

Partial FCC Test Report

Report No.: RF191205C07-1

FCC ID: J9C-QCNFA524

Test Model: QCNFA524

Received Date: Dec. 31, 2019

Test Date: Feb. 12 ~ Feb. 26, 2020

Issued Date: Mar. 05, 2020

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

FCC Registration / 788550 / TW0003

Designation Number: 427177 / TW0011



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Release Control Record

Issue No.	Description	Date Issued
RF191205C07-1	Original Release	Mar. 05, 2020

1 Certificate of Conformity

Product: Wi-Fi 6 + BT 5.1 M.2 1216 Module

Brand: Qualcomm

Test Model: QCNFA524

Sample Status: Engineering Sample

Applicant: Qualcomm Technologies, Inc.

Test Date: Feb. 12 ~ Feb. 26, 2020

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

ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.



Prepared by : _____, **Date:** Mar. 05, 2020
Lena Wang / Specialist



Approved by : _____, **Date:** Mar. 05, 2020
Dylan Chiou / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -14.55 dB at 0.16173 MHz.
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -7.13 dB at 33.78 MHz.
15.247(d)	Band Edge Measurement	N/A	Refer to Note
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
---	Occupied Bandwidth Measurement	N/A	Refer to Note
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

Note:

1. This is a partial report. Only test item of AC Power Conducted Emission, Maximum Peak Output Power and Radiated Emissions tests were performed for this report. Other testing data please refer to BV CPS report no.: RF190716E01-3 for module (Brand: Qualcomm, Model: QCNFA524)
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wi-Fi 6 + BT 5.1 M.2 1216 Module
Brand	Qualcomm
Test Model	QCNFA524
Status of EUT	Engineering Sample
Power Supply Rating	3.3 Vdc (host equipment)
Modulation Type	GFSK
Transfer Rate	LE 4.0: 1 Mbps LE 5.0: 2 Mbps
Operating Frequency	2402 ~ 2480 MHz
Number of Channel	40
Output Power	LE 4.0: 1.690 mW LE 5.0: 1.766 mW
Antenna Type	Refer to Note as below
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. The EUT is authorized for use in specific End-product. Please refer to below table for further details.

Product Name	Brand Name	Model	Description
Portable Computer	DELL	P91F	--

2. The antenna information is listed as below.

Color	Antenna Type	Antenna Mode	Manufacturer	Parts Number	Antenna Gain (dBi)			
					BT / WLAN 2.4 GHz	WLAN 5.15~5.35 GHz	WLAN 5.47~5.72 5 GHz	WLAN 5.725~5.8 5 GHz
Black	Slot	0	Speedwire	Main Antenna: F.0G.FH-6101-004-00 (DC33002CW3L) Aux. Antenna: F.0G.FH-6101-003-00 (DC33002CW2L)	Main: -3.46 Aux.: -2.31	Main: 2.38 Aux.: -2.47	Main: 0.35 Aux.: -3.33	Main: -2.01 Aux.: -3.24
		1			Main: -3.53 Aux.: -2.41	Main: 0.11 Aux.: -1.31	Main: -1.56 Aux.: -1.61	Main: -1.56 Aux.: -2.78
White	Slot	0	Speedwire	Main Antenna: F.0G.FH-6101-008-00 (DC33002CW7L) Aux. Antenna: F.0G.FH-6101-007-00 (DC33002CW6L)	Main: -2.78 Aux.: -1.56	Main: 2.77 Aux.: -1.86	Main: 1.32 Aux.: -2.68	Main: -1.36 Aux.: -2.68
		1			Main: -2.97 Aux.: -1.88	Main: 0.96 Aux.: -0.70	Main: -0.61 Aux.: -0.97	Main: -0.61 Aux.: -1.95
Black	Slot	0	Wistron Neweb Corporation	Main Antenna: 81ELAS15.G34 (DC33002CV3L) Aux. Antenna: 81ELAS15.G33 (DC33002CV2L)	Main: -3.46 Aux.: -2.31	Main: 2.38 Aux.: -2.47	Main: 2.21 Aux.: -3.33	Main: -2.01 Aux.: -3.24
		1			Main: -3.53 Aux.: -2.41	Main: 0.11 Aux.: -1.31	Main: -1.56 Aux.: -1.61	Main: -1.56 Aux.: -2.78
White	Slot	0	Wistron Neweb Corporation	Main Antenna: 81ELAS15.G69 (DC33002CV7L) Aux. Antenna: 81ELAS15.G70 (DC33002CV6L)	Main: -5.12 Aux.: -1.78	Main: -3.01 Aux.: 2.26	Main: -4.82 Aux.: -0.47	Main: -4.82 Aux.: -4.31
		1			Main: -2.47 Aux.: -1.69	Main: -0.61 Aux.: 0.91	Main: -4.87 Aux.: -2.96	Main: -5.17 Aux.: -5.07

