

## FCC Test Report

**Report No.:** RF180323C16-2

**FCC ID:** 2APRXH2C

**Test Model:** H2C

**Series Model:** H3C (refer to item 3.1 for more details)

**Received Date:** Mar. 23, 2018

**Test Date:** Apr. 02 ~ Apr. 18, 2018

**Issued Date:** Apr. 25, 2018

**Applicant:** Western Digital Technologies, Inc

**Address:** 3355 Michelson Dr #100, Irvine, CA 92612

**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.

**Test Location (1):** No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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

**FCC Registration/  
Designation Number:** 788550 / TW0003



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

## 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	7
3.2 Description of Test Modes	9
3.2.1 Test Mode Applicability and Tested Channel Detail	10
3.3 Duty Cycle of Test Signal	11
3.4 Description of Support Units	12
3.4.1 Configuration of System under Test	12
3.5 General Description of Applied Standards	12
<b>4 Test Types and Results</b>	<b>13</b>
4.1 Radiated Emission and Bandedge Measurement	13
4.1.1 Limits of Radiated Emission and Bandedge Measurement	13
4.1.2 Test Instruments	14
4.1.3 Test Procedures	15
4.1.4 Deviation from Test Standard	15
4.1.5 Test Set Up	16
4.1.6 EUT Operating Conditions	17
4.1.7 Test Results	18
4.2 Conducted Emission Measurement	22
4.2.1 Limits of Conducted Emission Measurement	22
4.2.2 Test Instruments	22
4.2.3 Test Procedures	23
4.2.4 Deviation from Test Standard	23
4.2.5 Test Setup	23
4.2.6 EUT Operating Conditions	23
4.2.7 Test Results	24
4.3 6dB Bandwidth Measurement	26
4.3.1 Limits of 6dB Bandwidth Measurement	26
4.3.2 Test Setup	26
4.3.3 Test Instruments	26
4.3.4 Test Procedure	26
4.3.5 Deviation from Test Standard	26
4.3.6 EUT Operating Conditions	26
4.3.7 Test Result	27
4.4 Conducted Output Power Measurement	28
4.4.1 Limits of Conducted Output Power Measurement	28
4.4.2 Test Setup	28
4.4.3 Test Instruments	28
4.4.4 Test Procedures	28
4.4.5 Deviation from Test Standard	28
4.4.6 EUT Operating Conditions	28
4.4.7 Test Results	28
4.5 Power Spectral Density Measurement	29
4.5.1 Limits of Power Spectral Density Measurement	29
4.5.2 Test Setup	29
4.5.3 Test Instruments	29
4.5.4 Test Procedure	29
4.5.5 Deviation from Test Standard	29
4.5.6 EUT Operating Condition	29

4.5.7 Test Results .....	30
4.6 Conducted Out of Band Emission Measurement.....	31
4.6.1 Limits of Conducted Out of Band Emission Measurement .....	31
4.6.2 Test Setup.....	31
4.6.3 Test Instruments .....	31
4.6.4 Test Procedure .....	31
4.6.5 Deviation from Test Standard .....	32
4.6.6 EUT Operating Condition .....	32
4.6.7 Test Results .....	32
<b>5 Pictures of Test Arrangements.....</b>	<b>34</b>
<b>Appendix – Information on the Testing Laboratories .....</b>	<b>35</b>

### Release Control Record

Issue No.	Description	Date Issued
RF180323C16-2	Original release	Apr. 25, 2018

## 1 Certificate of Conformity

**Product:** ibi Wireless

**Brand:** SanDisk

**Test Model:** H2C

**Series Model:** H3C (refer to item 3.1 for more details)

**Sample Status:** Engineering sample

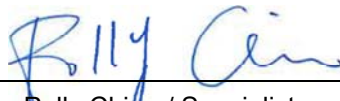
**Applicant:** Western Digital Technologies, Inc

**Test Date:** Apr. 02 ~ Apr. 18, 2018

**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 :**



Polly Chien / Specialist

**Date:**

Apr. 25, 2018

**Approved by :**



Bruce Chen / Project Engineer

**Date:**

Apr. 25, 2018

## 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 -10.75dB at 0.16955MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -10.5dB at 894.08MHz.
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) ( $\pm$ )
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	3.89 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.77 dB
	6GHz ~ 40GHz	5.48 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	ibi Wireless
Brand	SanDisk
Model	H2C
Series Model	H3C
Model Difference	Refer to Note
Sample Status	Engineering sample
Power Supply Rating	12dc (Adapter)
Modulation Type	GFSK
Transfer Rate	1Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Channel Spacing	2MHz
Output Power	3.758mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	Adapter
Data Cable Supplied	NA

