

## FCC Test Report

**Report No.:** RF180918C26-1

**FCC ID:** 2AAWQ-CAPRICA5

**Test Model:** Caprica5

**Received Date:** Sep. 18, 2018

**Test Date:** Jul. 16 ~ Oct. 03, 2019

**Issued Date:** Oct. 18, 2019

**Applicant:** Phorus, Inc.

**Address:** 5220 Las Virgenes Road Calabasas California United States 91302

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Lin Kou Laboratories

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**Test Location:** B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan

**FCC Registration /  
Designation Number:** 427177 / TW0011



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### Release Control Record

Issue No.	Description	Date Issued
RF180918C26-1	Original Release	Oct. 18, 2019

## 1 Certificate of Conformity

**Product:** Wireless module

**Brand:** XPERI

**Test Model:** Caprica5

**Sample Status:** Engineering Sample

**Applicant:** Phorus, Inc.

**Test Date:** Jul. 16 ~ Oct. 03, 2019

**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 :** Gina Liu, **Date:** Oct. 18, 2019  
Gina Liu / Specialist

**Approved by :** Dylan Chiou, **Date:** Oct. 18, 2019  
Dylan Chiou / 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 -13.32 dB at 0.15391 MHz.
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -4.03 dB at 331.5 MHz.
15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Reference only
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note: 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) ( $\pm$ )
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 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

<b>Product</b>	Wireless module
<b>Brand</b>	XPERI
<b>Test Model</b>	Caprica5
<b>Status of EUT</b>	Engineering Sample
<b>Power Supply Rating</b>	18 Vdc (adapter) 3.3 Vdc (Host equipment)
<b>Modulation Type</b>	GFSK
<b>Transfer Rate</b>	1 Mbps
<b>Operating Frequency</b>	2402 ~ 2480 MHz
<b>Number of Channel</b>	40
<b>Output Power</b>	2.924 mW
<b>Antenna Type</b>	PIFA antenna with 4.8 dBi gain / Dipole antenna with 5 dBi gain
<b>Antenna Connector</b>	IPEX Compatible
<b>Accessory Device</b>	Refer to Note as below
<b>Data Cable Supplied</b>	Refer to Note as below

Note:

1. The EUT contains following accessory devices. (Not for sale together)

Product	Brand	Model	Description
Adapter	ADAPTER TECH.	ATS090T-P180	I/P: 100-240 Vac, 50-60 Hz, 1.2A MAX. O/P: 18Vdc, 5.0A, 90W MAX. 1.5m non-shielded cable with 1 core

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



### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
A	√	√	√	√	EUT with Dipole Antenna
B	√	√	√	-	EUT with PIFA Antenna

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:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.  
**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)
A, B	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)
A, B	0 to 39	39	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)
A, B	0 to 39	39	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.

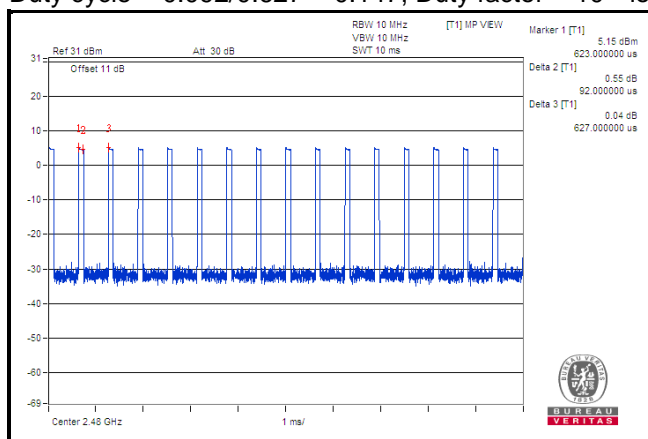
EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

**Test Condition:**

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥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	Thomas Wei
APCM	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin

**3.3 Duty Cycle of Test Signal**

Duty cycle = 0.092/0.627 = 0.147, Duty factor = 10 \* log(1/0.147) = 8.33



### 3.4 Description of Support Units

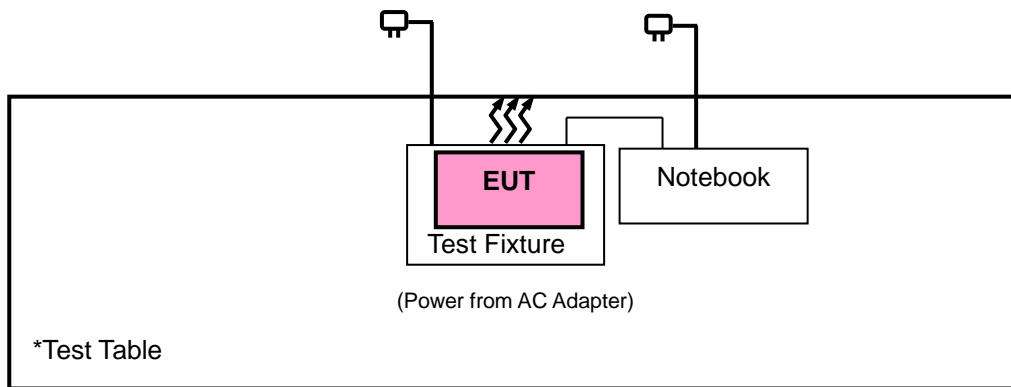
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook	DELL	E5410	1HC2XM1	N/A

Note:

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

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standards

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

**FCC Part 15, Subpart C (15.247)**

**KDB 558074 D01 15.247 Meas Guidance v05r02**

ANSI C63.10-2013

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

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 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 (dBuV/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. 20, 2018	Aug. 19, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 25, 2018	Sep. 24, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 27, 2018	Nov. 26, 2019
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
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. 05, 2018	Sep. 04, 2019
Power Sensor Anritsu	MA2411B	1315050	Sep. 04, 2018	Sep. 03, 2019
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC -SMS-100-SMS-12 0+RFC-SMS-100-S MS-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
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:**