3. The End-product contains following accessory devices.

Product	Brand	Model	Description
Adapter	DELL	HA130PM170	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 20Vdc, 6.5A or 5Vdc, 1A
Battery 1	DELL	8FCTC	11.4Vdc, 4650mAh, 56Wh
Battery 2	DELL	69KF2	11.4Vdc, 7167mAh, 86Wh

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.

3.2 Description of Test Modes

40 channels are provided to this EUT:

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

<LE 4.0>

EUT Configure Mode	Applicable To				Description
	RE \geq 1G	RE $<$ 1G	PLC	APCM	
-	✓	✓	✓	✓	-

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

Note: “-”means no effect.

Radiated Emission Test (Above 1 GHz):

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

Radiated Emission Test (Below 1 GHz):

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0	GFSK	1

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0	GFSK	1

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

<LE 5.0>

EUT Configure Mode	Applicable To				Description
	RE \geq 1G	RE $<$ 1G	PLC	APCM	
-	√	√	√	√	-

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

Note: “-”means no effect.

Radiated Emission Test (Above 1 GHz):

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2

Radiated Emission Test (Below 1 GHz):

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	19	GFSK	2

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	19	GFSK	2

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE \geq 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Jones Chang
APCM	25 deg. C, 65 % RH	11.4 Vdc	Wayne Lin

3.3 Description of Support Units

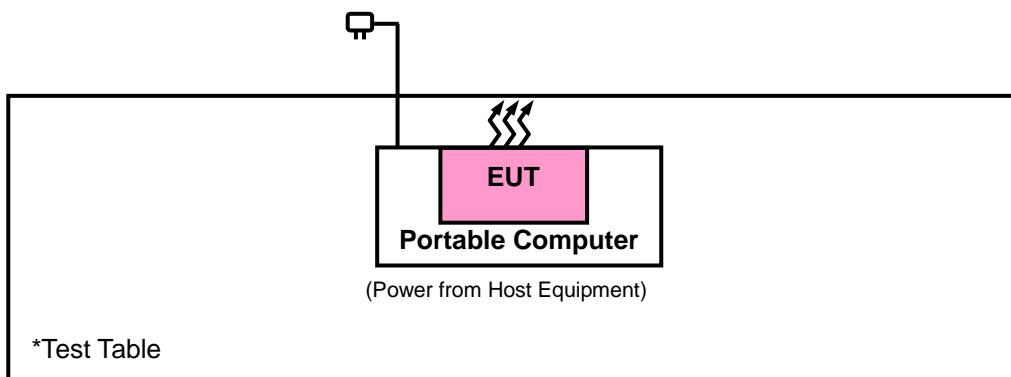
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Adapter	DELL	HA130PM170	NA	NA
2.	Portable Computer	DELL	P91F	NA	FCC DoC Approved

No.	Signal Cable Description Of The Above Support Units
1.	Type C cable: 0.85m

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item 1, 2 was provided by client

3.3.1 Configuration of System under Test


*Test Table

3.4 General Description of Applied Standards and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB_{uV/m}) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 26, 2019	Aug. 25, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 12, 2019	Nov. 11, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 24, 2019	Nov. 23, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 16, 2019	Sep. 15, 2020
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	83017A	MY39501357	Jun. 18, 2019	Jun. 17, 2020
Power Meter Anritsu	ML2495A	1012010	Sep. 04, 2019	Sep. 03, 2020
Power Meter Anritsu	MA2411B	1315050	Sep. 04, 2019	Sep. 03, 2020
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 18, 2019	Jun. 17, 2020
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 18, 2019	Jun. 17, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HsinTien Chamber 1.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