Note:

1. All models are listed as below. Model H2C is the representative for final test.

Model	HDD Capacity	AC adapter	Interface	Remark
H2C	1TB	12V / 1.5A	USB & DC in	H3C & H2C share identical PCB, with H3C being the de-populated version without USB port. H2C/ H3C are available with 1GB/ 512MB RAM, respectively.
	2TB			
	4TB			
H3C	500GB	12V / 1.0A	DC in	

2. The following antennas were provided to the EUT.

Ant. Type	PCB
Connector Type	NA
Antenna Gain (dBi)	
Item	2.4G
Ant. 1	<b>2.14</b>
Ant. 2	0.78

\* The maximum antenna gain is chosen for final test.

3. The EUT consumes power from the following Adapters

#### For H3C

Adapter 1	
Brand	Ktec
Model	KSAS0181200100HU
Input Power	100-240Vac, 50/60Hz, 0.5A
Output Power	12Vdc, 1.0A
Power Line	1.5m cable without core attached on adapter

Adapter 2	
Brand	Ktec
Model	KSAS0181200100D5
Input Power	100-240Vac, 50/60Hz, 0.5A
Output Power	12Vdc, 1.0A
Power Line	1.5m cable without core attached on adapter

**For H2C**

Adapter 3	
Brand	Ktec
Model	KSA-24W-120150D5
Input Power	120-240Vac, 50/60Hz, 0.6A
Output Power	12Vdc, 1.5A
Power Line	1.8m cable with 1 core attached on adapter

Adapter 4	
Brand	Asian Power Devices Inc.
Model	WB-18R12R
Input Power	120-240Vac, 50/60Hz, 0.6A Max.
Output Power	12Vdc, 1.5A
Power Line	1.75m cable without core attached on adapter

Adapter 5	
Brand	Asian Power Devices Inc.
Model	WB-18R12FU
Input Power	120-240Vac, 50/60Hz, 0.6A Max.
Output Power	12Vdc, 1.5A
Power Line	1.75m cable without core attached on adapter

Adapter 6	
Brand	Ktec
Model	KSA-24W-120150HU
Input Power	120-240Vac 50/60Hz 0.6A
Output Power	12Vdc 1.5A
Power Line	1.8m cable without core attached on adapter

4. \* Adapter 1 & 2, 3 & 6, 4 & 5 are identical with each other except for their Plug Type difference, therefore adapter 4 was the worst case, therefore chosen for final tests and presented in the test report.
5. WLAN 2.4GHz, 5GHz and BT LE technology cannot transmit at same time.



### 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	
-	√	√	√	√	-

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

#### 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	19	GFSK	1

#### Power Line Conducted Emission Test:

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
-	0 to 39	19	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

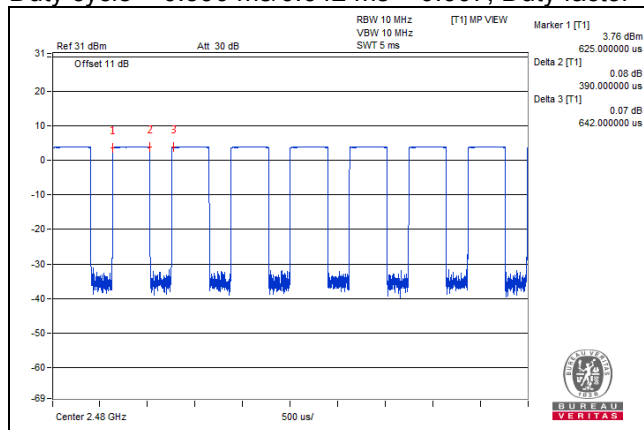
### Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	25 deg. C, 77% RH	120Vac, 60Hz	James Wei
RE $<$ 1G	22 deg. C, 79% RH	120Vac, 60Hz	James Wei
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Jones Chang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Frank Chiu

### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98%.

Duty cycle =  $0.390 \text{ ms} / 0.642 \text{ ms} = 0.607$ , Duty factor =  $10 * \log(1/0.607) = 2.17$



### 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.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB Flash	HP	v250W	01	NA	For PLC & APCM test
	USB Flash	HP	v250w	NA	NA	For RE test