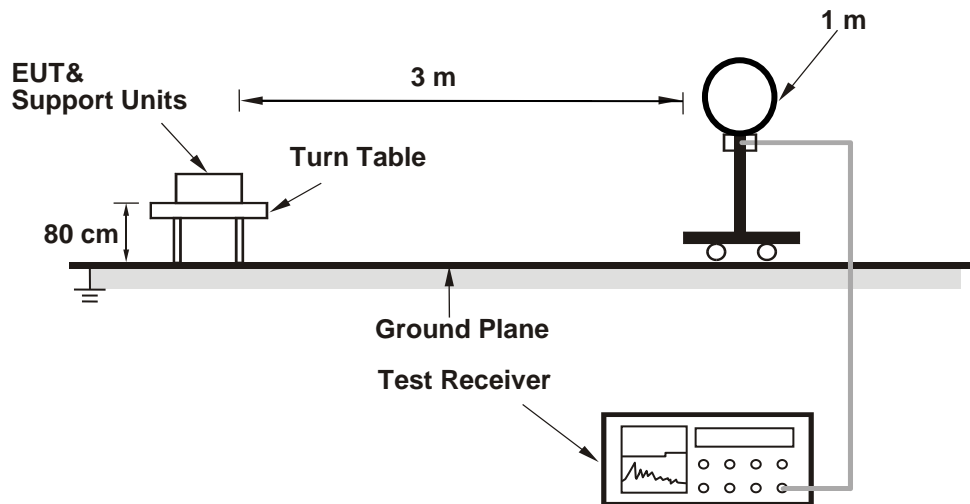
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) 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 = 30 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

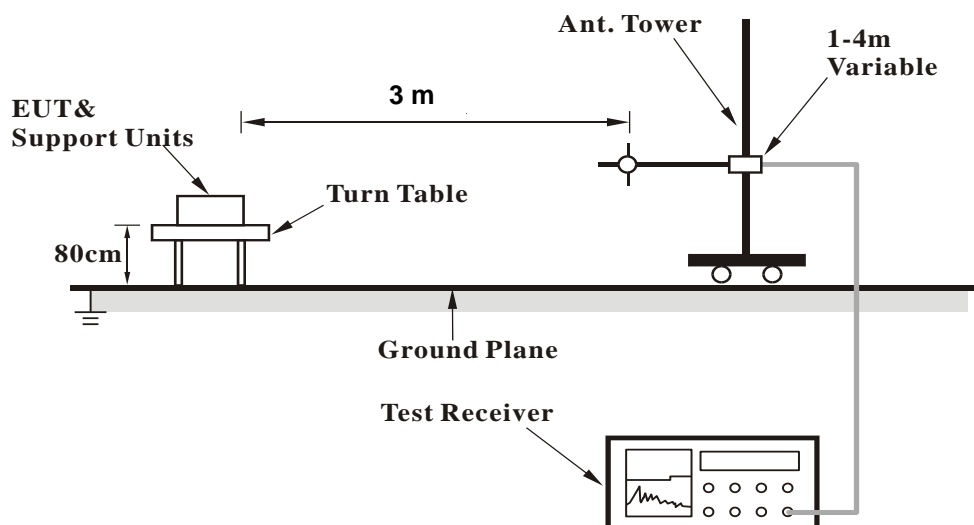
No deviation.

#### 4.1.5 Test Set Up

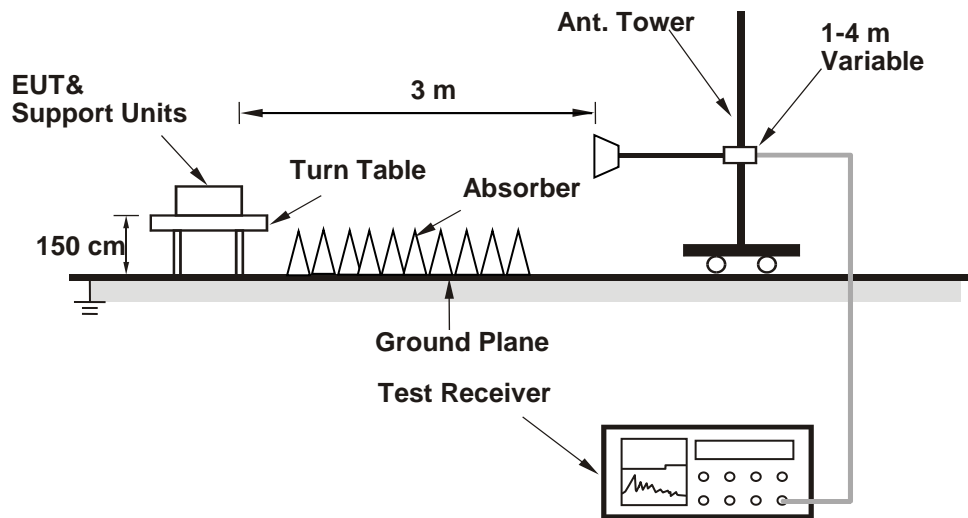
##### <Radiated Emission below 30 MHz>



##### <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**

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



4.1.7 Test Results

Mode A

Above 1 GHz Data:

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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
2387.58	40.11	35.62	4.49	54	-13.89	126	74	Average
2387.58	51.32	46.83	4.49	74	-22.68	126	74	Peak
2402	95.66	91.14	4.52			126	74	Average
2402	96.74	92.22	4.52			126	74	Peak
4804	38.16	27.81	10.35	54	-15.84	151	190	Average
4804	47.85	37.5	10.35	74	-26.15	151	190	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
2382.56	40.37	35.9	4.47	54	-13.63	152	86	Average
2382.56	51.42	46.95	4.47	74	-22.58	152	86	Peak
2402	90.45	85.93	4.52			152	86	Average
2402	91.53	87.01	4.52			152	86	Peak
4804	37.66	27.31	10.35	54	-16.34	146	271	Average
4804	47.45	37.1	10.35	74	-26.55	146	271	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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
2376.42	40.64	36.17	4.47	54	-13.36	126	74	Average
2376.42	51.33	46.86	4.47	74	-22.67	126	74	Peak
2440	95.69	91.1	4.59			126	74	Average
2440	96.82	92.23	4.59			126	74	Peak
2486.34	41.25	36.59	4.66	54	-12.75	126	74	Average
2486.34	51.37	46.71	4.66	74	-22.63	126	74	Peak
4880	38.14	27.93	10.21	54	-15.86	160	58	Average
4880	47.65	37.44	10.21	74	-26.35	160	58	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
2385.05	41.23	36.76	4.47	54	-12.77	152	86	Average
2385.05	51.39	46.92	4.47	74	-22.61	152	86	Peak
2440	90.51	85.92	4.59			152	86	Average
2440	91.65	87.06	4.59			152	86	Peak
2490.45	41.42	36.74	4.68	54	-12.58	152	86	Average
2490.45	51.62	46.94	4.68	74	-22.38	152	86	Peak
4880	38.27	28.06	10.21	54	-15.73	147	31	Average
4880	47.75	37.54	10.21	74	-26.25	147	31	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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	95.39	90.75	4.64			126	74	Average
2480	96.22	91.58	4.64			126	74	Peak
2493.64	41.58	36.91	4.67	54	-12.42	126	74	Average
2493.64	52.24	47.57	4.67	74	-21.76	126	74	Peak
4960	37.54	27.18	10.36	54	-16.46	187	112	Average
4960	47.16	36.8	10.36	74	-26.84	187	112	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	90.11	85.47	4.64			152	86	Average
2480	91.03	86.39	4.64			152	86	Peak
2494.74	41.26	36.59	4.67	54	-12.74	152	86	Average
2494.74	51.89	47.22	4.67	74	-22.11	152	86	Peak
4960	37.96	27.6	10.36	54	-16.04	160	285	Average
4960	47.52	37.16	10.36	74	-26.48	160	285	Peak

