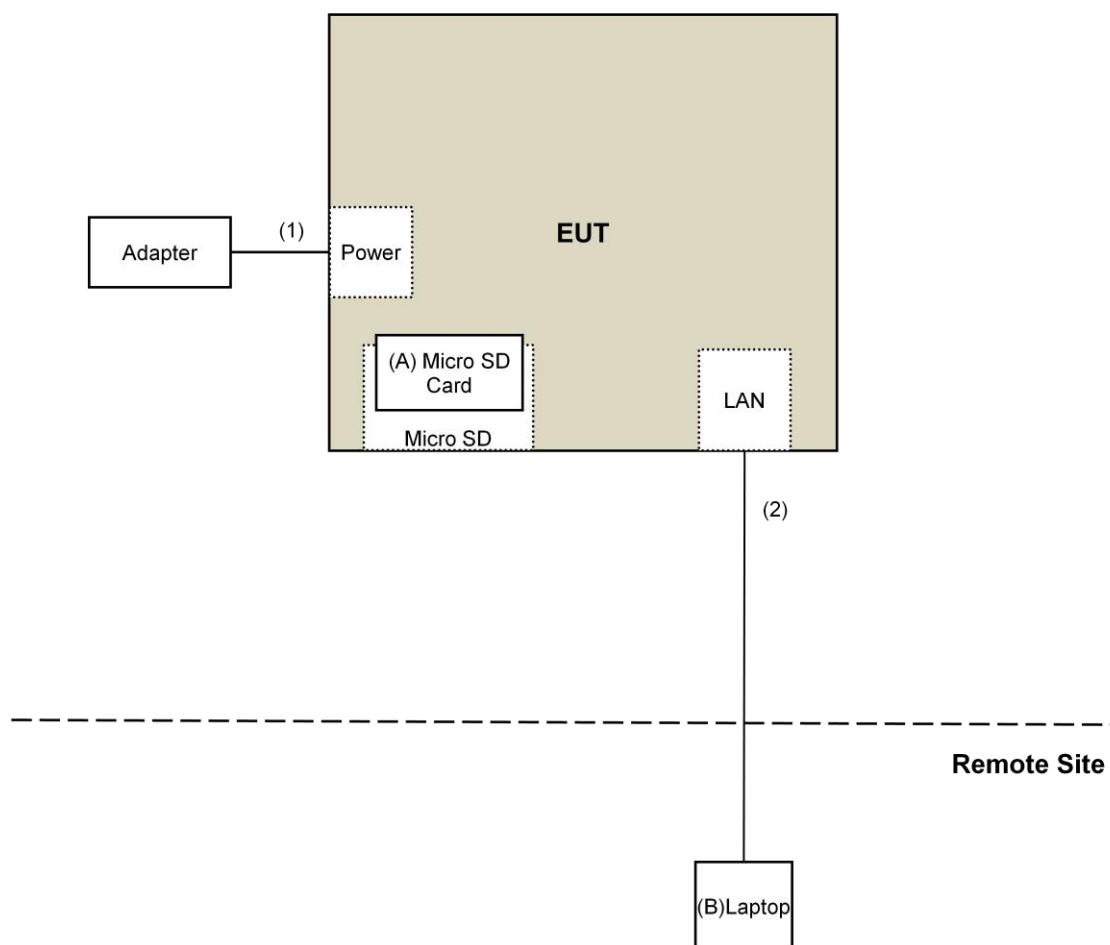
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	MicroSD Card	SanDisk	8GB	NA	NA	Provided by Lab
B.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab

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	1.8	No	0	Supplied by client
2.	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:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 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	<input checked="" type="checkbox"/>	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}
	<input type="checkbox"/>	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	July 12, 2018	July 11, 2019
Pre-Amplifier EMCI	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001	Jan. 15, 2018	Jan. 14, 2019
RF Cable	NA	LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 05, 2018	May 04, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 29, 2017	Nov. 28, 2018
RF Cable	8D	966-3-1	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-2	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-3	Mar. 20, 2018	Mar. 19, 2019
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Dec. 12, 2017	Dec. 11, 2018
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-1200	160922	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-2000	150317	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-5000	150322	Jan. 29, 2018	Jan. 28, 2019
Spectrum Analyzer Keysight	N9030A	MY54490679	July 23, 2018	July 22, 2019
Pre-Amplifier EMCI	EMC184045SE	980386	Jan. 29, 2018	Jan. 28, 2019
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018
RF Cable	EMC102-KM-KM-1200	160924	Jan. 29, 2018	Jan. 28, 2019
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
Spectrum Analyzer R&S	FSV40	100964	June 20, 2018	June 19, 2019

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 CANADA Site Registration No. is 20331-1
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: Oct. 08 to 10, 2018

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:

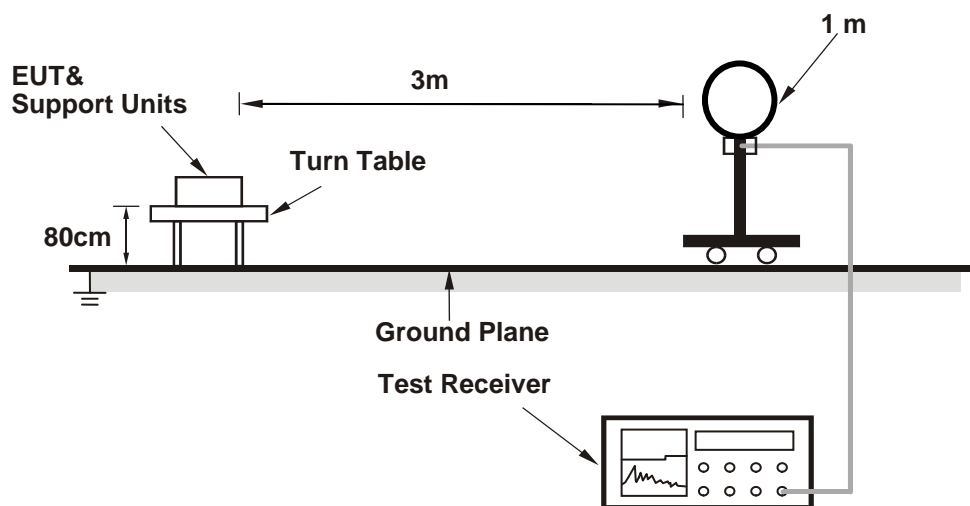
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

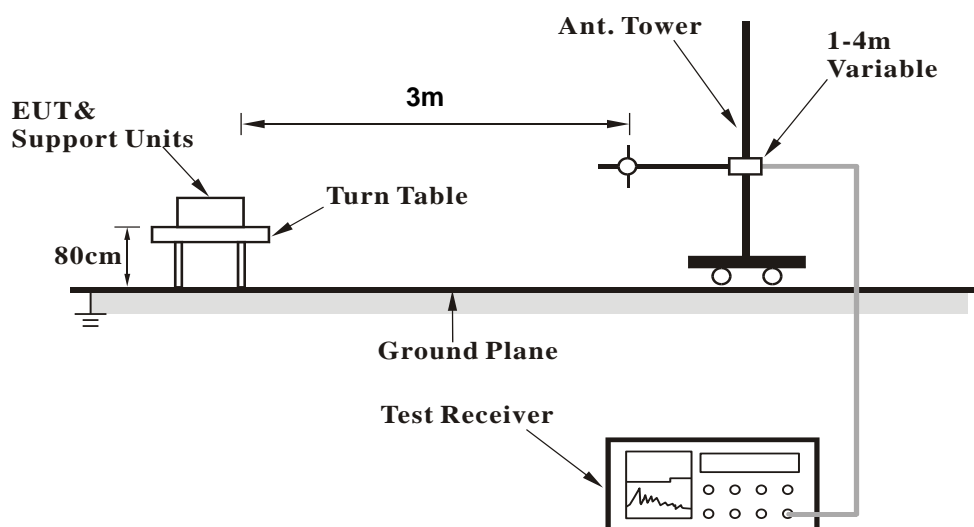
No deviation.