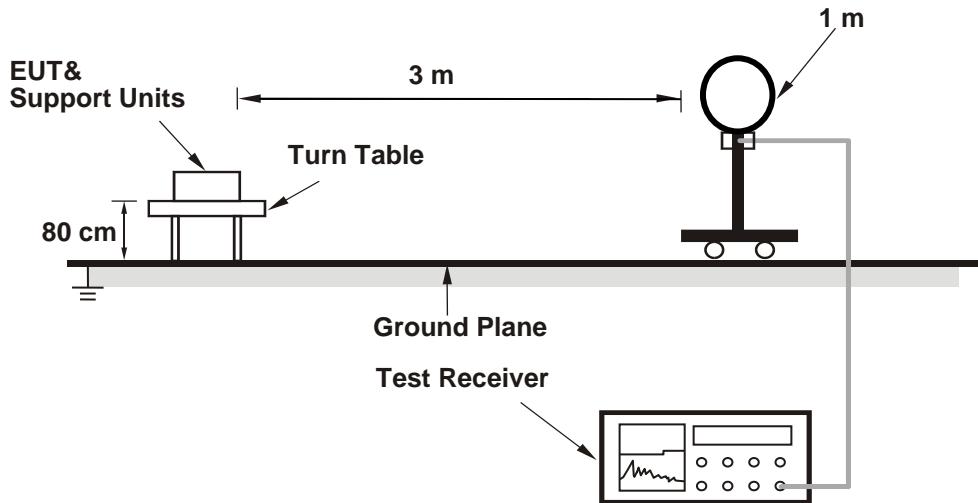
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK)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

4.1.4 Deviation from Test Standard

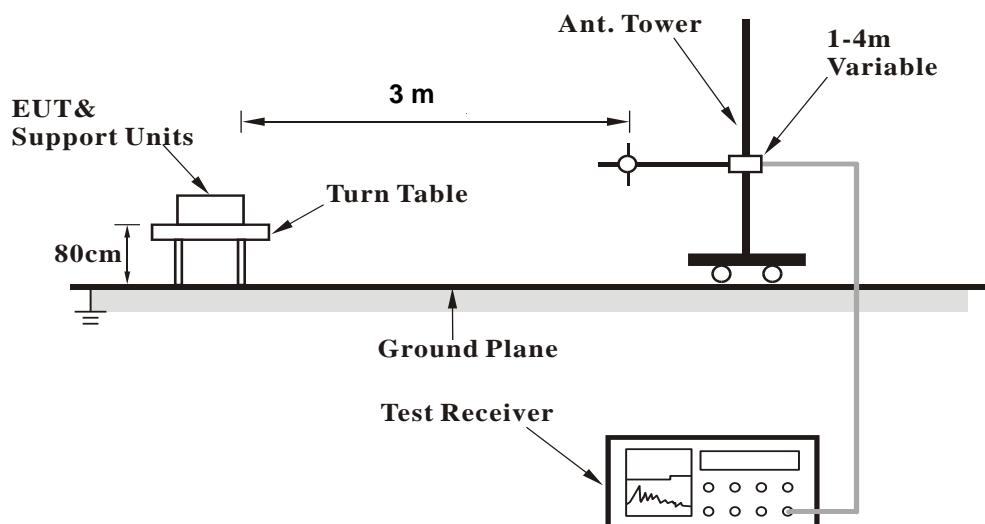
No deviation.

4.1.5 Test Set Up

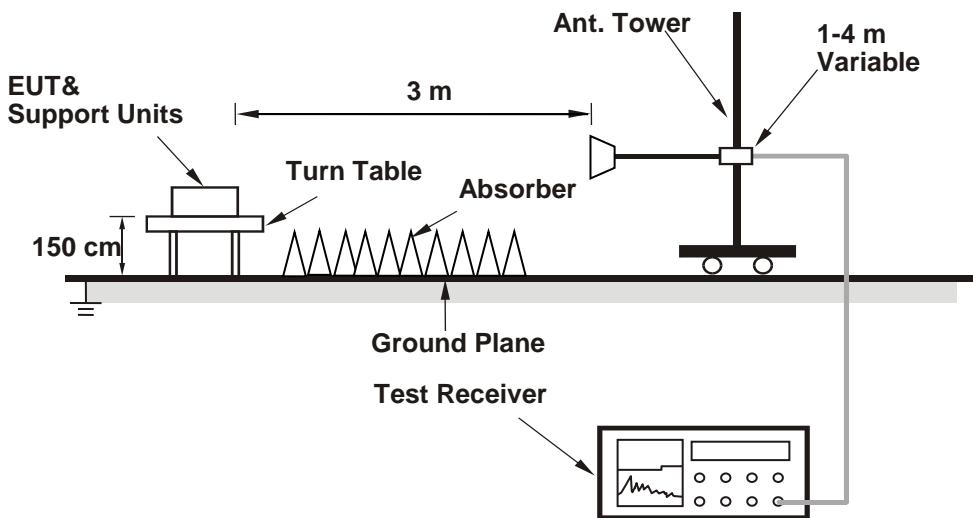
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data:

<LE 4.0>

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2377.95	41.11	36.64	4.47	54	-12.89	362	356	Average
2377.95	51.62	47.15	4.47	74	-22.38	362	356	Peak
2402	92.95	88.43	4.52			362	356	Average
2402	93.83	89.31	4.52			362	356	Peak
4804	42.75	32.4	10.35	54	-11.25	164	276	Average
4804	49.09	38.74	10.35	74	-24.91	164	276	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2354.1	41.24	36.84	4.4	54	-12.76	287	294	Average
2354.1	51.25	46.85	4.4	74	-22.75	287	294	Peak
2402	99.84	95.32	4.52			287	294	Average
2402	100.65	96.13	4.52			287	294	Peak
4804	41.83	31.48	10.35	54	-12.17	150	87	Average
4804	48.04	37.69	10.35	74	-25.96	150	87	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2402 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2385.06	41.1	36.63	4.47	54	-12.9	362	356	Average
2385.06	51.39	46.92	4.47	74	-22.61	362	356	Peak
2440	92.68	88.09	4.59			362	356	Average
2440	93.62	89.03	4.59			362	356	Peak
2496.88	40.5	35.83	4.67	54	-13.5	362	356	Average
2496.88	51.38	46.71	4.67	74	-22.62	362	356	Peak
4880	41.17	30.96	10.21	54	-12.83	136	107	Average
4880	47.58	37.37	10.21	74	-26.42	136	107	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2343.93	42.61	38.23	4.38	54	-11.39	287	294	Average
2343.93	51.74	47.36	4.38	74	-22.26	287	294	Peak
2440	99.33	94.74	4.59			287	294	Average
2440	100.3	95.71	4.59			287	294	Peak
2487.76	42.02	37.34	4.68	54	-11.98	287	294	Average
2487.76	52.01	47.33	4.68	74	-21.99	287	294	Peak
4880	41.58	31.37	10.21	54	-12.42	174	206	Average
4880	47.95	37.74	10.21	74	-26.05	174	206	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2440 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	92.21	87.57	4.64			362	356	Average
2480	93.15	88.51	4.64			362	356	Peak
2484.76	41.63	36.97	4.66	54	-12.37	362	356	Average
2484.76	51.27	46.61	4.66	74	-22.73	362	356	Peak
4960	41.57	31.21	10.36	54	-12.43	105	49	Average
4960	47.75	37.39	10.36	74	-26.25	105	49	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	99.08	94.44	4.64			287	294	Average
2480	99.98	95.34	4.64			287	294	Peak
2483.52	41.53	36.87	4.66	54	-12.47	287	294	Average
2483.52	51.54	46.88	4.66	74	-22.46	287	294	Peak
4960	42.31	31.95	10.36	54	-11.69	146	270	Average
4960	48.3	37.94	10.36	74	-25.7	146	270	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2480 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

<LE 5.0>

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.23	41.74	37.25	4.49	54	-12.26	362	356	Average
2386.23	50.82	46.33	4.49	74	-23.18	362	356	Peak
2402	90.3	85.78	4.52			362	356	Average
2402	92.98	88.46	4.52			362	356	Peak
4805	42.54	32.19	10.35	54	-11.46	128	325	Average
4805	48.66	38.31	10.35	74	-25.34	128	325	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.7	41.89	37.42	4.47	54	-12.11	287	294	Average
2384.7	51.5	47.03	4.47	74	-22.5	287	294	Peak
2402	98.08	93.56	4.52			287	294	Average
2402	100.62	96.1	4.52			287	294	Peak
4804	41.97	31.62	10.35	54	-12.03	178	129	Average
4804	48.28	37.93	10.35	74	-25.72	178	129	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2402 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.52	41.66	37.19	4.47	54	-12.34	362	356	Average
2384.52	51.53	47.06	4.47	74	-22.47	362	356	Peak
2440	90.3	85.71	4.59			362	356	Average
2440	92.6	88.01	4.59			362	356	Peak
2494.76	41.3	36.63	4.67	54	-12.7	362	356	Average
2494.76	51.34	46.67	4.67	74	-22.66	362	356	Peak
4880	41.18	30.97	10.21	54	-12.82	169	335	Average
4880	47.27	37.06	10.21	74	-26.73	169	335	Peak

Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2344.02	43.51	39.13	4.38	54	-10.49	287	294	Average
2344.02	51.15	46.77	4.38	74	-22.85	287	294	Peak
2440	97.51	92.92	4.59			287	294	Average
2440	100.26	95.67	4.59			287	294	Peak
2487.64	41.67	36.99	4.68	54	-12.33	287	294	Average
2487.64	51.52	46.84	4.68	74	-22.48	287	294	Peak
4880	41.57	31.36	10.21	54	-12.43	162	119	Average
4880	48.03	37.82	10.21	74	-25.97	162	119	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2440 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	89.35	84.71	4.64			362	356	Average
2480	91.58	86.94	4.64			362	356	Peak
2486.8	41.45	36.79	4.66	54	-12.55	362	356	Average
2486.8	52.22	47.56	4.66	74	-21.78	362	356	Peak
4960	41.36	31	10.36	54	-12.64	153	108	Average
4960	47.65	37.29	10.36	74	-26.35	153	108	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	94.53	89.89	4.64			287	294	Average
2480	99.71	95.07	4.64			287	294	Peak
2484.4	42.45	37.79	4.66	54	-11.55	287	294	Average
2484.4	51.53	46.87	4.66	74	-22.47	287	294	Peak
4960	42.04	31.68	10.36	54	-11.96	184	277	Average
4960	48.59	38.23	10.36	74	-25.41	184	277	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. 2480 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

9 kHz ~ 30 MHz Data:

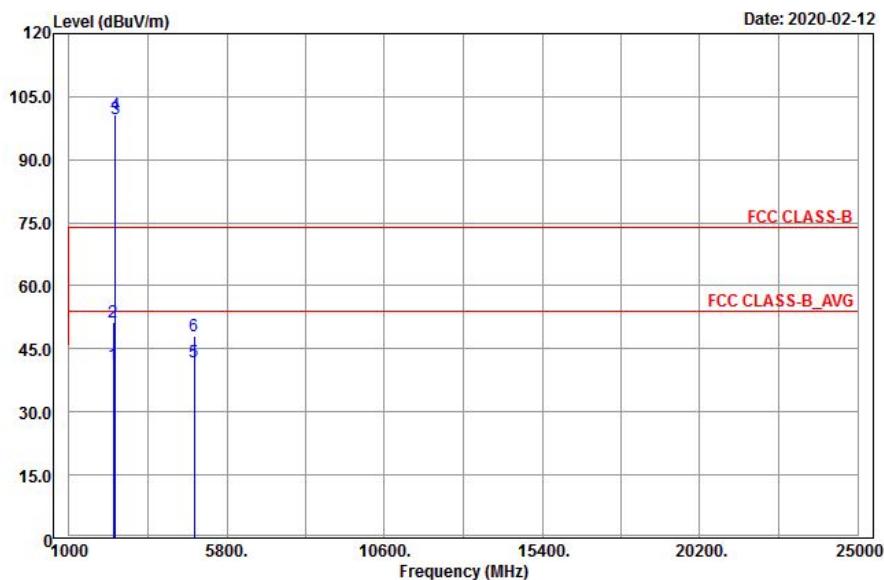
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