#### 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 DTS Meas Guidance v04**

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 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
HP Preamplifier	8447D	2432A03504	Feb. 21, 2018	Feb. 20, 2019
HP Preamplifier	8449B	3008A01201	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 06, 2018	Feb. 05, 2019
Schwarzbeck Antenna	VULB 9168	139	Nov. 29, 2017	Nov. 28, 2018
Schwarzbeck Antenna	VHBA 9123	480	May 19, 2017	May 18, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 01, 2017	Nov. 30, 2018
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Dec. 01, 2017	Nov. 30, 2018
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Loop Antenna EMCI	LPA600	270	Aug. 11, 2017	Aug. 10, 2019
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 14, 2017	Aug. 13, 2018
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 14, 2017	Aug. 13, 2018
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	May 31, 2017	May 30, 2018
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Jul. 26, 2017	Jul. 25, 2018
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
EMCO Horn Antenna	3115	00028257	Nov. 30, 2017	Nov. 29, 2018
High Speed Peak Power Meter	ML2495A	0824012	Aug. 18, 2017	Aug. 17, 2018
Power Sensor	MA2411B	0738171	Aug. 18, 2017	Aug. 17, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Dec. 12, 2017	Dec. 11, 2018

- 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 test was performed in HwaYa Chamber 3 (PLC & APCM test) and in Lin Kou Chamber No. 6 (RE test).
  3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  4. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
  5. The IC Site Registration No. is IC 7450F-3.

#### 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:

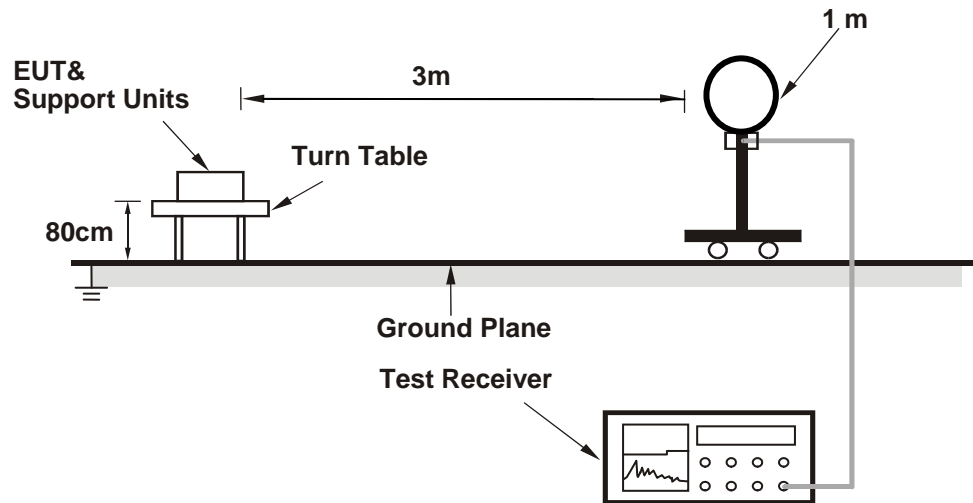
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 3 x RBW (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

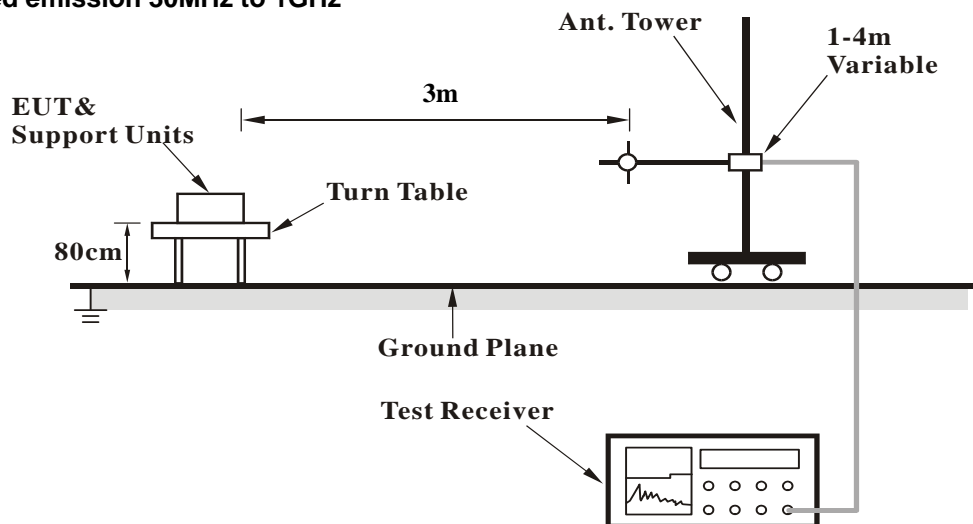
No deviation.

