

## FCC Test Report (BT-LE)

**Report No.:** RF161021D03 R1

**FCC ID:** HV4ESP101B21

**Test Model:** 5T70M55297

**Received Date:** Oct. 21, 2016

**Test Date:** Oct. 24 ~ 25, 2016

**Issued Date:** Nov. 21, 2016

**Applicant:** Wacom Co., Ltd.

**Address:** 2-510-1 Toyonodai, Kazo-shi, Saitama 349-1148 Japan

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

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)



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## Table of Contents

<b>Release Control Record.....</b>	<b>4</b>
<b>1 Certificate of Conformity.....</b>	<b>5</b>
<b>2 Summary of Test Results .....</b>	<b>6</b>
2.1 Measurement Uncertainty.....	6
2.2 Modification Record.....	6
<b>3 General Information.....</b>	<b>7</b>
3.1 General Description of EUT (BT-LE).....	7
3.2 Description of Test Modes .....	8
3.2.1 Test Mode Applicability and Tested Channel Detail.....	9
3.3 Description of Support Units .....	10
3.3.1 Configuration of System under Test .....	10
3.4 Duty Cycle of Test Signal.....	10
3.5 General Description of Applied Standards.....	11
<b>4 Test Types and Results.....</b>	<b>12</b>
4.1 Radiated Emission and Bandedge Measurement.....	12
4.1.1 Limits of Radiated Emission and Bandedge Measurement .....	12
4.1.2 Test Instruments .....	13
4.1.3 Test Procedures .....	14
4.1.4 Deviation from Test Standard .....	15
4.1.5 Test Setup .....	15
4.1.6 EUT Operating Conditions .....	16
4.1.7 Test Results.....	17
4.2 6dB Bandwidth Measurement.....	21
4.2.1 Limits of 6dB Bandwidth Measurement .....	21
4.2.2 Test Setup .....	21
4.2.3 Test Instruments .....	21
4.2.4 Test Procedure .....	21
4.2.5 Deviation from Test Standard .....	21
4.2.6 EUT Operating Conditions .....	21
4.2.7 Test Result .....	22
4.3 Conducted Output Power Measurement.....	23
4.3.1 Limits OF Conducted Output Power Measurement.....	23
4.3.2 Test Setup .....	23
4.3.3 Test Instruments .....	23
4.3.4 Test Procedures .....	23
4.3.5 Deviation from Test Standard .....	23
4.3.6 EUT Operating Conditions .....	23
4.3.7 Test Results.....	24
4.4 Power Spectral Density Measurement.....	25
4.4.1 Limits of Power Spectral Density Measurement.....	25
4.4.2 Test Setup .....	25
4.4.3 Test Instruments .....	25
4.4.4 Test Procedure .....	25
4.4.5 Deviation from Test Standard .....	25
4.4.6 EUT Operating Condition.....	25
4.4.7 Test Results.....	26
4.5 Conducted Out of Band Emission Measurement.....	27
4.5.1 Limits of Conducted Out of Band Emission Measurement .....	27
4.5.2 Test Setup .....	27
4.5.3 Test Instruments .....	27
4.5.4 Test Procedure .....	27
4.5.5 Deviation from Test Standard .....	27

4.5.6 EUT Operating Condition.....	27
4.5.7 Test Results.....	28
<b>5 Pictures of Test Arrangements.....</b>	<b>29</b>
<b>Appendix – Information on the Testing Laboratories.....</b>	<b>30</b>

### Release Control Record

Issue No.	Description	Date Issued
RF161021D03	Original release.	Oct. 31, 2016
RF161021D03 R1	Modify of antenna specification.	Nov. 21, 2016

## 1 Certificate of Conformity

**Product:** Lenovo Active Pen 2

**Brand:** Lenovo

**Test Model:** 5T70M55297

**Sample Status:** Engineering sample

**Applicant:** Wacom Co., Ltd.

**Test Date:** Oct. 24 ~ 25, 2016

**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 EMC characteristics under the conditions specified in this report.

**Prepared by :**



Celia Chen / Supervisor

**Date:** Nov. 21, 2016

**Approved by :**



Rex Lai / Assistant Manager

**Date:** Nov. 21, 2016

## 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	N/A	Power supply is 3Vdc from batteries
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -10.55dB at 2400.00MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
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.