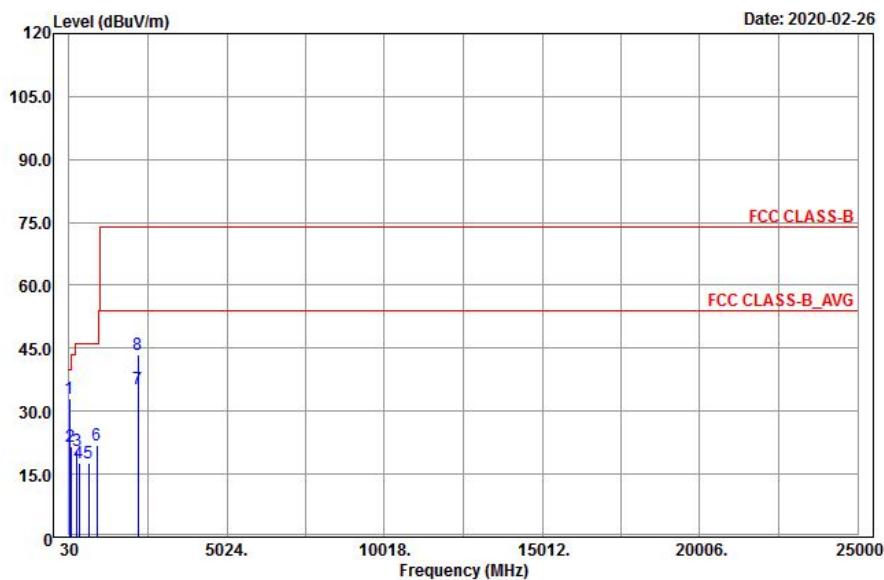
<LE 4.0>

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
162.84	26.14	48.03	-21.89	43.5	-17.36	148	16	Peak
263.01	27.05	44.69	-17.64	46	-18.95	117	145	Peak
285.96	28.26	45.55	-17.29	46	-17.74	158	57	Peak
330.1	23.34	39.46	-16.12	46	-22.66	134	330	Peak
354.6	20.78	36.39	-15.61	46	-25.22	152	22	Peak
897.1	22.6	29.17	-6.57	46	-23.4	105	104	Peak
2284	35.85	34.18	1.67	54	-18.15	122	326	Average
2284	43.54	41.87	1.67	74	-30.46	122	326	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
33.78	32.87	52.54	-19.67	40	-7.13	138	85	Peak
85.08	21.71	43.37	-21.66	40	-18.29	119	197	Peak
280.02	20.59	37.94	-17.35	46	-25.41	124	203	Peak
334.3	17.77	33.75	-15.98	46	-28.23	145	178	Peak
638.1	17.69	28.65	-10.96	46	-28.31	125	255	Peak
904.1	21.76	28.2	-6.44	46	-24.24	180	187	Peak
2212	35.25	33.78	1.47	54	-18.75	154	153	Average
2212	43.43	41.96	1.47	74	-30.57	154	153	Peak

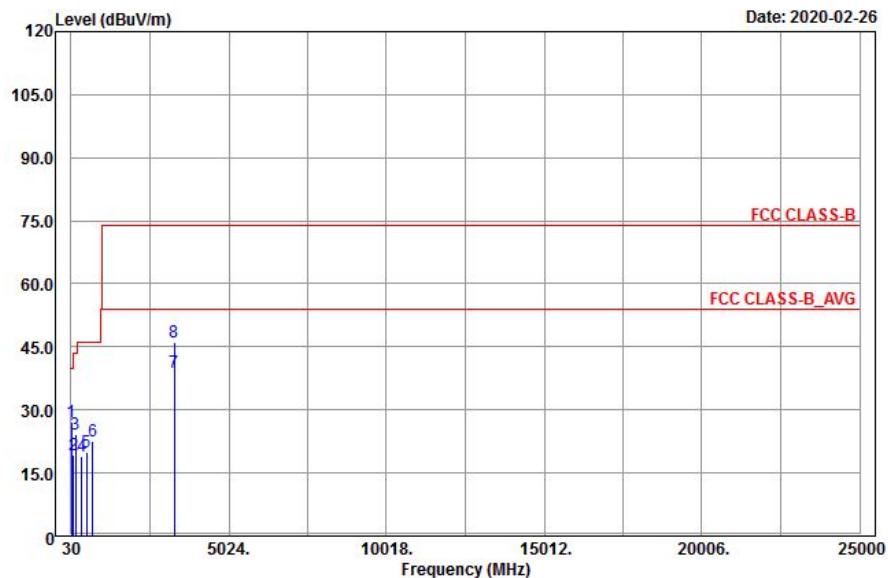
Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. The emission levels of other frequencies were very low against the limit.