Remarks:

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

### Mode B

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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
2385.4	40.31	35.84	4.47	54	-13.69	127	264	Average
2385.4	51.37	46.9	4.47	74	-22.63	127	264	Peak
2402	91.43	86.91	4.52			127	264	Average
2402	92.37	87.85	4.52			127	264	Peak
4804	38.3	27.95	10.35	54	-15.7	133	84	Average
4804	47.68	37.33	10.35	74	-26.32	133	84	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
2369.17	40.02	35.57	4.45	54	-13.98	264	347	Average
2369.17	50.25	45.8	4.45	74	-23.75	264	347	Peak
2402	86.52	82	4.52			264	347	Average
2402	87.69	83.17	4.52			264	347	Peak
4804	37.81	27.46	10.35	54	-16.19	164	252	Average
4804	47.61	37.26	10.35	74	-26.39	164	252	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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
2380.35	40.29	35.82	4.47	54	-13.71	127	264	Average
2380.35	51.24	46.77	4.47	74	-22.76	127	264	Peak
2440	91.29	86.7	4.59			127	264	Average
2440	92.56	87.97	4.59			127	264	Peak
2495.54	40.52	35.85	4.67	54	-13.48	127	264	Average
2495.54	51.07	46.4	4.67	74	-22.93	127	264	Peak
4880	37.56	27.35	10.21	54	-16.44	142	111	Average
4880	47.39	37.18	10.21	74	-26.61	142	111	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
2387.29	41.27	36.78	4.49	54	-12.73	264	347	Average
2387.29	51.25	46.76	4.49	74	-22.75	264	347	Peak
2440	86.39	81.8	4.59			264	347	Average
2440	87.44	82.85	4.59			264	347	Peak
2486.42	40.57	35.91	4.66	54	-13.43	264	347	Average
2486.42	51.54	46.88	4.66	74	-22.46	264	347	Peak
4880	38	27.79	10.21	54	-16	169	223	Average
4880	47.53	37.32	10.21	74	-26.47	169	223	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	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	90.65	86.01	4.64			127	264	Average
2480	91.84	87.2	4.64			127	264	Peak
2488.32	41.32	36.64	4.68	54	-12.68	127	264	Average
2488.32	51.64	46.96	4.68	74	-22.36	127	264	Peak
4960	37.69	27.33	10.36	54	-16.31	138	257	Average
4960	47.51	37.15	10.36	74	-26.49	138	257	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	85.83	81.19	4.64			264	347	Average
2480	86.77	82.13	4.64			264	347	Peak
2486.34	41.07	36.41	4.66	54	-12.93	264	347	Average
2486.34	51.54	46.88	4.66	74	-22.46	264	347	Peak
4960	38.04	27.68	10.36	54	-15.96	125	71	Average
4960	47.84	37.48	10.36	74	-26.16	125	71	Peak

Remarks:

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

**9 kHz ~ 30 MHz Data:**

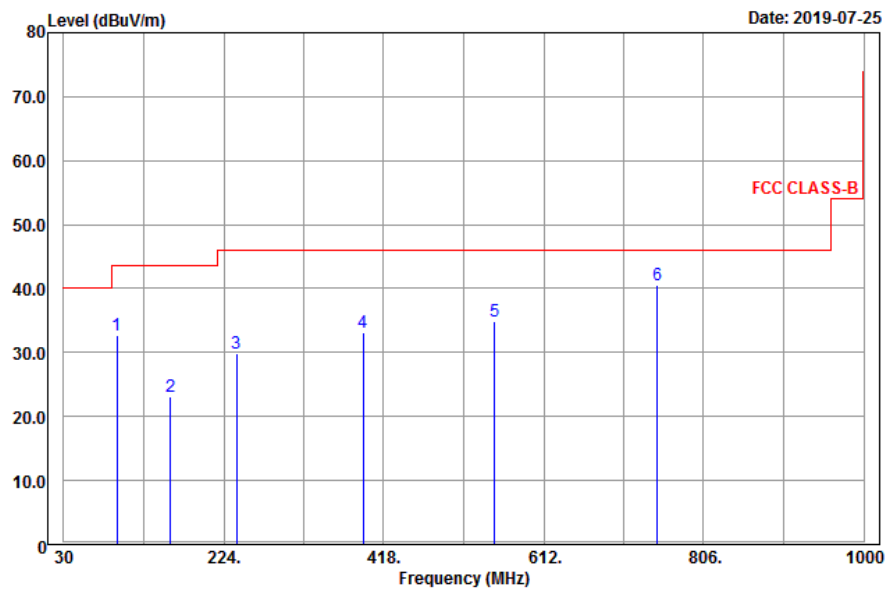
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