### 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) ( $\pm$ )
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1000MHz	5.32 dB
Radiated Emissions above 1 GHz	1GHz ~ 40GHz	3.36 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT (BT-LE)

Product	Lenovo Active Pen 2
Brand	Lenovo
Test Model	5T70M55297
Status of EUT	Engineering sample
Power Supply Rating	3Vdc from Coin battery*2 (For Rear Cap) 1.5Vdc from AAAA battery*1 (For Pen body)
Modulation Type	GFSK
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	1.156mW
Antenna Type	Chip antenna with 2.93dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The EUT is a Lenovo Active Pen 2.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

### 3.2 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 <sup>≥</sup> 1G	RE<1G	PLC	APCM	
-	√	√	Note 2	√	-

Where **RE<sup>≥</sup>1G**: Radiated Emission above 1GHz

**RE<1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**APCM**: Antenna Port Conducted Measurement

**NOTE 1**: The EUT had been pre-tested on the positioned of XZ axis. The worst case was found when positioned on **X-plane**.

**NOTE 2**: No need to concern of Conducted Emission due to the EUT is powered by batteries.

#### 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 TYPE	DATA RATE (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

#### 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 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

#### Test Condition:

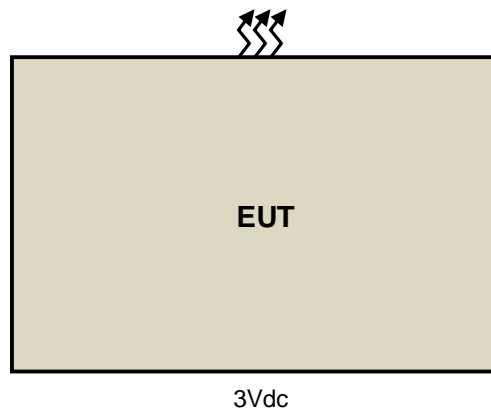
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE <sup>≥</sup> 1G	30deg. C, 68%RH	3Vdc	Ian Chang
RE<1G	30deg. C, 68%RH	3Vdc	Ian Chang
APCM	25deg. C, 76%RH	3Vdc	Saxon Lee

### 3.3 Description of Support Units

The EUT has been tested as an independent unit together without other necessary accessories or support units.

#### 3.3.1 Configuration of System under Test

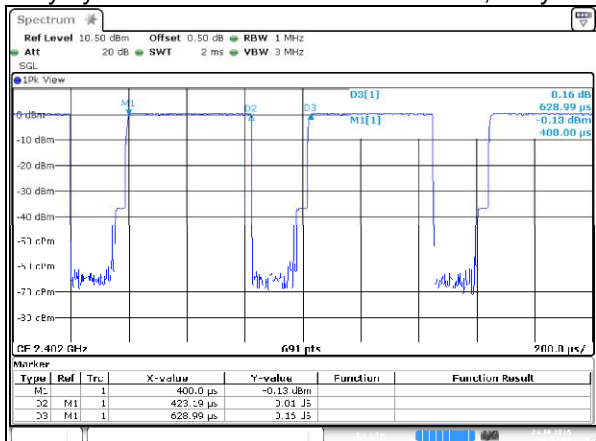
##### TEST CONFIGURATION



### 3.4 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

Duty cycle =  $0.423 \text{ ms} / 0.628 \text{ ms} = 0.674$ , Duty factor =  $10 * \log(1/0.674) = 1.7$