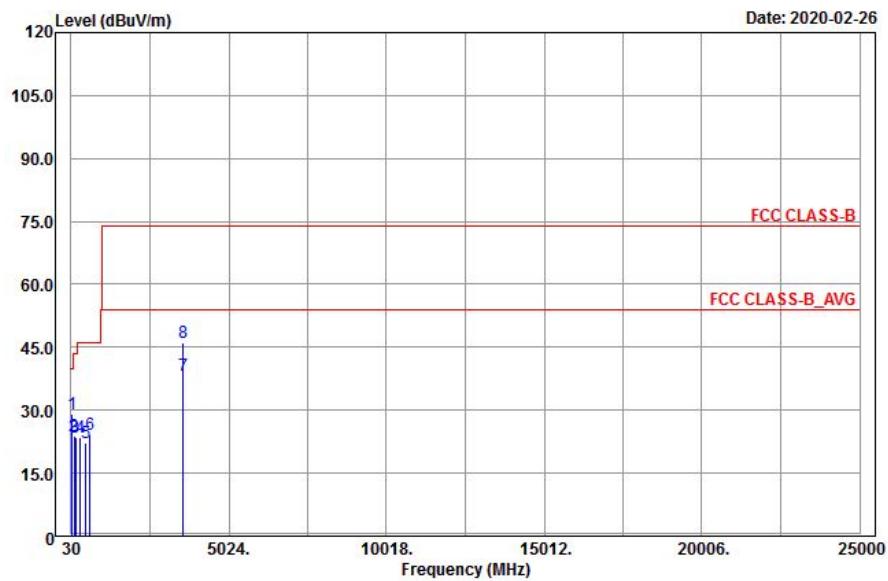
<LE 5.0>

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
39.45	27.19	45.27	-18.08	40	-12.81	142	154	Peak
104.79	19.4	37.96	-18.56	43.5	-24.1	114	187	Peak
176.61	24.26	45.39	-21.13	43.5	-19.24	102	132	Peak
365.8	18.84	34.28	-15.44	46	-27.16	185	196	Peak
507.9	19.81	32.83	-13.02	46	-26.19	175	188	Peak
713	22.52	32.09	-9.57	46	-23.48	166	157	Peak
3298	38.94	34.57	4.37	54	-15.06	142	157	Average
3298	46.21	41.84	4.37	74	-27.79	142	157	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
60.78	29.02	47.24	-18.22	40	-10.98	166	198	Peak
123.42	23.98	45.05	-21.07	43.5	-19.52	158	176	Peak
172.29	23.58	45.04	-21.46	43.5	-19.92	102	30	Peak
332.9	23.48	39.52	-16.04	46	-22.52	155	169	Peak
486.9	22.26	35.57	-13.31	46	-23.74	148	157	Peak
623.4	24.34	35.42	-11.08	46	-21.66	101	121	Peak
3574	38.41	33.52	4.89	54	-15.59	104	154	Average
3574	46.02	41.13	4.89	74	-27.98	104	154	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. The emission levels of other frequencies were very low against the limit.

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

Note: 1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_V7.3.7.4	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-12040.

4.2.3 Test Procedures

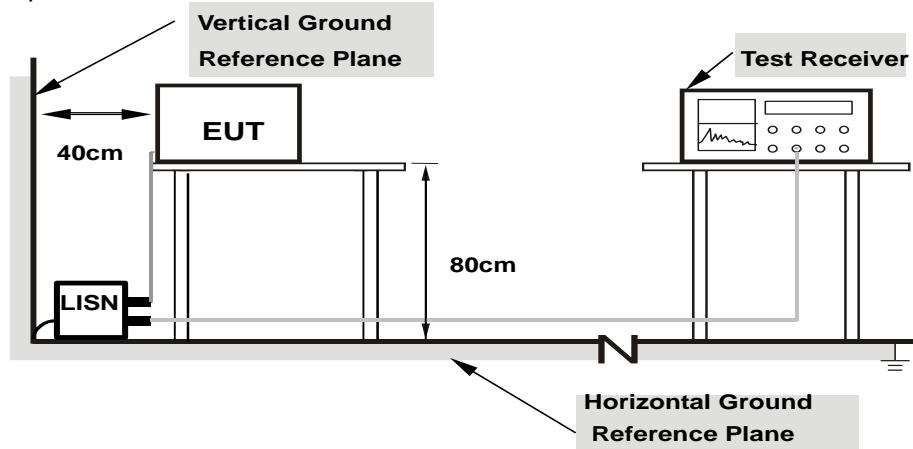
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note:

1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

4.2.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Set the EUT under transmission condition continuously at specific channel frequency.