4.1.5 Test Setup

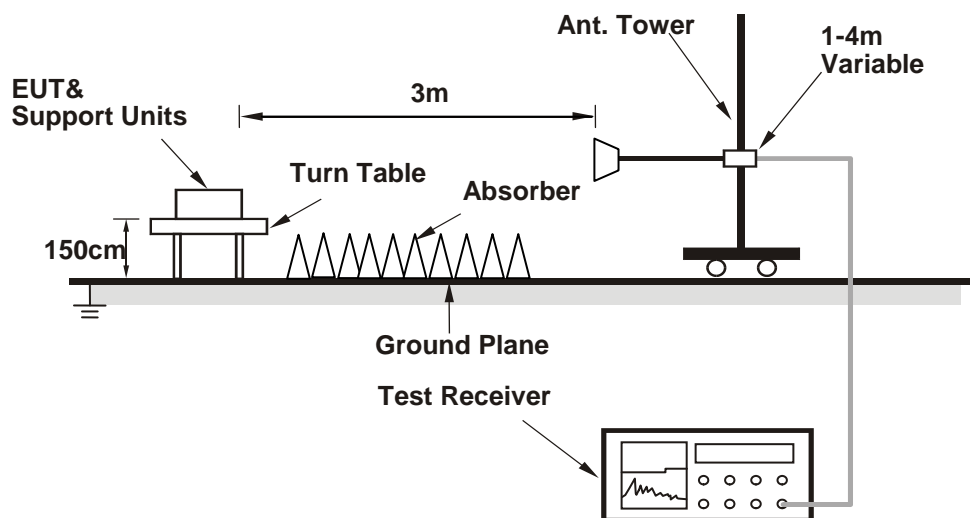
For Radiated emission below 30MHz



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.
- Controlling software (WLAN: QDART-Connectivity100040.exe / Zigbee, Z-Wave & Sub-GHz: Run teraturn paste TX command) 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	2745.00	41.1 PK	74.0	-32.9	1.50 H	203	43.0	-1.9
2	2745.00	36.9 AV	54.0	-17.1	1.50 H	203	38.8	-1.9
3	2748.00	43.9 PK	74.0	-30.1	1.52 H	180	45.8	-1.9
4	2748.00	31.7 AV	54.0	-22.3	1.52 H	180	33.6	-1.9
5	3660.00	49.6 PK	74.0	-24.4	1.50 H	12	50.2	-0.6
6	3660.00	47.3 AV	54.0	-6.7	1.50 H	12	47.9	-0.6
7	3664.00	45.7 PK	74.0	-28.3	1.64 H	210	46.3	-0.6
8	3664.00	33.3 AV	54.0	-20.7	1.64 H	210	33.9	-0.6
9	4810.00	37.6 PK	74.0	-36.4	1.36 H	301	36.0	1.6
10	4810.00	28.5 AV	54.0	-25.5	1.36 H	301	26.9	1.6
11	4874.00	46.4 PK	74.0	-27.6	1.99 H	129	44.8	1.6
12	4874.00	31.7 AV	54.0	-22.3	1.99 H	129	30.1	1.6
13	7311.00	47.0 PK	74.0	-27.0	1.45 H	262	39.3	7.7
14	7311.00	34.9 AV	54.0	-19.1	1.45 H	262	27.2	7.7
15	10400.00	53.8 PK	68.2	-14.4	1.63 H	284	41.6	12.2
16	15600.00	53.7 PK	74.0	-20.3	1.65 H	320	40.8	12.9
17	15600.00	41.6 AV	54.0	-12.4	1.65 H	320	28.7	12.9

