Partial FCC Test Report

Report No.:	RF200109C11-3
FCC ID:	J9C-QCNFA524
Test Model:	QCNFA524
Received Date:	Oct. 21, 2019
Test Date:	Dec. 26, 2019 ~ Feb. 26, 2020
Issued Date:	Feb. 27, 2020
Applicant:	Qualcomm Technologies, Inc.
Address:	5775 Morehouse Drive, San Diego, CA 92121-1714
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RF200109C11-3	Original release	Feb. 27, 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:	Dec. 26, 2019 ~ Feb. 26, 2020
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

This report is issued as a supplementary report of RF190716E01-3. This report shall be used combined together with its original report.

Prepared by : _____ , **Date:** Feb. 27, 2020

Polly Chien / Specialist

Approved by : _____ , **Date:** Feb. 27, 2020

Bruce Chen / Senior Project Engineer

Note: Radiated emission, conducted emission and Maximum Peak Output Power are performed for the addendum. Refer to original report for the other test data.

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 -7.96dB at 0.17698MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -4.9dB at 66.86MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6dB bandwidth	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	Pass	Antenna connector is I-PEX NGFF not a standard connector.

*Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
Note: Radiated emission, conducted emission and Maximum Peak Output Power are performed for the addendum. Refer to original report for the other test data.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wi-Fi 6 + BT 5.1 M.2 1216 Module
Brand	Qualcomm
Test Model	QCNFA524
Status of EUT	Engineering Sample
Power Supply Rating	3.3Vdc (from host equipment)
Modulation Type	GFSK
Transfer Rate	Up to 2Mbps
Operating Frequency	2402~2480MHz
Number of Channel	40
Output Power	LE 1M: 3.119mW LE 2M: 3.334mW
Antenna Type	Refer to Note
Antenna Connector	I-PEX NGFF
Accessory Device	NA
Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. This is a supplementary report of RF190716E01-3. The difference compared with original report is adding End-product (Portable Computer, Brand: DELL, Model: P92F). Therefore, test item of Radiated emission, conducted emission and Conducted power were performed for this addendum. Refer to original report for the other test data.
2. The following antennas were provided to the EUT.

Main Antenna Model	Aux. Antenna Model	Type	Antenna Manufacturer	Maximum Gain (dBi)			
				2.400-2.500 GHz	5.150-5.350 GHz	5.470-5.725 GHz	5.725-5.850 GHz
025.901LS.0021 (F.0G.FS-6086-001-00)	025.901LT.0021 (F.0G.FS-6086-002-00)	Slot	Speed	1.36	0.31	1.57	1.56
025.901LS.0001 (81ELAS15.G41)	025.901LT.0001 (81ELAS15.G42)	Slot	Wistron Neweb Corporation	1.38	0.35	1.62	1.69

*For Bluetooth was fixed on Aux. antenna

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

Product Name	Brand Name	Model No.	Description
Portable Computer	DELL	P92F	-

The following accessories were for the End-product.

Product Name	Brand Name	Model No.	Description
Battery	DELL	XG4K6	Rating: 11.4Vdc, 8071mAh
Adapter	DELL	HA130PM170	I/P: 100-240Vac, 1.8A, 50-60 Hz, O/P: 5Vdc / 20Vdc / 1A / 6.5A 1.8m cable without core attached on adapter

3.2 Description of Test Modes

40 channels are provided for EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	Power	
-	√	√	√	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
Power: Maximum Output Power Measurement

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

Radiated Emission Test (Above 1GHz):

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)	Remark
-	0 to 39	0, 19, 39	GFSK	1, 2	-

Radiated Emission Test (Below 1GHz):

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

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

Maximum Output Power Measurement:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)	Remark
-	0 to 39	0, 19, 39	GFSK	1, 2	-

Test Condition:

Applicable to	Environmental Conditions	Input Power (system)	Tested by
RE≥1G	22deg. C, 66%RH	120Vac, 60Hz	Greg Lin
RE<1G	22deg. C, 66%RH	120Vac, 60Hz	Han Wu
PLC	25deg. C, 75%RH	120Vac, 60Hz	Greg Lin
Power	25deg. C, 60%RH	120Vac, 60Hz	Jisyong Wang