### 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 DTS Meas Guidance v03r05**

ANSI C63.10-2013

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

**NOTE:** The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

## 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.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 26, 2016	Feb. 25, 2017
HP Preamplifier	8449B	3008A01201	Feb. 26, 2016	Feb. 25, 2017
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Mar. 01, 2016	Feb. 28, 2017
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 02, 2016	Feb. 01, 2017
Schwarzbeck Antenna	VULB 9168	139	Jan. 04, 2016	Jan. 03, 2017
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2015	May 28, 2017
Schwarzbeck Horn Antenna	BBHA-9170	212	Jan. 08, 2016	Jan. 07, 2017
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Jan. 21, 2016	Jan. 20, 2017
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 15, 2016	Aug. 14, 2017
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 15, 2016	Aug. 14, 2017
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	May 25, 2016	May 24, 2017
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Jul. 26, 2016	Jul. 25, 2017
Loop Antenna EMCI	LPA600	270	Aug. 20, 2015	Aug. 19, 2017
EMCO Horn Antenna	3115	00028257	Jan. 19, 2016	Jan. 18, 2017
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 30, 2016	Sep. 29, 2017
Anritsu Power Sensor	MA2411B	0738404	Apr. 28, 2016	Apr. 27, 2017
Anritsu Power Meter	ML2495A	0842014	Apr. 28, 2016	Apr. 27, 2017

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

#### 4.1.3 Test Procedures

##### **For Radiated emission below 30MHz**

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

##### **NOTE:**

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

##### **For Radiated emission above 30MHz**

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

##### **Note:**

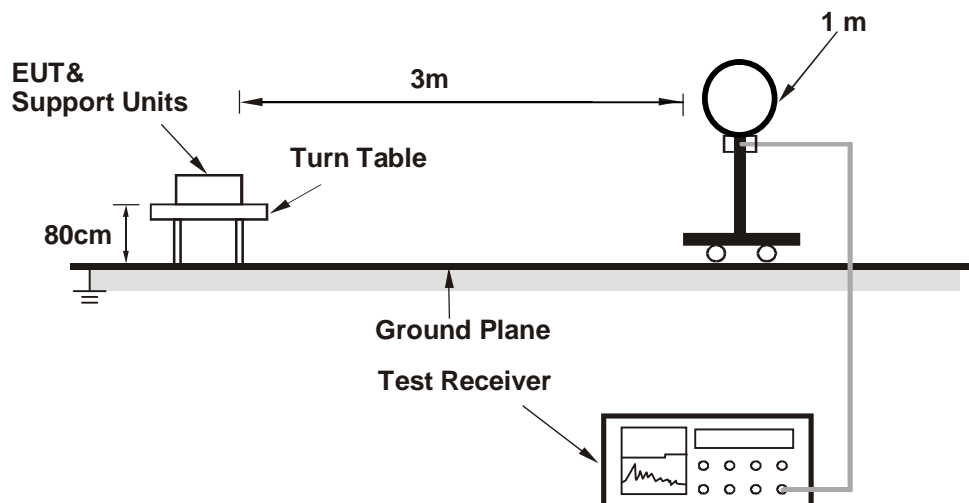
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

#### 4.1.4 Deviation from Test Standard

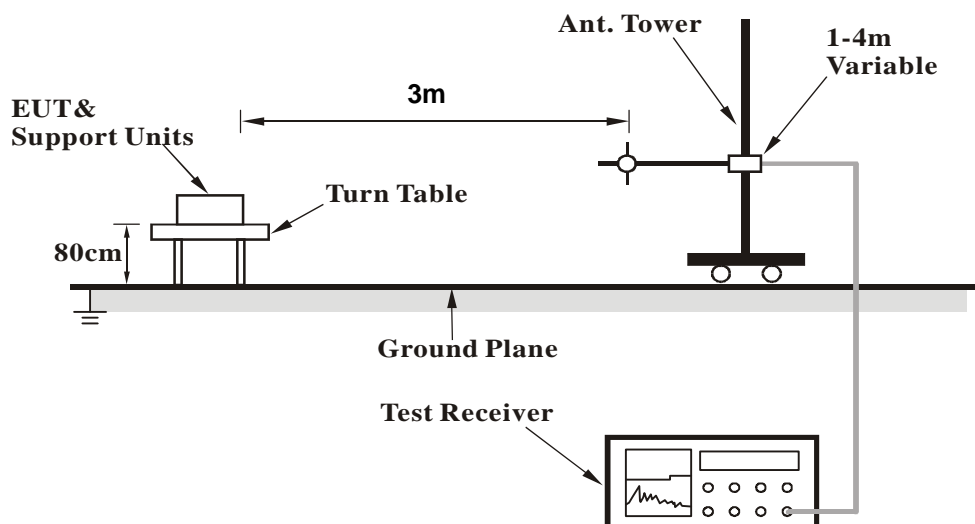
No deviation.