**30 MHz ~ 1 GHz Worst-Case Data:**

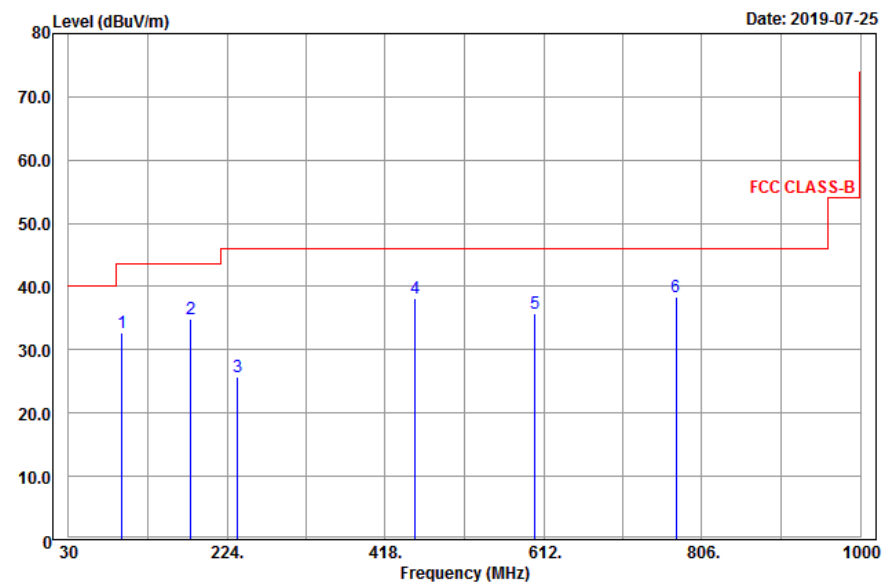
**Mode A**

EUT Test Condition		Measurement Detail	
Channel	Channel 39	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
94.53	32.62	50.47	-17.85	43.5	-10.88	124	175	Peak
159.6	23.01	43.6	-20.59	43.5	-20.49	188	206	Peak
239.79	29.9	46.95	-17.05	46	-16.1	120	224	Peak
393.1	33.06	47.12	-14.06	46	-12.94	126	334	Peak
552.7	34.88	46.4	-11.52	46	-11.12	148	137	Peak
750.1	40.63	49.17	-8.54	46	-5.37	164	102	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
95.34	32.73	50.58	-17.85	43.5	-10.77	111	45	Peak
180.12	34.78	54.42	-19.64	43.5	-8.72	173	234	Peak
237.36	25.61	42.71	-17.1	46	-20.39	168	129	Peak
454.7	38.06	51.25	-13.19	46	-7.94	121	137	Peak
601.7	35.74	46.28	-10.54	46	-10.26	184	136	Peak
774.6	38.41	46.6	-8.19	46	-7.59	190	257	Peak

Remarks:

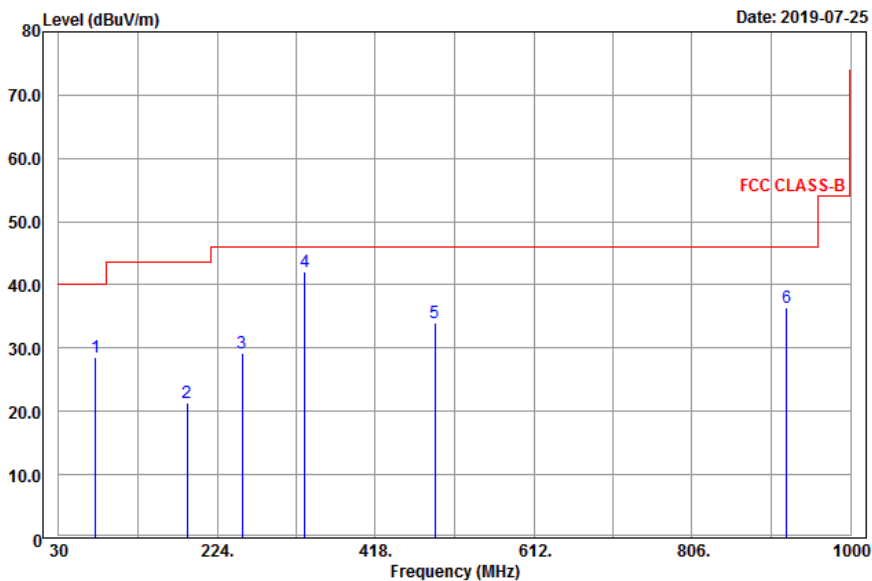
- Emission Level = Read Level + Factor  
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.



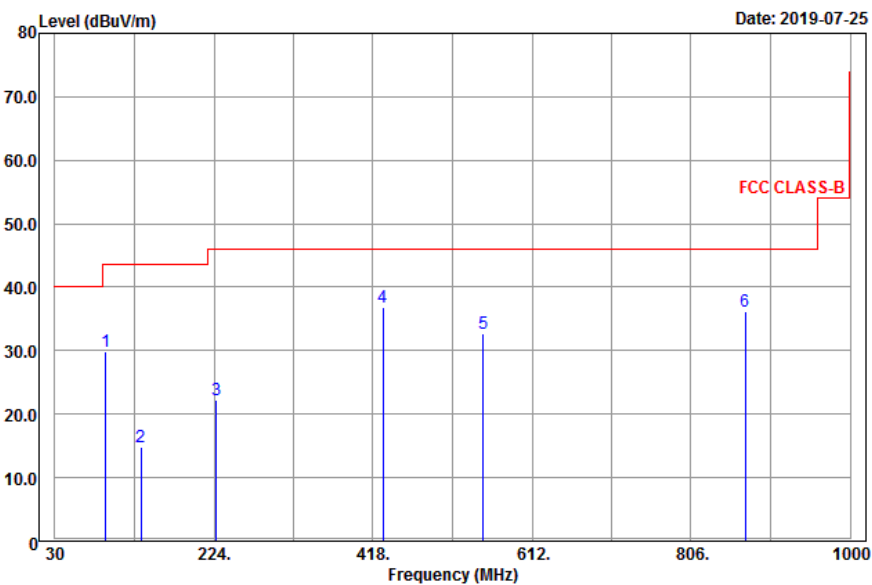
**Mode B**

EUT Test Condition		Measurement Detail	
Channel	Channel 39	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
74.82	28.6	49.81	-21.21	40	-11.4	160	322	Peak
187.41	21.43	40.4	-18.97	43.5	-22.07	174	341	Peak
254.91	29.25	45.99	-16.74	46	-16.75	158	226	Peak
331.5	41.97	57.19	-15.22	46	-4.03	154	8	Peak
491.1	34.11	46.6	-12.49	46	-11.89	161	137	Peak
921.6	36.39	42.08	-5.69	46	-9.61	153	207	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
92.1	29.81	48.38	-18.57	43.5	-13.69	146	351	Peak
135.03	14.77	35.49	-20.72	43.5	-28.73	105	134	Peak
227.37	22.26	39.79	-17.53	46	-23.74	161	209	Peak
430.2	36.83	50.35	-13.52	46	-9.17	134	185	Peak
552.7	32.64	44.16	-11.52	46	-13.36	160	215	Peak
872.6	36.21	42.51	-6.3	46	-9.79	112	345	Peak

Remarks:

- Emission Level = Read Level + Factor  
Margin value = Emission level – Limit value
- 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. 10, 2018	Dec. 09, 2019
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

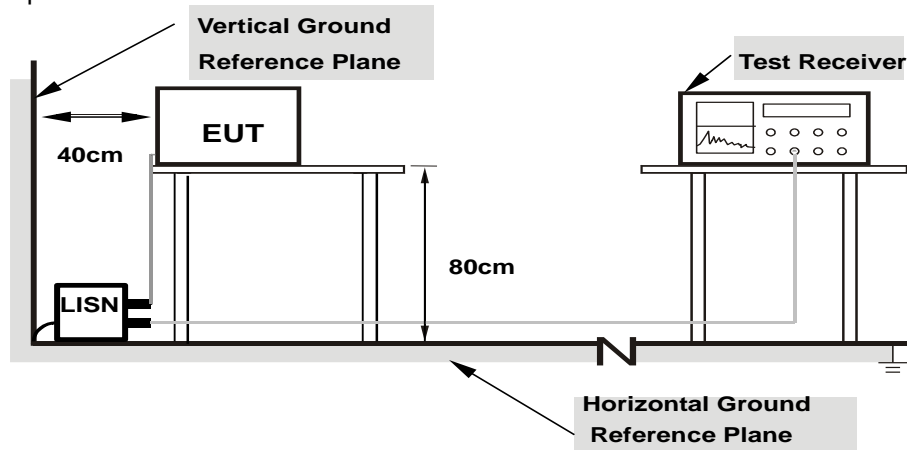
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance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