#### 4.1.5 Test Set Up

##### For Radiated emission below 30MHz

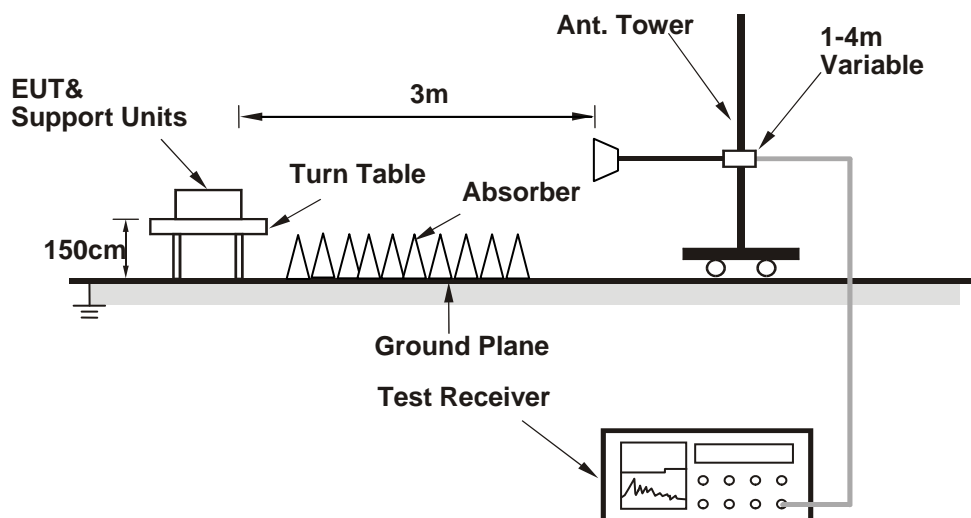


##### For Radiated emission 30MHz to 1GHz





### 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

- Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

Above 1GHz worst-case data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	53.2 PK	74.0	-20.8	2.45 H	262	55.60	-2.38
2	2390.00	40.2 AV	54.0	-13.8	2.45 H	262	42.60	-2.38
3	*2402.00	97.5 PK			2.45 H	262	99.92	-2.47
4	*2402.00	96.5 AV			2.45 H	262	99.01	-2.47
5	4804.00	44.3 PK	74.0	-29.7	1.00 H	22	41.02	3.30
6	4804.00	33.6 AV	54.0	-20.4	1.00 H	22	30.31	3.30
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	51.9 PK	74.0	-22.1	2.44 V	256	54.29	-2.38
2	2390.00	39.9 AV	54.0	-14.1	2.44 V	256	42.26	-2.38
3	*2402.00	96.5 PK			2.44 V	256	98.97	-2.47
4	*2402.00	95.9 AV			2.44 V	256	98.32	-2.47
5	4804.00	43.3 PK	74.0	-30.7	1.60 V	256	39.98	3.30
6	4804.00	32.6 AV	54.0	-21.4	1.60 V	256	29.29	3.30

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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	98.3 PK			2.44 H	199	100.91	-2.65
2	*2440.00	97.5 AV			2.44 H	199	100.15	-2.65
3	4880.00	44.7 PK	74.0	-29.3	1.00 H	35	41.38	3.33
4	4880.00	33.9 AV	54.0	-20.1	1.00 H	35	30.59	3.33
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	97.2 PK			2.46 V	247	99.81	-2.65
2	*2440.00	96.4 AV			2.46 V	247	99.03	-2.65
3	4880.00	43.5 PK	74.0	-30.5	1.66 V	255	40.21	3.33
4	4880.00	32.8 AV	54.0	-21.3	1.66 V	255	29.42	3.33

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)
FREQUENCY RANGE	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	97.9 PK			3.44 H	248	100.18	-2.29
2	*2480.00	97.1 AV			3.44 H	248	99.38	-2.29
3	2483.50	52.2 PK	74.0	-21.8	3.44 H	248	54.42	-2.24
4	2483.50	39.7 AV	54.0	-14.3	3.44 H	248	41.93	-2.24
5	4960.00	44.5 PK	74.0	-29.5	1.52 H	33	41.29	3.17
6	4960.00	33.6 AV	54.0	-20.4	1.52 H	33	30.44	3.17
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	96.7 PK			2.11 V	257	99.03	-2.29
2	*2480.00	96.3 AV			2.11 V	257	98.57	-2.29
3	2483.50	51.8 PK	74.0	-22.2	2.11 V	257	54.01	-2.24
4	2483.50	39.2 AV	54.0	-14.8	2.11 V	257	41.42	-2.24
5	4960.00	43.3 PK	74.0	-30.8	1.71 V	233	40.08	3.17
6	4960.00	32.5 AV	54.0	-21.5	1.71 V	233	29.33	3.17