#### 4.1.5 Test Setup

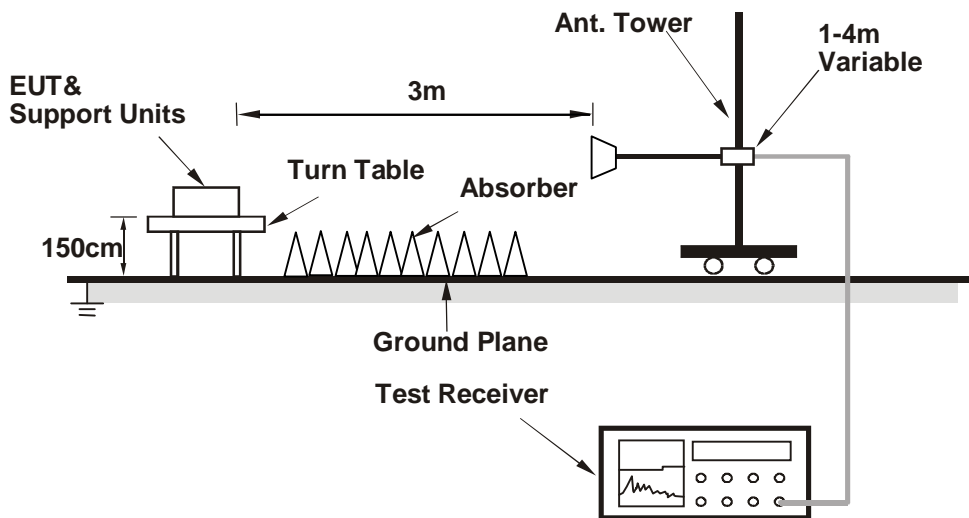
##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



### For Radiated emission above 1GHz



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

#### 4.1.6 EUT Operating Conditions

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



#### 4.1.7 Test Results

##### ABOVE 1GHz DATA

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.95 PK	74.00	-18.05	2.38 H	216	55.52	0.43
2	2390.00	41.24 AV	54.00	-12.76	2.38 H	216	40.81	0.43
3	2400.00	60.82 PK	74.00	-13.18	2.38 H	216	60.34	0.48
4	2400.00	43.45 AV	54.00	-10.55	2.38 H	216	42.97	0.48
5	*2402.00	90.73 PK			2.38 H	216	90.24	0.49
6	*2402.00	89.83 AV			2.38 H	216	89.34	0.49
7	4804.00	46.63 PK	74.00	-27.37	1.63 H	62	39.83	6.80
8	4804.00	35.08 AV	54.00	-18.92	1.63 H	62	28.28	6.80
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	54.61 PK	74.00	-19.39	1.46 V	182	54.18	0.43
2	2390.00	39.46 AV	54.00	-14.54	1.46 V	182	39.03	0.43
3	2400.00	59.08 PK	74.00	-14.92	1.46 V	182	58.60	0.48
4	2400.00	40.66 AV	54.00	-13.34	1.46 V	182	40.18	0.48
5	*2402.00	87.44 PK			1.46 V	182	86.95	0.49
6	*2402.00	86.29 AV			1.46 V	182	85.80	0.49
7	4804.00	45.83 PK	74.00	-28.17	1.34 V	102	39.03	6.80
8	4804.00	34.44 AV	54.00	-19.56	1.34 V	102	27.64	6.80

##### 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.

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

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	88.94 PK			1.43 H	223	88.22	0.72
2	*2440.00	88.20 AV			1.43 H	223	87.48	0.72
3	4880.00	46.69 PK	74.00	-27.31	1.73 H	42	39.86	6.83
4	4880.00	35.59 AV	54.00	-18.41	1.73 H	42	28.76	6.83

**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	85.50 PK			1.69 V	189	84.78	0.72
2	*2440.00	84.41 AV			1.69 V	189	83.69	0.72
3	4880.00	45.84 PK	74.00	-28.16	1.82 V	164	39.01	6.83
4	4880.00	34.31 AV	54.00	-19.69	1.82 V	164	27.48	6.83