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	2745.00	38.0 PK	74.0	-36.0	1.28 V	66	39.9	-1.9
2	2745.00	31.1 AV	54.0	-22.9	1.28 V	66	33.0	-1.9
3	2748.00	44.2 PK	74.0	-29.8	1.53 V	360	46.1	-1.9
4	2748.00	32.2 AV	54.0	-21.8	1.53 V	360	34.1	-1.9
5	3660.00	47.7 PK	74.0	-26.3	1.50 V	89	48.3	-0.6
6	3660.00	45.1 AV	54.0	-8.9	1.50 V	89	45.7	-0.6
7	3664.00	46.4 PK	74.0	-27.6	1.54 V	351	47.0	-0.6
8	3664.00	33.7 AV	54.0	-20.3	1.54 V	351	34.3	-0.6
9	4810.00	38.8 PK	74.0	-35.2	1.41 V	241	37.2	1.6
10	4810.00	29.8 AV	54.0	-24.2	1.41 V	241	28.2	1.6
11	4874.00	48.9 PK	74.0	-25.1	1.49 V	257	47.3	1.6
12	4874.00	35.9 AV	54.0	-18.1	1.49 V	257	34.3	1.6
13	7311.00	46.7 PK	74.0	-27.3	1.64 V	326	39.0	7.7
14	7311.00	34.5 AV	54.0	-19.5	1.64 V	326	26.8	7.7
15	10400.00	49.5 PK	68.2	-18.7	1.95 V	128	37.3	12.2
16	15600.00	55.6 PK	74.0	-18.4	1.50 V	237	42.7	12.9
17	15600.00	41.7 AV	54.0	-12.3	1.50 V	237	28.8	12.9

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

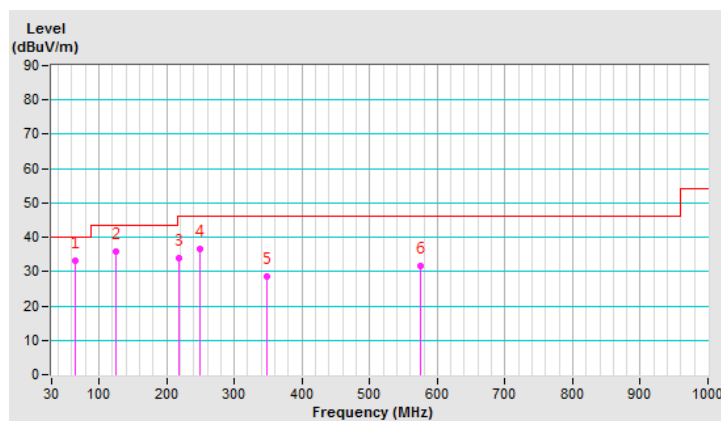
Below 1GHz Data:

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	64.53	33.0 QP	40.0	-7.0	1.00 H	145	42.2	-9.2
2	125.11	35.9 QP	43.5	-7.6	3.50 H	217	45.2	-9.3
3	217.89	33.9 QP	46.0	-12.1	1.50 H	217	44.7	-10.8
4	250.00	36.5 QP	46.0	-9.5	2.50 H	319	45.4	-8.9
5	347.84	28.7 QP	46.0	-17.3	1.50 H	254	34.4	-5.7
6	574.78	31.5 QP	46.0	-14.5	2.00 H	258	32.0	-0.5

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. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