#### 4.2.6 EUT Operating Conditions

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

#### 4.2.7 Test Results

#### CONDUCTED WORST-CASE DATA

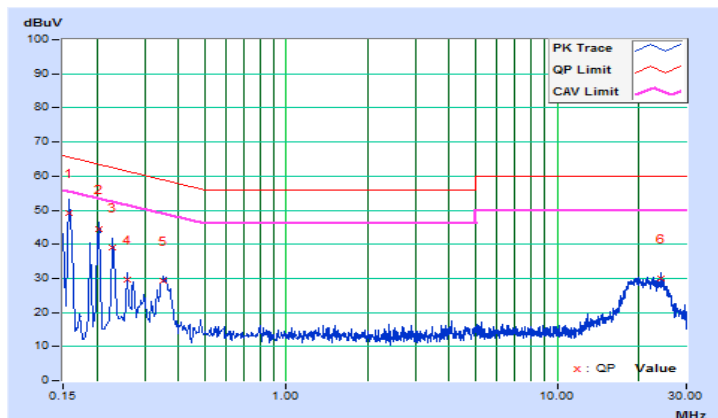
#### Mode A

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Thomas Wei	Test Date	2019/10/3

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15782	9.67	39.38	27.58	49.05	37.25	65.58	55.58	-16.53	-18.33
2	0.20458	9.66	34.86	24.96	44.52	34.62	63.42	53.42	-18.90	-18.80
3	0.22820	9.66	29.30	19.15	38.96	28.81	62.51	52.51	-23.55	-23.70
4	0.25948	9.67	20.08	10.96	29.75	20.63	61.45	51.45	-31.70	-30.82
5	0.35332	9.68	19.59	6.57	29.27	16.25	58.88	48.88	-29.61	-32.63
6	24.12612	10.00	19.98	11.51	29.98	21.51	60.00	50.00	-30.02	-28.49

#### 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

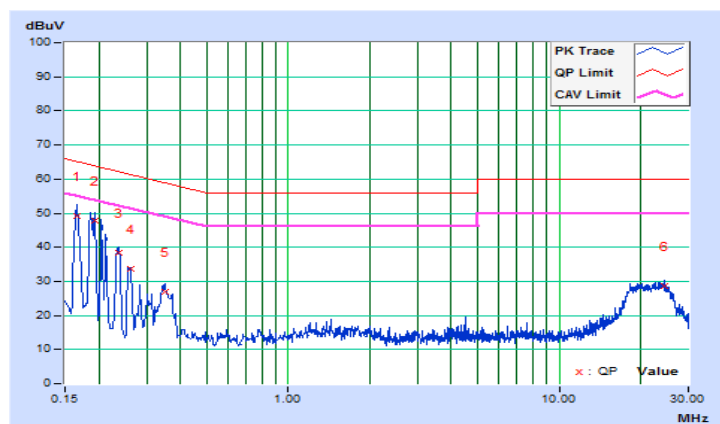


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Thomas Wei	Test Date	2019/10/3

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	0.16564	9.64	39.44	29.95	49.08	39.59	65.18	55.18	-16.10	-15.59
2	0.19301	9.64	38.02	26.22	47.66	35.86	63.91	53.91	-16.25	-18.05
3	0.23586	9.64	28.78	21.59	38.42	31.23	62.24	52.24	-23.82	-21.01
4	0.26339	9.65	24.07	14.33	33.72	23.98	61.32	51.32	-27.60	-27.34
5	0.34926	9.65	17.45	5.44	27.10	15.09	58.98	48.98	-31.88	-33.89
6	24.34508	10.08	18.58	7.80	28.66	17.88	60.00	50.00	-31.34	-32.12

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



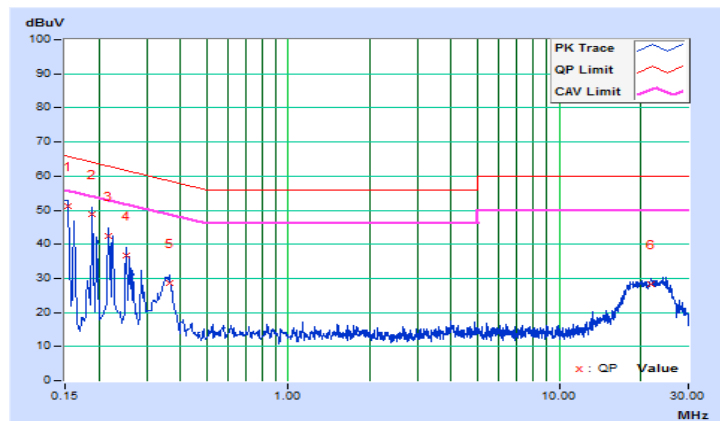
### Mode B

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Thomas Wei	Test Date	2019/10/3

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.67	41.43	31.47	51.10	41.14	65.79	55.79	-14.69	-14.65
2	0.18910	9.66	39.30	28.59	48.96	38.25	64.08	54.08	-15.12	-15.83
3	0.21647	9.66	32.87	24.49	42.53	34.15	62.95	52.95	-20.42	-18.80
4	0.25166	9.67	26.89	17.31	36.56	26.98	61.70	51.70	-25.14	-24.72
5	0.36505	9.68	19.03	8.06	28.71	17.74	58.61	48.61	-29.90	-30.87
6	21.82704	9.99	18.25	7.61	28.24	17.60	60.00	50.00	-31.76	-32.40

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

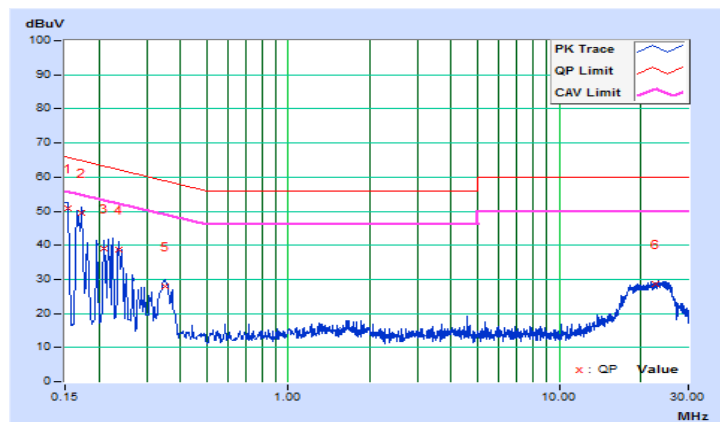


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Thomas Wei	Test Date	2019/10/3