**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.

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

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	90.62 PK			1.23 H	236	89.65	0.97
2	*2480.00	89.76 AV			1.23 H	236	88.79	0.97
3	2483.50	58.57 PK	74.00	-15.43	1.23 H	236	57.58	0.99
4	2483.50	41.55 AV	54.00	-12.45	1.23 H	236	40.56	0.99
5	4960.00	46.84 PK	74.00	-27.16	1.73 H	42	39.86	6.98
6	4960.00	35.74 AV	54.00	-18.26	1.73 H	42	28.76	6.98

**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	86.75 PK			1.69 V	187	85.78	0.97
2	*2480.00	85.66 AV			1.69 V	187	84.69	0.97
3	2483.50	56.27 PK	74.00	-17.73	1.69 V	187	55.28	0.99
4	2483.50	41.22 AV	54.00	-12.78	1.69 V	187	40.23	0.99
5	4960.00	45.43 PK	74.00	-28.57	1.63 V	69	38.45	6.98
6	4960.00	34.40 AV	54.00	-19.60	1.63 V	69	27.42	6.98

**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

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

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	37.23	19.55 QP	40.00	-20.45	2.61 H	4	30.22	-10.67
2	151.15	18.56 QP	43.50	-24.94	2.31 H	64	27.93	-9.37
3	338.75	21.43 QP	46.00	-24.57	1.94 H	51	28.47	-7.04
4	469.51	24.50 QP	46.00	-21.50	1.18 H	299	28.77	-4.27
5	667.29	28.91 QP	46.00	-17.09	1.24 H	160	29.16	-0.25
6	895.19	33.09 QP	46.00	-12.91	1.22 H	51	29.99	3.10
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	36.94	19.36 QP	40.00	-20.64	1.69 V	117	30.10	-10.74
2	114.49	21.20 QP	43.50	-22.30	2.98 V	62	33.51	-12.31
3	148.05	18.48 QP	43.50	-25.02	1.18 V	258	27.82	-9.34
4	296.31	19.70 QP	46.00	-26.30	1.46 V	182	27.45	-7.75
5	508.21	26.41 QP	46.00	-19.59	2.51 V	144	29.56	-3.15
6	976.28	33.82 QP	54.00	-20.18	2.55 V	247	29.01	4.81

## REMARKS:

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

## 4.2 6dB Bandwidth Measurement

### 4.2.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 4.2.2 Test Setup



### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- 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