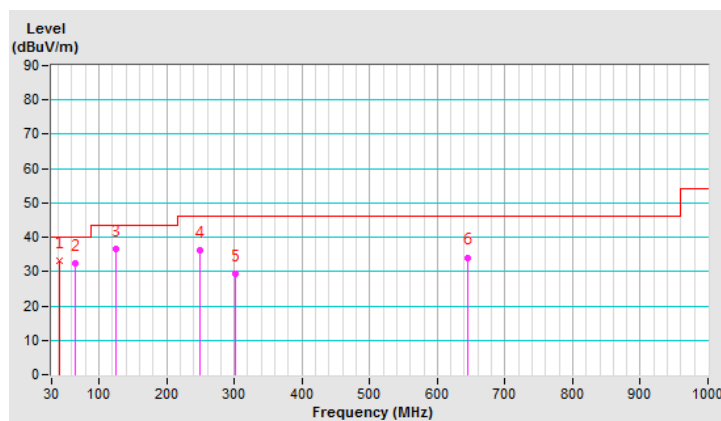


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
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ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	41.59	33.2 QP	40.0	-6.8	1.00 V	153	41.3	-8.1
2	65.57	32.5 QP	40.0	-7.5	3.00 V	217	41.9	-9.4
3	124.99	36.6 QP	43.5	-6.9	1.50 V	179	45.9	-9.3
4	250.00	36.3 QP	46.0	-9.7	1.50 V	237	45.2	-8.9
5	302.30	29.2 QP	46.0	-16.8	2.50 V	278	36.0	-6.8
6	644.33	34.1 QP	46.0	-11.9	1.00 V	177	32.9	1.2

REMARKS:

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



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Nov. 01, 2017	Oct. 31, 2018
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Nov. 15, 2017	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	EMC-04	Nov. 01, 2017	Oct. 31, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 16, 2018	Mar. 15, 2019
Software BVADT	BVADT_Conc_ 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 Conduction 1.
- 3 Tested Date: Oct. 10, 2018

4.2.3 Test Procedures

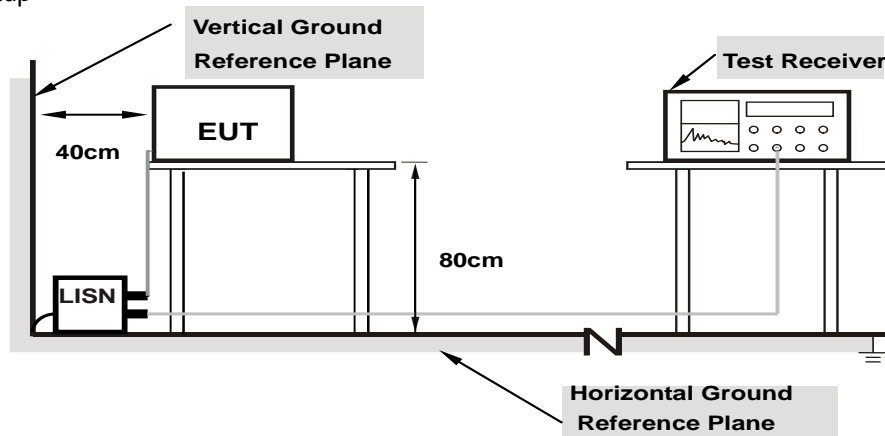
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

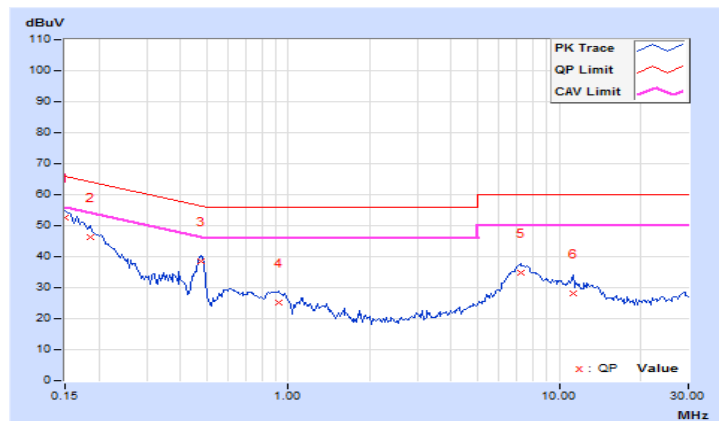
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.05	42.46	25.90	52.51	35.95	66.00	56.00	-13.49	-20.05
2	0.18516	10.06	36.36	20.32	46.42	30.38	64.25	54.25	-17.83	-23.87
3	0.47422	10.13	28.21	21.30	38.34	31.43	56.44	46.44	-18.10	-15.01
4	0.91953	10.16	15.08	8.99	25.24	19.15	56.00	46.00	-30.76	-26.85
5	7.20703	10.54	24.35	19.31	34.89	29.85	60.00	50.00	-25.11	-20.15
6	11.22656	10.80	17.29	10.61	28.09	21.41	60.00	50.00	-31.91	-28.59