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.64	41.36	32.83	51.00	42.47	65.79	55.79	-14.79	-13.32
2	0.17346	9.64	39.82	28.81	49.46	38.45	64.79	54.79	-15.33	-16.34
3	0.20865	9.64	29.32	20.13	38.96	29.77	63.26	53.26	-24.30	-23.49
4	0.23602	9.64	28.92	19.86	38.56	29.50	62.24	52.24	-23.68	-22.74
5	0.34926	9.65	18.14	5.80	27.79	15.45	58.98	48.98	-31.19	-33.53
6	22.57385	10.07	18.41	6.85	28.48	16.92	60.00	50.00	-31.52	-33.08

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



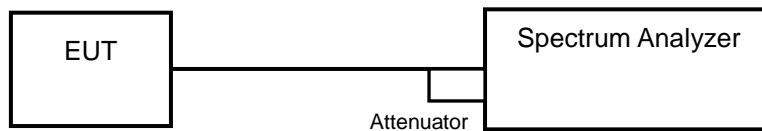


### 4.3 6 dB Bandwidth Measurement

#### 4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

#### 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 Procedure

- a. Set resolution bandwidth (RBW) = 100 kHz
- b. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

#### 4.3.5 Deviation from Test Standard

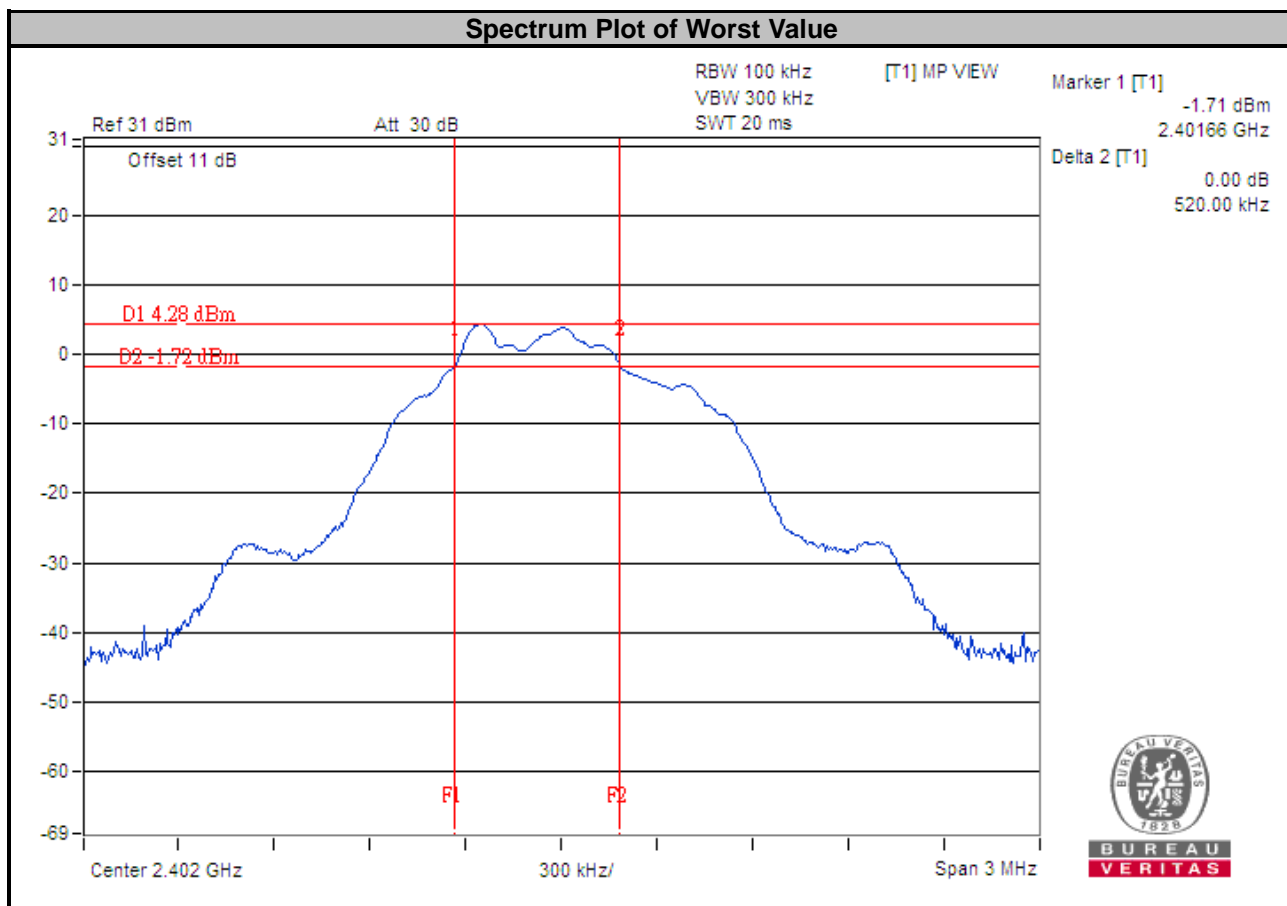
No deviation.

#### 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.

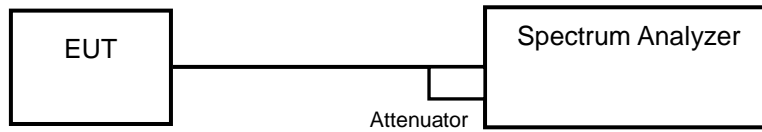
### 4.3.7 Test Results

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.52	0.5	Pass
19	2440	0.53	0.5	Pass
39	2480	0.52	0.5	Pass



## 4.4 Occupied Bandwidth Measurement

### 4.4.1 Test Setup



### 4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

### 4.4.4 Deviation from Test Standard

No deviation.