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	9kHz ~ 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	50.18	21.2 QP	40.0	-18.8	2.71 H	357	28.20	-7.03
2	112.67	16.9 QP	43.5	-26.6	2.28 H	160	27.10	-10.19
3	528.14	28.2 QP	46.0	-17.8	2.12 H	352	28.63	-0.45
4	641.88	26.9 QP	46.0	-19.1	2.09 H	350	24.94	2.00
5	780.39	34.2 QP	46.0	-11.8	2.22 H	99	29.74	4.44
6	894.08	35.6 QP	46.0	-10.5	2.01 H	162	29.81	5.74
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	49.30	20.1 QP	40.0	-19.9	1.02 V	80	27.22	-7.08
2	100.23	11.5 QP	43.5	-32.0	2.22 V	224	23.39	-11.87
3	523.97	25.5 QP	46.0	-20.5	2.08 V	135	25.93	-0.46
4	612.39	30.7 QP	46.0	-15.3	2.03 V	142	29.17	1.49
5	748.43	30.1 QP	46.0	-15.9	2.29 V	350	26.42	3.72
6	799.50	32.8 QP	46.0	-13.2	2.65 V	297	28.30	4.47

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 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: Apr. 18, 2018

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 06, 2018	Mar. 05, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
Software ADT	BV ADT_Cond_ V7.3.7.3	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-2040.

### 4.2.3 Test Procedures

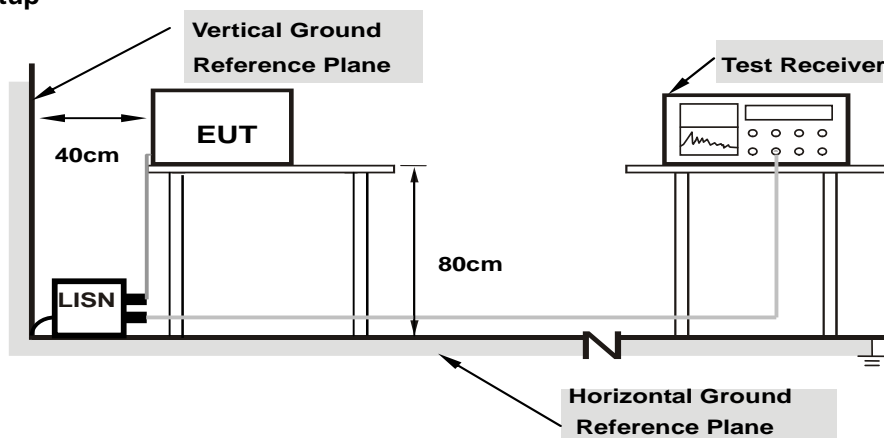
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

### 4.2.4 Deviation from Test Standard

No deviation.

### 4.2.5 Test Setup



**Note:** 1.Support units were connected to second LISN.

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

### 4.2.6 EUT Operating Conditions

Same as 4.1.6.

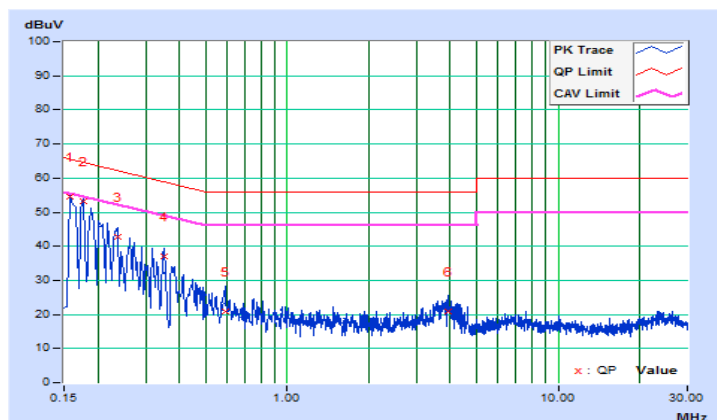
#### 4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15782	10.16	44.52	26.01	54.68	36.17	65.58	55.58	-10.90	-19.41
2	0.17698	10.16	43.01	27.98	53.17	38.14	64.63	54.63	-11.46	-16.49
3	0.23602	10.16	32.59	20.73	42.75	30.89	62.24	52.24	-19.49	-21.35
4	0.34926	10.19	26.97	20.83	37.16	31.02	58.98	48.98	-21.82	-17.96
5	0.58792	10.20	10.55	3.84	20.75	14.04	56.00	46.00	-35.25	-31.96
6	3.90751	10.34	10.51	0.65	20.85	10.99	56.00	46.00	-35.15	-35.01