### 4.2.5 Deviation from Test Standard

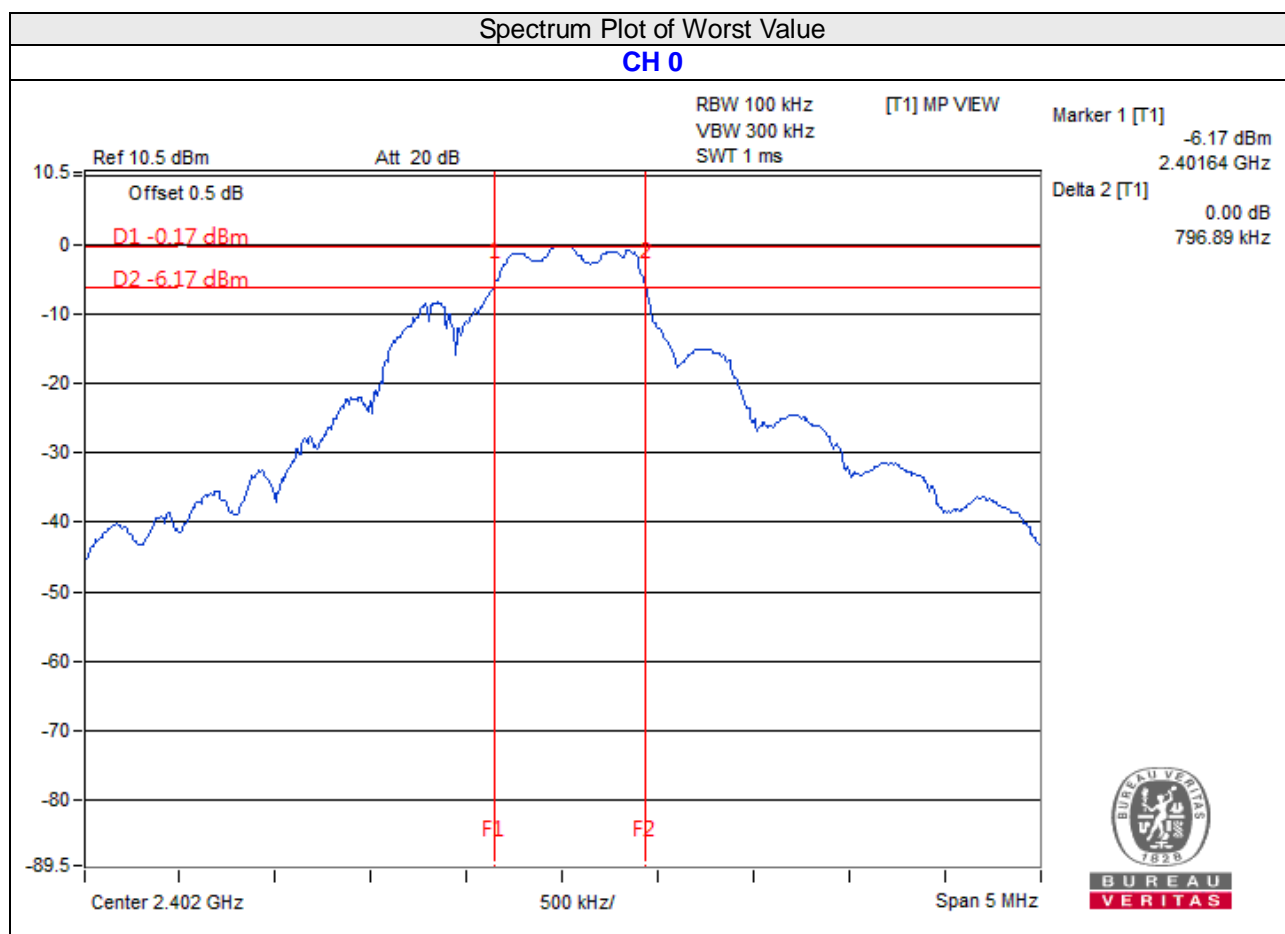
No deviation.

### 4.2.6 EUT Operating Conditions

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

#### 4.2.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.79	0.5	Pass
19	2440	0.71	0.5	Pass
39	2480	0.70	0.5	Pass

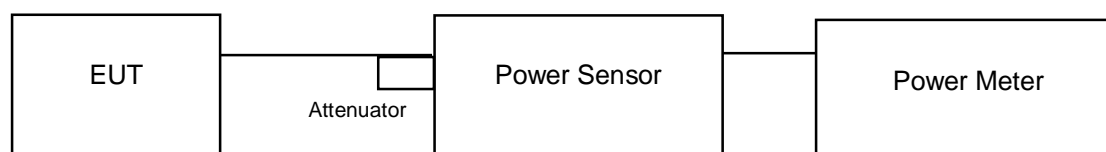


### 4.3 Conducted Output Power Measurement

#### 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

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

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Conditions

Same as Item 4.2.6.

#### 4.3.7 Test Results

##### FOR PEAK POWER

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	<b>1.156</b>	0.63	30	Pass
19	2440	1.112	0.46	30	Pass
39	2480	0.984	-0.07	30	Pass

##### FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	1.117	0.48
19	2440	1.079	0.33
39	2480	0.966	-0.15

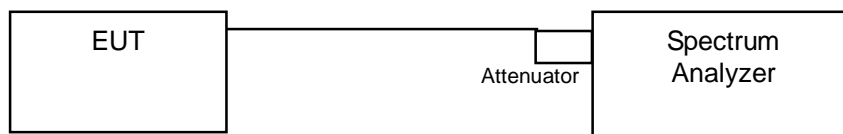


#### 4.4 Power Spectral Density Measurement

##### 4.4.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

##### 4.4.2 Test Setup



##### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

##### 4.4.4 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.

##### 4.4.5 Deviation from Test Standard

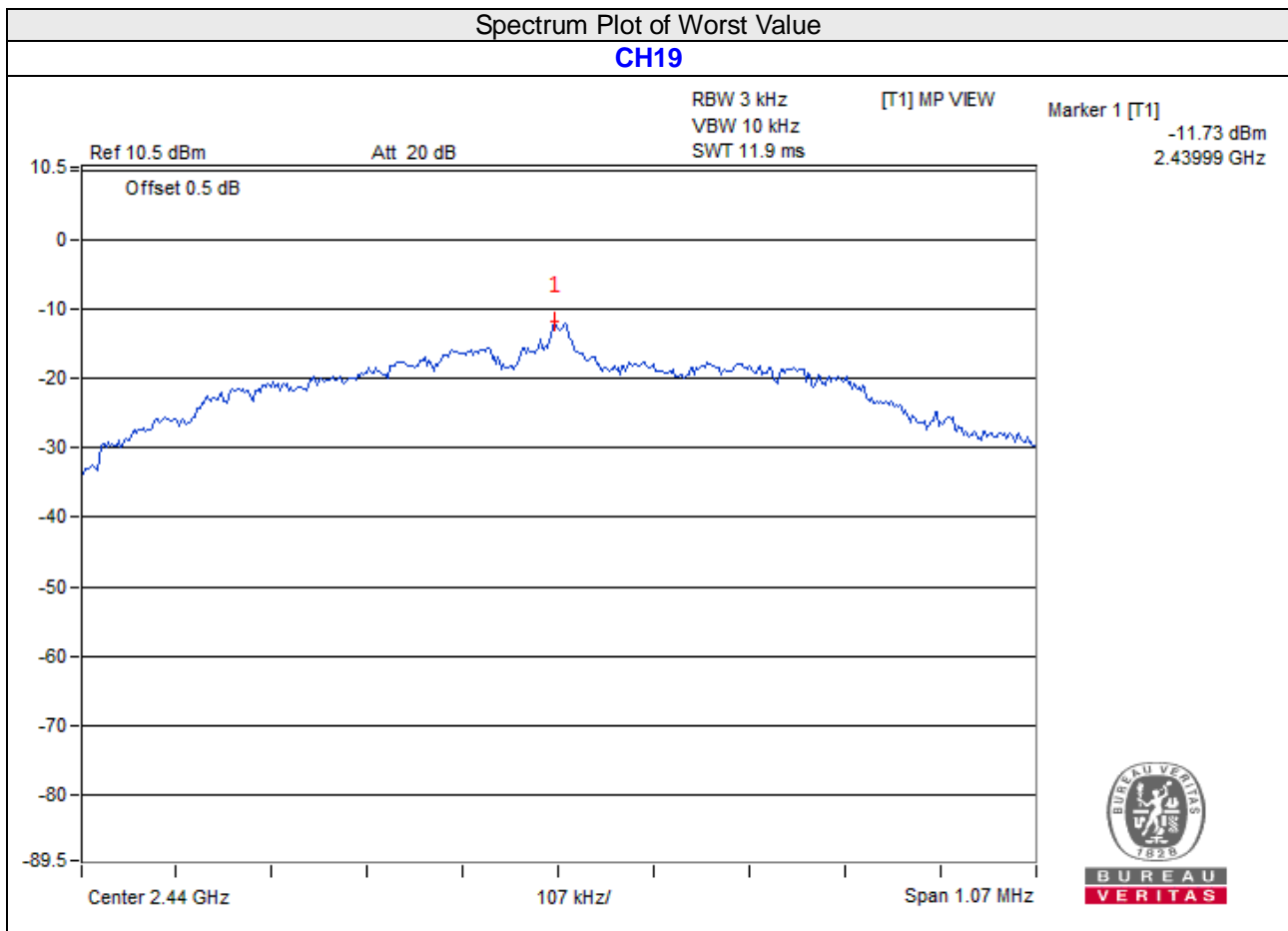
No deviation.