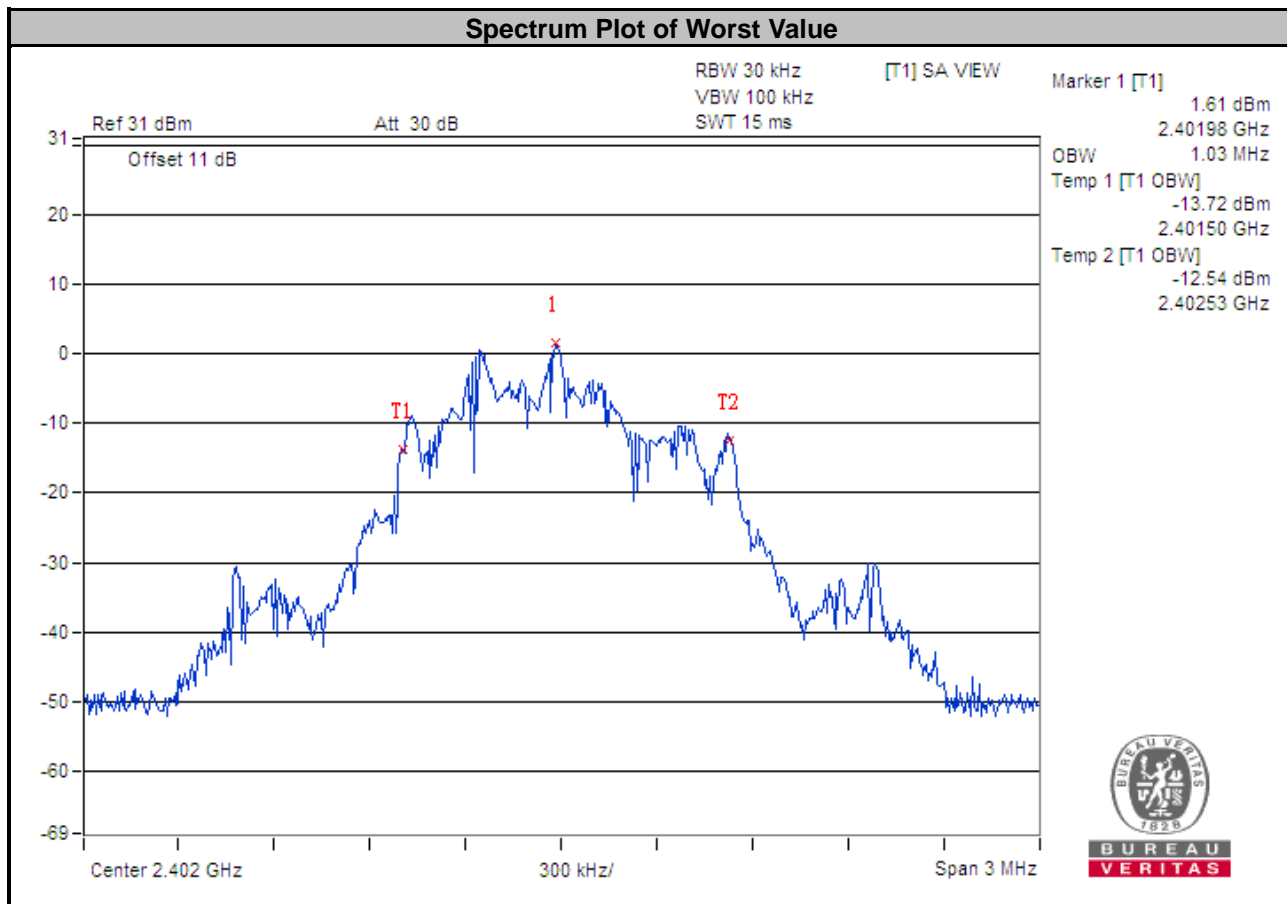
### 4.4.5 EUT Operating Conditions

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

#### 4.4.6 Test Results

<LE 4.0>

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	Pass / Fail
0	2402	1.03	Pass
19	2440	1.03	Pass
39	2480	1.03	Pass

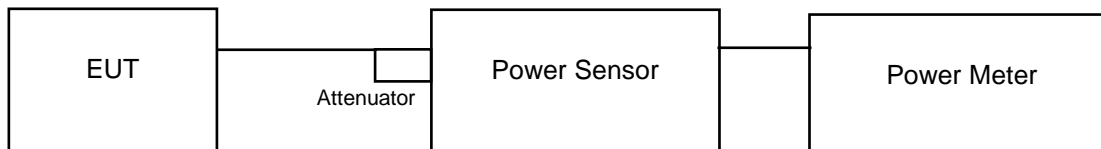


## 4.5 Conducted Output Power Measurement

### 4.5.1 Limits of Conducted Output Power Measurement

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

### 4.5.2 Test Setup



### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 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.

### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Conditions

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

### 4.5.7 Test Results

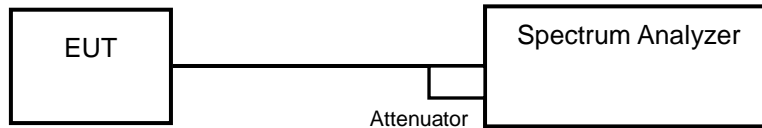
Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	2.884	4.60	30	Pass
19	2440	2.924	4.66	30	Pass
39	2480	2.844	4.54	30	Pass

## 4.6 Power Spectral Density Measurement

### 4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 4.6.2 Test Setup



### 4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 Test Procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d. Set the VBW  $\geq 3 \times \text{RBW}$ .
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### 4.6.5 Deviation from Test Standard

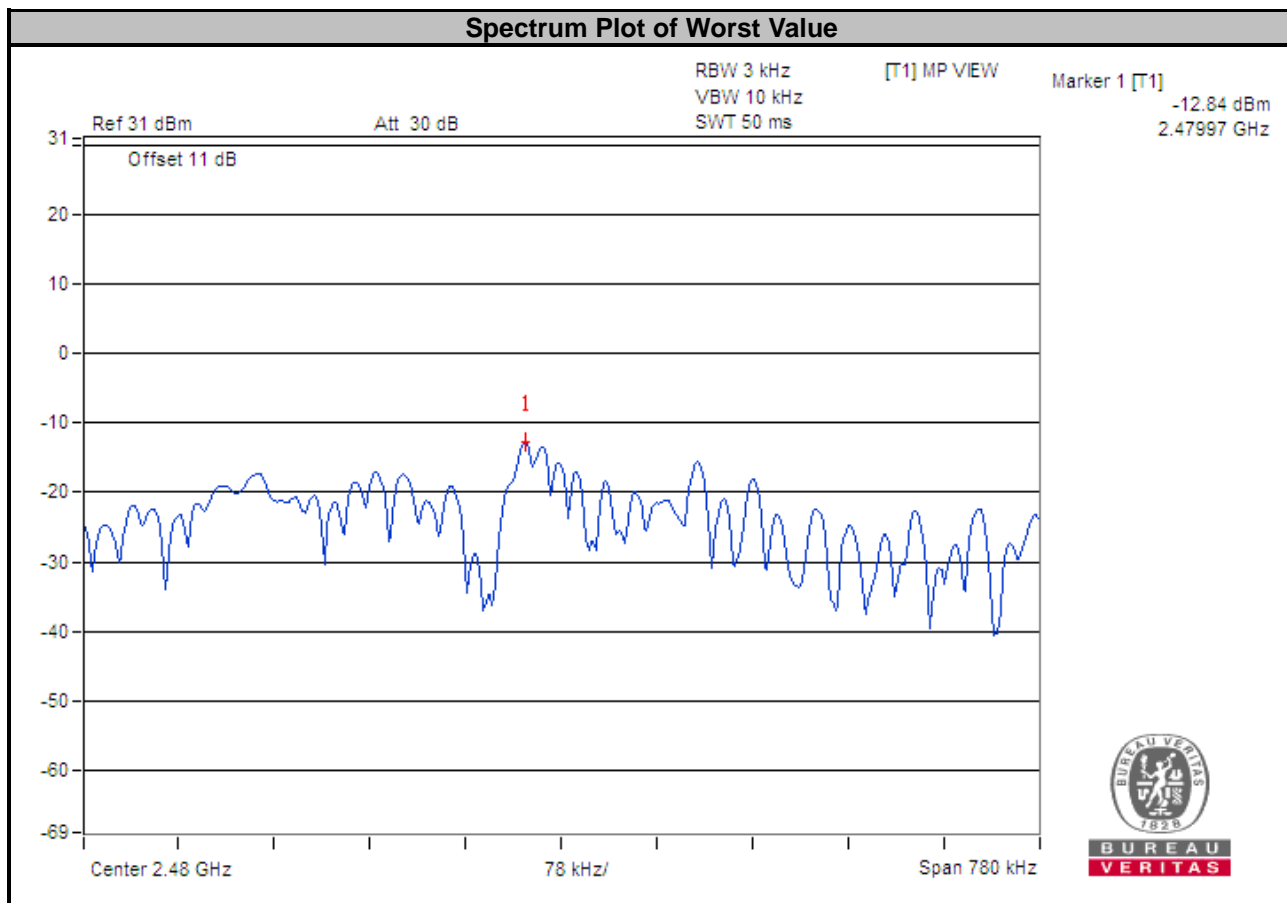
No deviation.