3.3 Description of Support Units

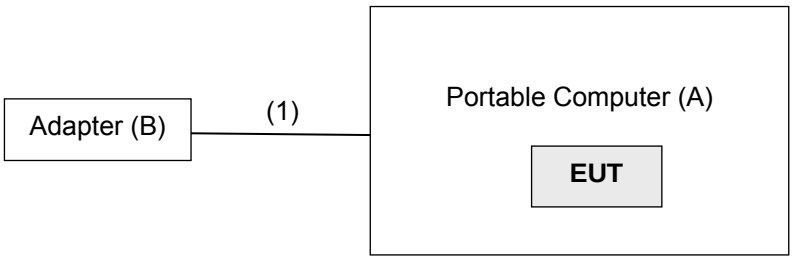
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Portable Computer	DELL	P92F	NA	FCC DoC Approved	-
B.	Adapter	DELL	HA130PM170	NA	NA	-

Note: 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.	Power cable	1	1.8	-	0	Provided by manufacturer

3.3.1 Configuration of System under Test



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 20dB below the highest level of the desired power:

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

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jun. 04, 2019	Jun. 03, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 07, 2019	Nov. 06, 2020
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Loop Antenna TESEQ	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jul. 11, 2019	Jul. 10, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 19, 2019	Feb. 18, 2020
			Feb. 18, 2020	Feb. 17, 2021
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 19, 2019	Jan. 18, 2020
			Jan. 18, 2020	Jan. 17, 2021
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jul. 11, 2019	Jul. 10, 2020
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 30, 2019	Jul. 29, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 15, 2019	Jul. 14, 2020

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.

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:

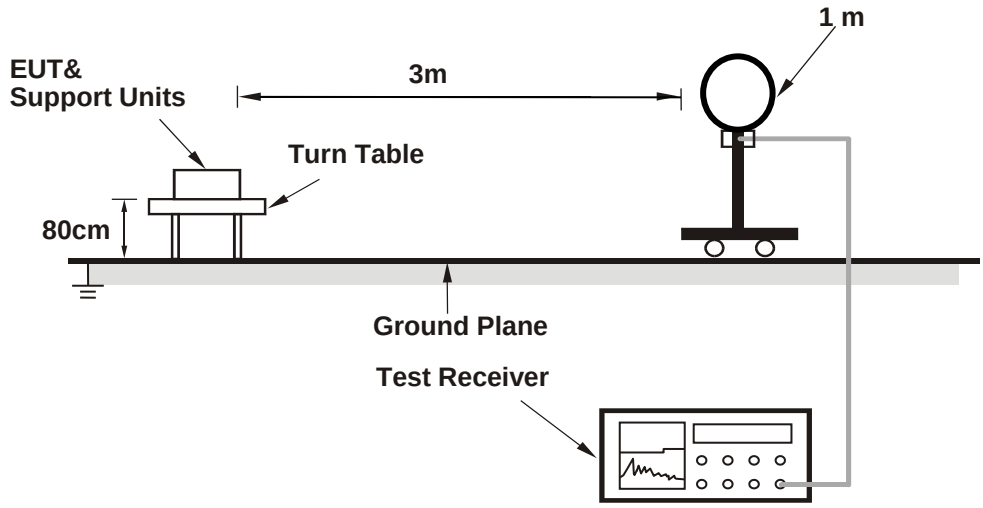
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

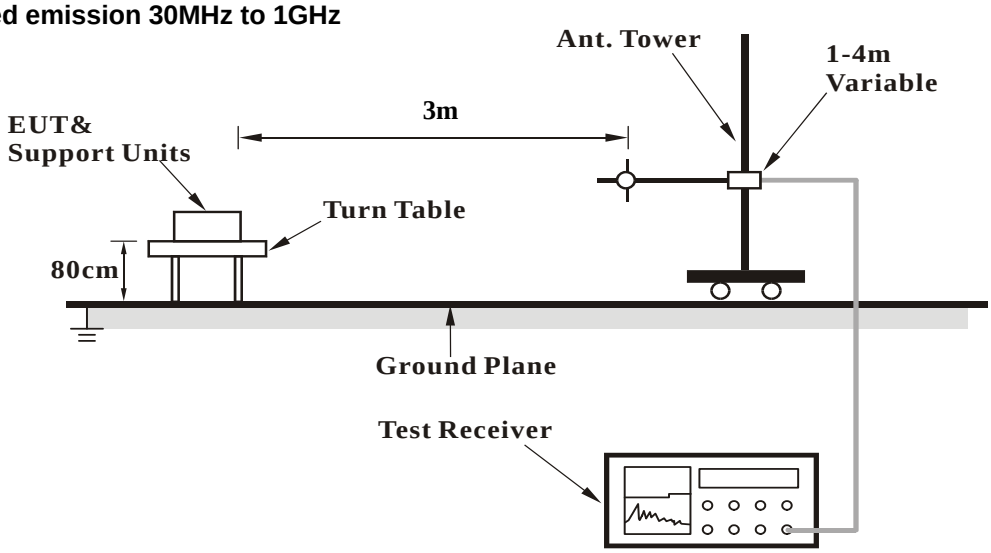
No deviation.