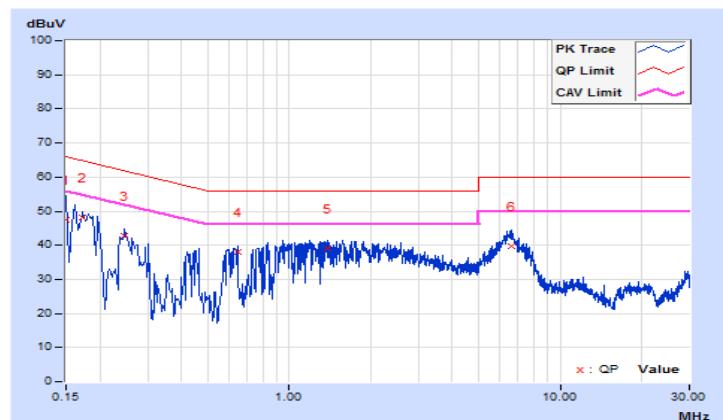
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 75%RH
Tested by	Jones Chang	Test Date	2020/2/26

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.63	37.99	17.27	47.62	26.90	66.00	56.00	-18.38	-29.10
2	0.17328	9.63	38.65	29.58	48.28	39.21	64.80	54.80	-16.52	-15.59
3	0.24775	9.63	32.98	20.90	42.61	30.53	61.83	51.83	-19.22	-21.30
4	0.64657	9.66	28.49	15.43	38.15	25.09	56.00	46.00	-17.85	-20.91
5	1.38947	9.70	29.34	18.09	39.04	27.79	56.00	46.00	-16.96	-18.21
6	6.57413	9.82	30.01	23.97	39.83	33.79	60.00	50.00	-20.17	-16.21

Remarks:

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

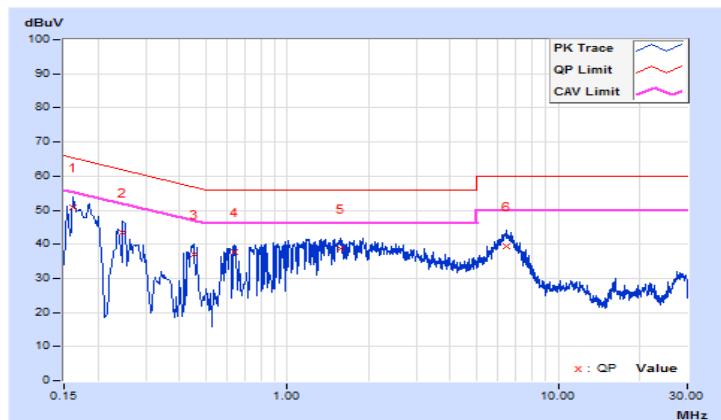


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 75%RH
Tested by	Jones Chang	Test Date	2020/2/26

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	0.16173	9.66	41.16	28.85	50.82	38.51	65.37	55.37	-14.55	-16.86
2	0.24775	9.65	33.95	21.84	43.60	31.49	61.83	51.83	-18.23	-20.34
3	0.45097	9.67	27.45	13.36	37.12	23.03	56.86	46.86	-19.74	-23.83
4	0.63520	9.68	27.87	12.56	37.55	22.24	56.00	46.00	-18.45	-23.76
5	1.58068	9.73	29.03	18.02	38.76	27.75	56.00	46.00	-17.24	-18.25
6	6.48420	9.86	29.63	23.83	39.49	33.69	60.00	50.00	-20.51	-16.31

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

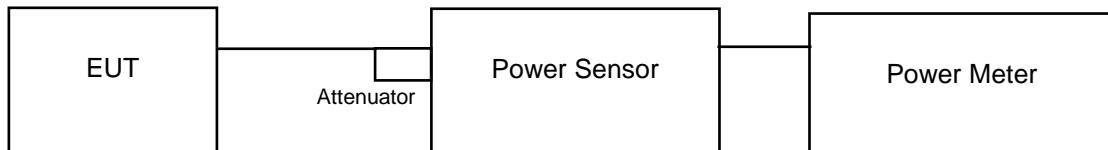


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

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

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

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

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

4.3.5 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

Peak Power

<LE 4.0>

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	1.714	2.34	30	Pass
19	2440	1.690	2.28	30	Pass
39	2480	1.538	1.87	30	Pass

<LE 5.0>

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	1.766	2.47	30	Pass
19	2440	1.714	2.34	30	Pass
39	2480	1.596	2.03	30	Pass

Average Power

<LE 4.0>

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	1.409	1.49	30	Pass
19	2440	1.393	1.44	30	Pass
39	2480	1.291	1.11	30	Pass

<LE 5.0>

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	1.380	1.40	30	Pass
19	2440	1.361	1.34	30	Pass
39	2480	1.256	0.99	30	Pass

5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

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

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232
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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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