### 4.6.6 EUT Operating Condition

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

#### 4.6.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	2402	-12.89	8	Pass
19	2440	-13.19	8	Pass
39	2480	-12.84	8	Pass

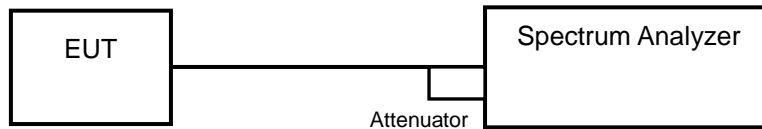


## 4.7 Conducted Out of Band Emission Measurement

### 4.7.1 Limits of Conducted Out of Band Emission Measurement

Below  $-20$  dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

### 4.7.2 Test Setup



### 4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.7.4 Test Procedure

#### 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.

### 4.7.5 Deviation from Test Standard

No deviation.

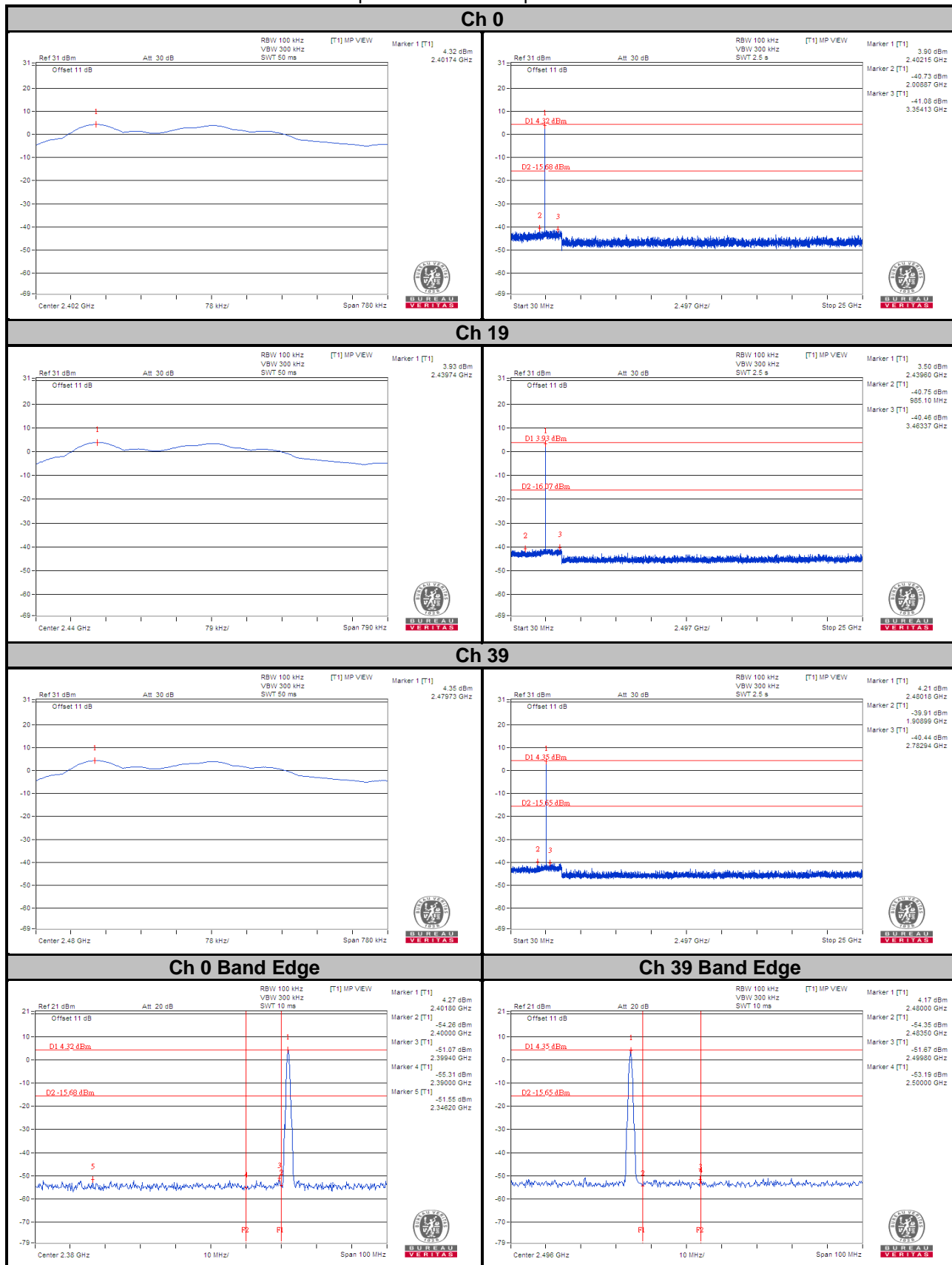
### 4.7.6 EUT Operating Condition

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



### 4.7.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement.



## 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.

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

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