#### 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.



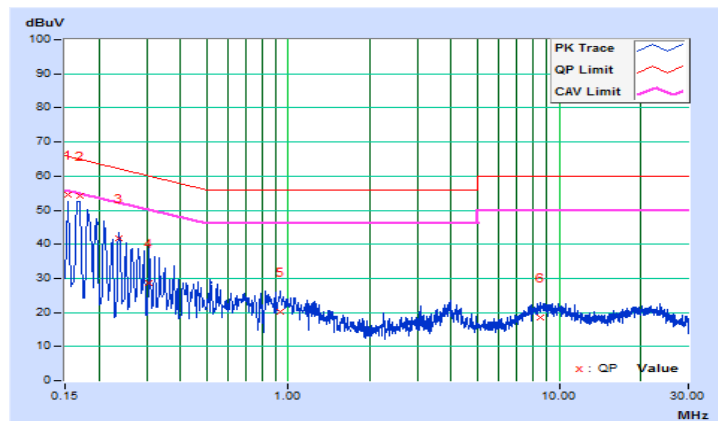


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.15	44.37	29.52	54.52	39.67	65.79	55.79	-11.27	-16.12
2	<b>0.16955</b>	<b>10.15</b>	<b>44.08</b>	<b>30.24</b>	<b>54.23</b>	<b>40.39</b>	<b>64.98</b>	<b>54.98</b>	<b>-10.75</b>	<b>-14.59</b>
3	0.23648	10.17	31.70	18.53	41.87	28.70	62.22	52.22	-20.35	-23.52
4	0.30640	10.18	18.56	3.59	28.74	13.77	60.07	50.07	-31.33	-36.30
5	0.93982	10.20	10.01	4.67	20.21	14.87	56.00	46.00	-35.79	-31.13
6	8.52913	10.51	8.14	1.88	18.65	12.39	60.00	50.00	-41.35	-37.61

#### 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.

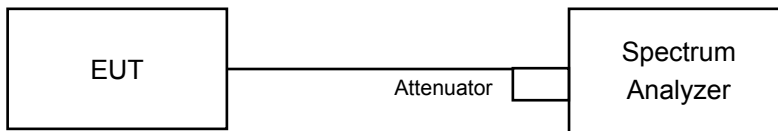


### 4.3 6dB Bandwidth Measurement

#### 4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB 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

- 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

#### 4.3.5 Deviation from Test Standard

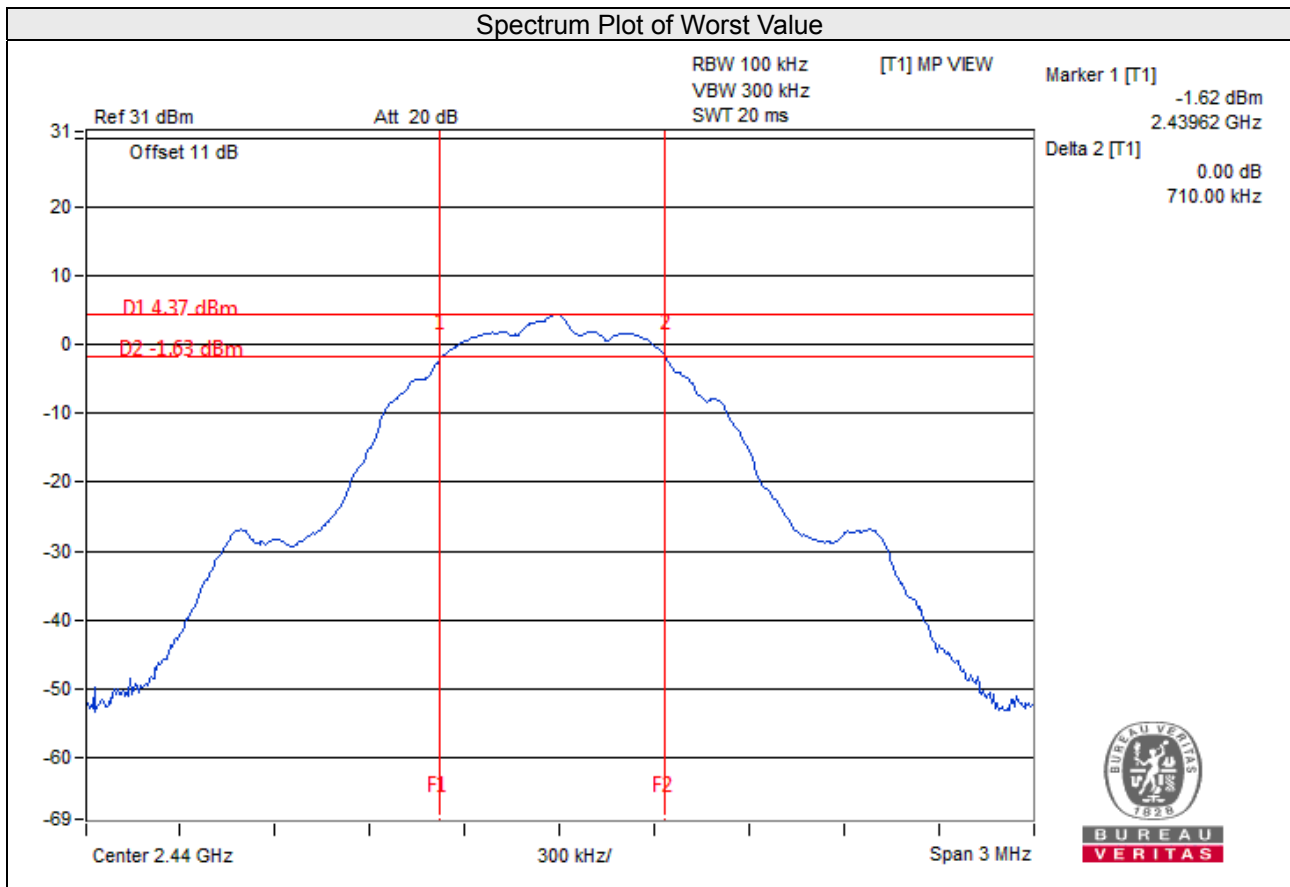
No deviation.