##### 4.4.6 EUT Operating Condition

Same as Item 4.2.6

#### 4.4.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	2402	-12.70	8	Pass
19	2440	-11.73	8	Pass
39	2480	-13.05	8	Pass

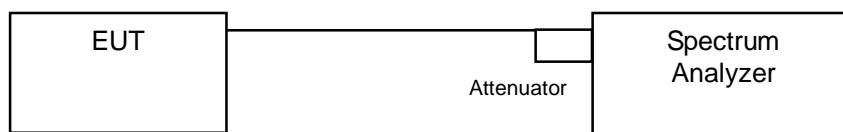


## 4.5 Conducted Out of Band Emission Measurement

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

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

### 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 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.

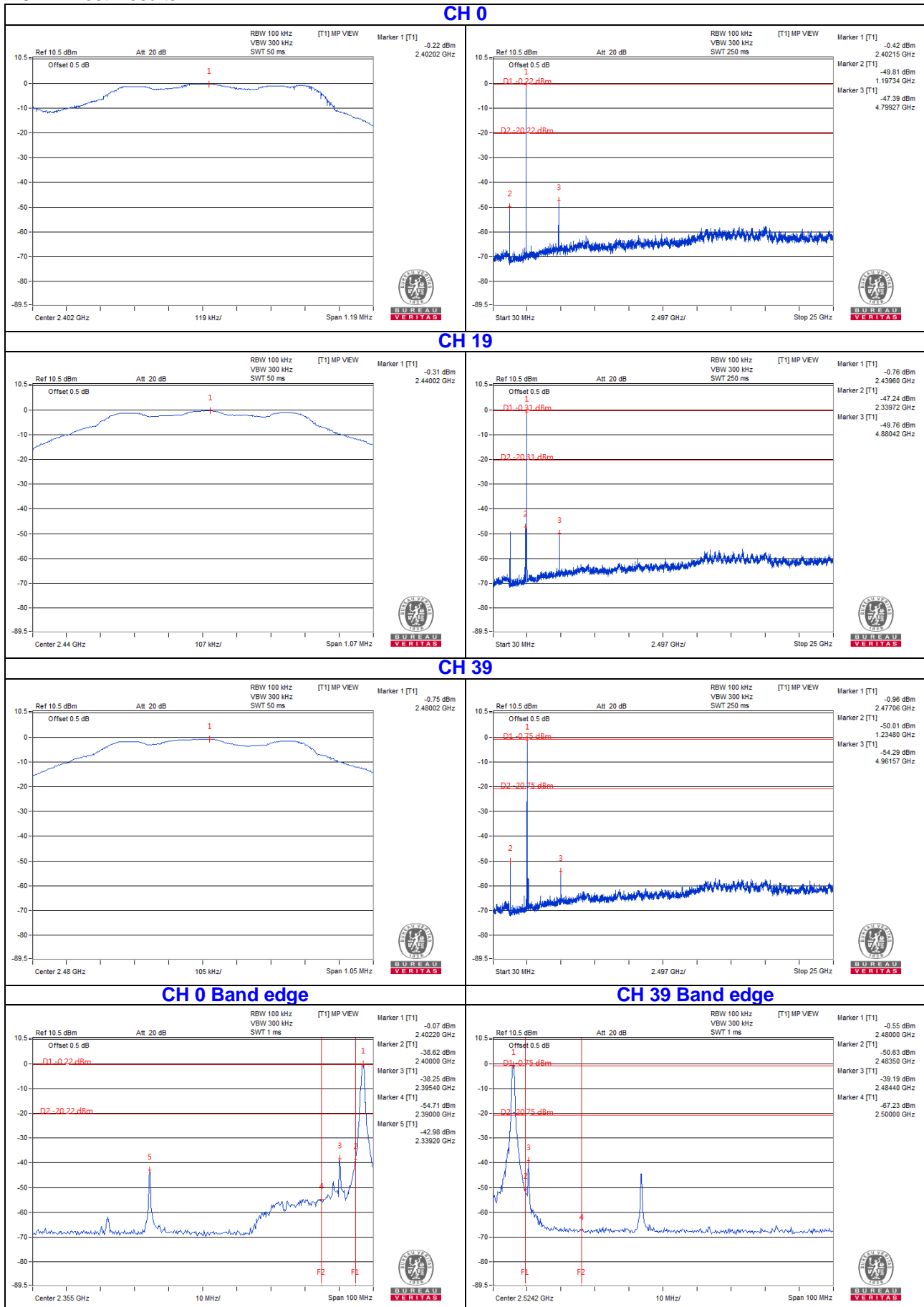
### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Condition

Same as Item 4.2.6

## 4.5.7 Test Results



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

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

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

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

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