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

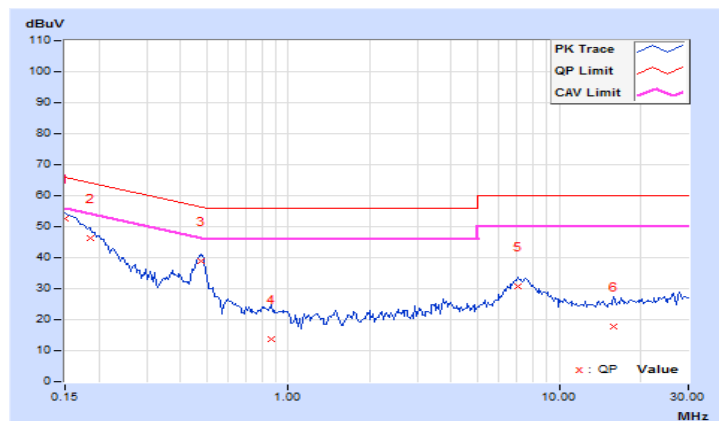


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.95	42.56	25.31	52.51	35.26	66.00	56.00	-13.49	-20.74
2	0.18516	9.97	36.50	19.44	46.47	29.41	64.25	54.25	-17.78	-24.84
3	0.47422	10.02	28.96	22.08	38.98	32.10	56.44	46.44	-17.46	-14.34
4	0.86094	10.04	3.51	-5.76	13.55	4.28	56.00	46.00	-42.45	-41.72
5	7.02344	10.37	20.38	14.89	30.75	25.26	60.00	50.00	-29.25	-24.74
6	15.99219	10.93	6.89	1.58	17.82	12.51	60.00	50.00	-42.18	-37.49

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

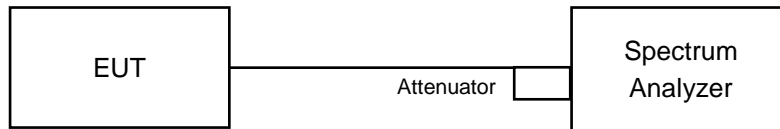


4.3 Conducted Out of Band Emission Measurement

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.

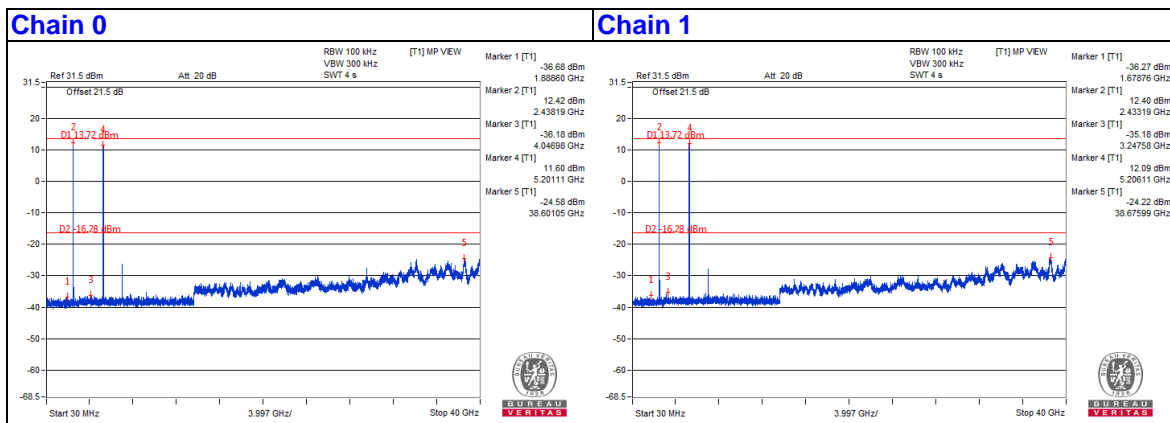
4.3.6 EUT Operating Conditions

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_802.11g CH6 + 5GHz_802.11ac (VHT20) CH40



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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

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Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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