#### 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 Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.69	0.5	Pass
19	2440	0.71	0.5	Pass
39	2480	0.71	0.5	Pass

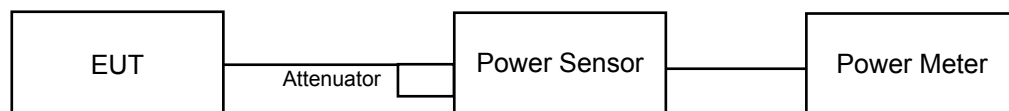


## 4.4 Conducted Output Power Measurement

### 4.4.1 Limits of Conducted Output Power Measurement

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

### 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 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..

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

### 4.4.7 Test Results

#### For Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	3.690	5.67	30	Pass
19	2440	<b>3.758</b>	5.75	30	Pass
39	2480	3.076	4.88	30	Pass

#### For Average Power

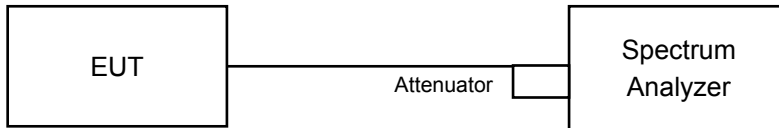
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	3.177	5.02
19	2440	3.214	5.07
39	2480	2.512	4.00