4.1.5 Test Setup

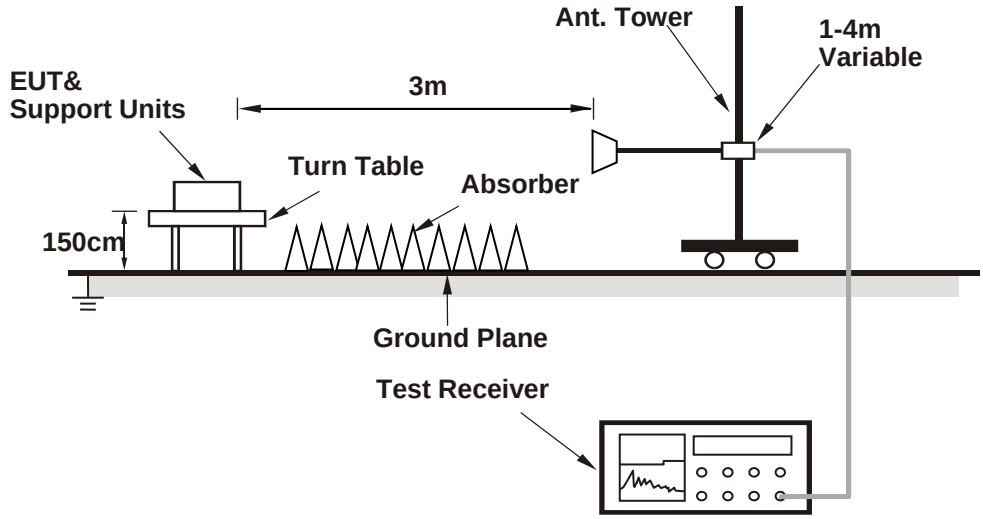
For Radiated emission below 30MHz



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

a. Installed the EUT into the Portable Computer which is placed on the testing table.
b. Controlling software (provided by manufacturer) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz data:

LE 1M:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.3 PK	74.0	-17.7	2.56 H	294	24.4	31.9
2	2390.00	44.5 AV	54.0	-9.5	2.56 H	294	12.6	31.9
3	*2402.00	89.5 PK			2.47 H	305	57.7	31.8
4	*2402.00	84.7 AV			2.47 H	305	52.9	31.8
5	4804.00	44.2 PK	74.0	-29.8	1.62 H	221	40.3	3.9
6	4804.00	30.1 AV	54.0	-23.9	1.62 H	221	26.2	3.9
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	2390.00	56.5 PK	74.0	-17.5	2.41 V	282	24.6	31.9
2	2390.00	45.1 AV	54.0	-8.9	2.41 V	282	13.2	31.9
3	*2402.00	99.1 PK			2.50 V	291	67.3	31.8
4	*2402.00	94.3 AV			2.50 V	291	62.5	31.8
5	4804.00	44.7 PK	74.0	-29.3	1.93 V	356	40.8	3.9
6	4804.00	30.5 AV	54.0	-23.5	1.93 V	356	26.6	3.9

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
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	89.0 PK			2.53 H	296	57.1	31.9
2	*2440.00	84.1 AV			2.53 H	296	52.2	31.9
3	4880.00	44.4 PK	74.0	-29.6	1.62 H	229	40.6	3.8
4	4880.00	30.1 AV	54.0	-23.9	1.62 H	229	26.3	3.8
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	*2440.00	98.5 PK			2.65 V	297	66.6	31.9
2	*2440.00	93.6 AV			2.65 V	297	61.7	31.9
3	4880.00	44.7 PK	74.0	-29.3	2.07 V	336	40.9	3.8
4	4880.00	30.5 AV	54.0	-23.5	2.07 V	336	26.7	3.8

Remarks:

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	90.5 PK			2.46 H	307	58.6	31.9
2	*2480.00	85.6 AV			2.46 H	307	53.7	31.9
3	2483.50	56.4 PK	74.0	-17.6	2.34 H	297	24.4	32.0
4	2483.50	44.6 AV	54.0	-9.4	2.34 H	297	12.6	32.0
5	4960.00	44.9 PK	74.0	-29.1	1.51 H	227	40.8	4.1
6	4960.00	30.8 AV	54.0	-23.2	1.51 H	227	26.7	4.1
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	*2480.00	100.0 PK			2.75 V	288	68.1	31.9
2	*2480.00	95.1 AV			2.75 V	288	63.2	31.9
3	2483.50	60.2 PK	74.0	-13.8	2.61 V	279	28.2	32.0
4	2483.50	47.1 AV	54.0	-6.9	2.61 V	279	15.1	32.0
5	4960.00	45.5 PK	74.0	-28.5	2.03 V	352	41.4	4.1
6	4960.00	31.4 AV	54.0	-22.6	2.03 V	352	27.3	4.1

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
5. " * ": Fundamental frequency.

LE 2M:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.2 PK	74.0	-17.8	2.42 H	294	24.3	31.9
2	2390.00	45.3 AV	54.0	-8.7	2.42 H	294	13.4	31.9
3	*2402.00	89.4 PK			2.57 H	303	57.6	31.8
4	*2402.00	72.6 AV			2.57 H	303	40.8	31.8
5	4804.00	44.3 PK	74.0	-29.7	1.55 H	237	40.4	3.9
6	4804.00	30.1 AV	54.0	-23.9	1.55 H	237	26.2	3.9
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	2390.00	56.4 PK	74.0	-17.6	2.43 V	276	24.5	31.9
2	2390.00	46.5 AV	54.0	-7.5	2.43 V	276	14.6	31.9
3	*2402.00	99.0 PK			2.51 V	289	67.2	31.8
4	*2402.00	82.2 AV			2.51 V	289	50.4	31.8
5	4804.00	44.7 PK	74.0	-29.3	1.94 V	332	40.8	3.9
6	4804.00	30.6 AV	54.0	-23.4	1.94 V	332	26.7	3.9

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
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	89.0 PK			2.49 H	293	57.1	31.9
2	*2440.00	72.3 AV			2.49 H	293	40.4	31.9
3	4880.00	44.3 PK	74.0	-29.7	1.69 H	245	40.5	3.8
4	4880.00	30.1 AV	54.0	-23.9	1.69 H	245	26.3	3.8
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	*2440.00	98.3 PK			2.68 V	294	66.4	31.9
2	*2440.00	81.6 AV			2.68 V	294	49.7	31.9
3	4880.00	44.7 PK	74.0	-29.3	1.99 V	348	40.9	3.8
4	4880.00	30.5 AV	54.0	-23.5	1.99 V	348	26.7	3.8

Remarks:

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	89.8 PK			2.48 H	306	57.9	31.9
2	*2480.00	73.1 AV			2.48 H	306	41.2	31.9
3	2483.50	56.6 PK	74.0	-17.4	2.38 H	295	24.6	32.0
4	2483.50	45.4 AV	54.0	-8.6	2.38 H	295	13.4	32.0
5	4960.00	44.4 PK	74.0	-29.6	1.64 H	236	40.3	4.1
6	4960.00	30.2 AV	54.0	-23.8	1.64 H	236	26.1	4.1
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	*2480.00	99.1 PK			2.69 V	293	67.2	31.9
2	*2480.00	82.4 AV			2.69 V	293	50.5	31.9
3	2483.50	57.3 PK	74.0	-16.7	2.62 V	283	25.3	32.0
4	2483.50	48.3 AV	54.0	-5.7	2.62 V	283	16.3	32.0
5	4960.00	44.8 PK	74.0	-29.2	1.97 V	336	40.7	4.1
6	4960.00	30.8 AV	54.0	-23.2	1.97 V	336	26.7	4.1

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
5. " * ": Fundamental frequency.

Below 1GHz worst-case data:

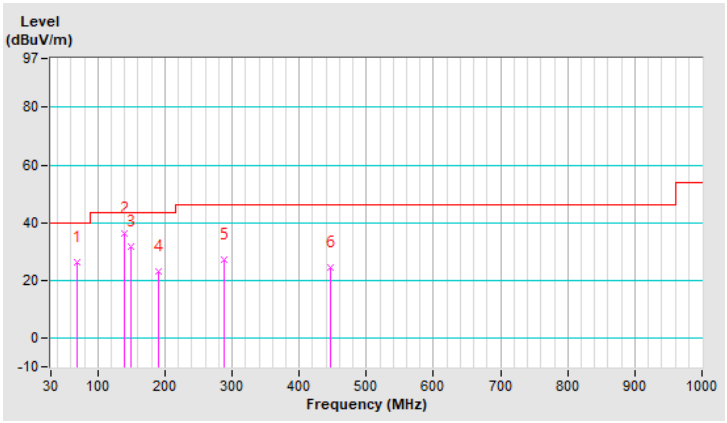
LE 2M

FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
CHANNEL	TX Channel 19		

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	69.77	26.2 QP	40.0	-13.8	1.00 H	281	37.7	-11.5
2	139.61	36.3 QP	43.5	-7.2	1.00 H	82	46.2	-9.9
3	149.31	31.9 QP	43.5	-11.6	1.00 H	99	41.1	-9.2
4	190.05	23.0 QP	43.5	-20.5	1.00 H	98	34.8	-11.8
5	288.02	27.0 QP	46.0	-19.0	1.00 H	285	35.2	-8.2
6	446.13	24.4 QP	46.0	-21.6	1.00 H	167	28.9	-4.5

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 of frequency range 30MHz~1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20dB below the permissible value to be report.

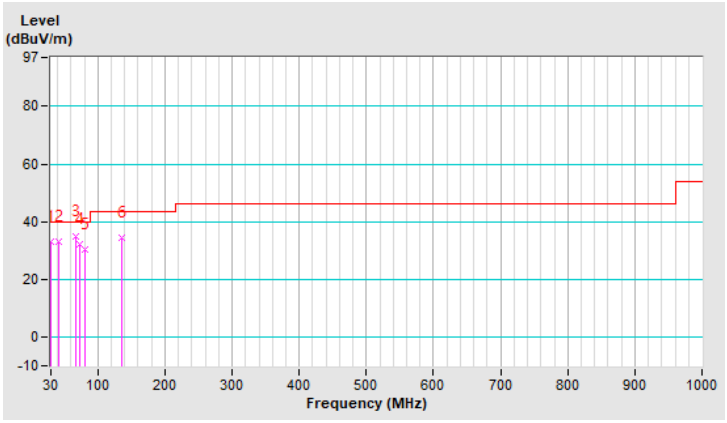


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
CHANNEL	TX Channel 19		

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	30.97	33.2 QP	40.0	-6.8	1.00 V	350	45.0	-11.8
2	42.61	33.1 QP	40.0	-6.9	1.00 V	358	43.3	-10.2
3	**66.86**	**35.1 QP**	**40.0**	**-4.9**	**1.00 V**	**102**	**46.0**	**-10.9**
4	73.65	32.0 QP	40.0	-8.0	1.00 V	358	44.4	-12.4
5	80.44	30.5 QP	40.0	-9.5	1.00 V	159	44.4	-13.9
6	134.76	34.5 QP	43.5	-9.0	1.00 V	193	44.8	-10.3

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 of frequency range 30MHz~1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20dB 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

Tested date: Jan. 04, 2020

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. 21, 2019	Feb. 20, 2020
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

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

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

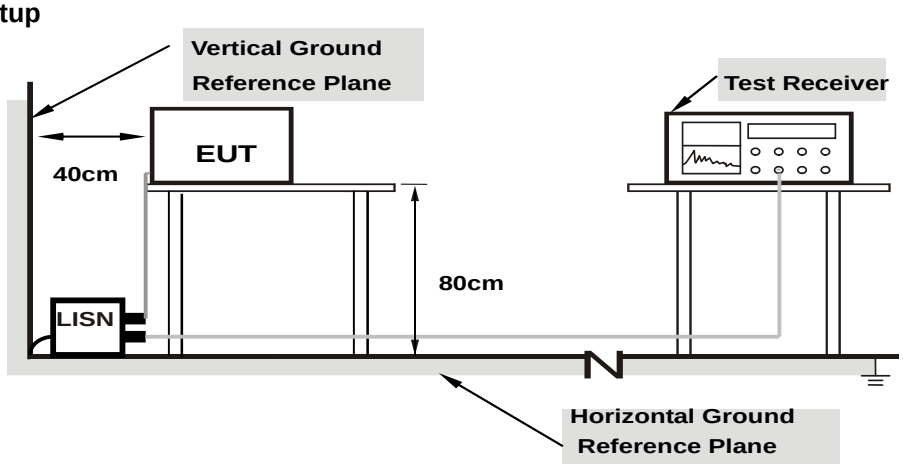
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

Worst-case data:

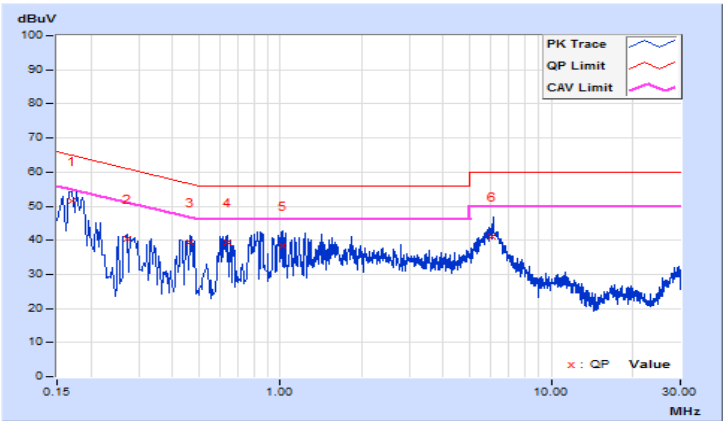
LE 2M

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 19		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	9.64	41.78	33.63	51.42	43.27	64.98	54.98	-13.56	-11.71
2	0.27120	9.65	30.60	19.83	40.25	29.48	61.08	51.08	-20.83	-21.60
3	0.46669	9.66	29.76	17.20	39.42	26.86	56.57	46.57	-17.15	-19.71
4	0.63484	9.68	29.75	17.16	39.43	26.84	56.00	46.00	-16.57	-19.16
5	1.01799	9.70	28.71	17.64	38.41	27.34	56.00	46.00	-17.59	-18.66
6	6.02282	9.83	31.25	25.75	41.08	35.58	60.00	50.00	-18.92	-14.42

Remarks:

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

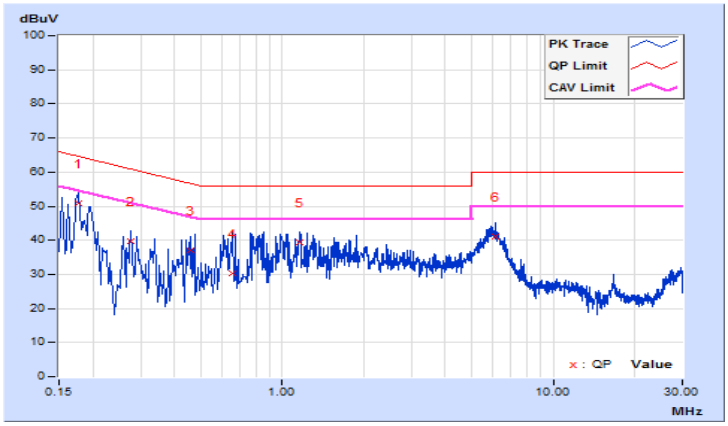


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 19		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.17698**	**9.64**	**41.04**	**37.03**	**50.68**	**46.67**	**64.63**	**54.63**	**-13.95**	**-7.96**
2	0.27512	9.65	29.99	17.05	39.64	26.70	60.96	50.96	-21.32	-24.26
3	0.45889	9.66	27.27	11.18	36.93	20.84	56.71	46.71	-19.78	-25.87
4	0.65830	9.67	20.50	8.94	30.17	18.61	56.00	46.00	-25.83	-27.39
5	1.16660	9.70	29.82	17.22	39.52	26.92	56.00	46.00	-16.48	-19.08
6	6.11275	9.84	31.09	24.78	40.93	34.62	60.00	50.00	-19.07	-15.38

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.

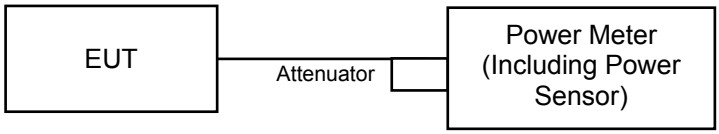


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

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

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

For Peak Power
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.

For Average Power
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

For Peak Power

1M

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	3.206	5.06	30	Pass
19	2440	**3.199**	5.05	30	Pass
39	2480	3.027	4.81	30	Pass

2M

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	3.289	5.17	30	Pass
19	2440	**3.334**	5.23	30	Pass
39	2480	3.184	5.03	30	Pass

For Average Power

1M

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.944	4.69
19	2440	3.062	4.86
39	2480	2.897	4.62

2M

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.931	4.67
19	2440	3.034	4.82
39	2480	2.891	4.61

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 and approved according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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