## 4.5 Power Spectral Density Measurement

### 4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

### 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

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

### 4.5.5 Deviation from Test Standard

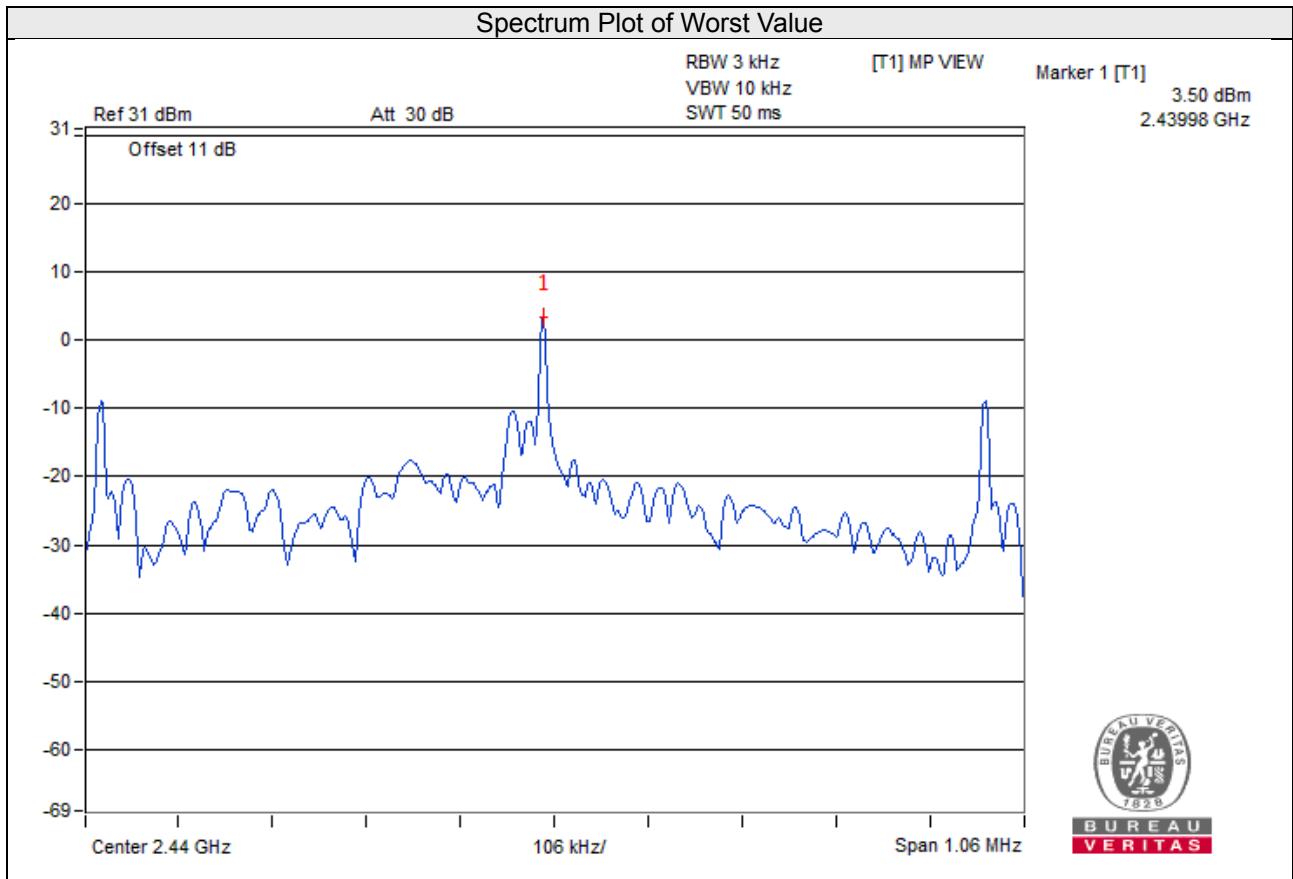
No deviation.

### 4.5.6 EUT Operating Condition

Same as Item 4.3.6

#### 4.5.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	2402	3.42	8.00	Pass
19	2440	3.50	8.00	Pass
39	2480	2.41	8.00	Pass

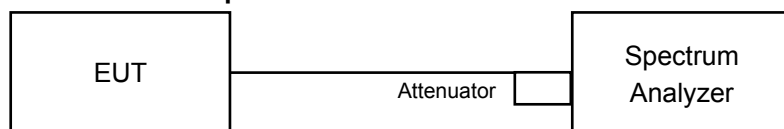


## 4.6 Conducted Out of Band Emission Measurement

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

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

### 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

#### MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW  $\geq$  300 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

#### MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW  $\geq$  300 kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

#### **4.6.5 Deviation from Test Standard**

No deviation.

#### **4.6.6 EUT Operating Condition**

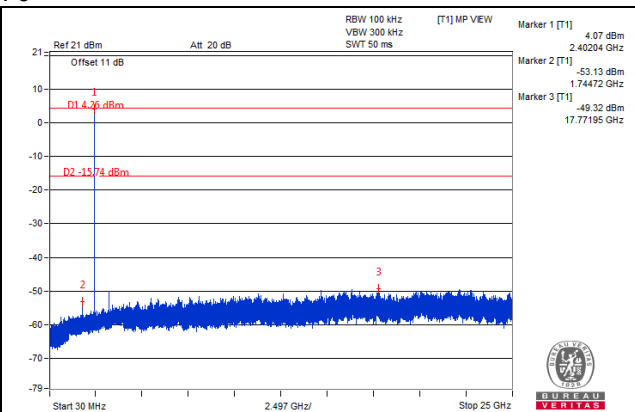
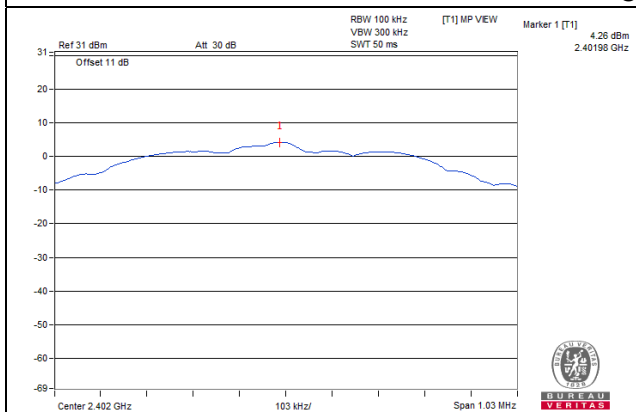
Same as Item 4.3.6

#### **4.6.7 Test Results**

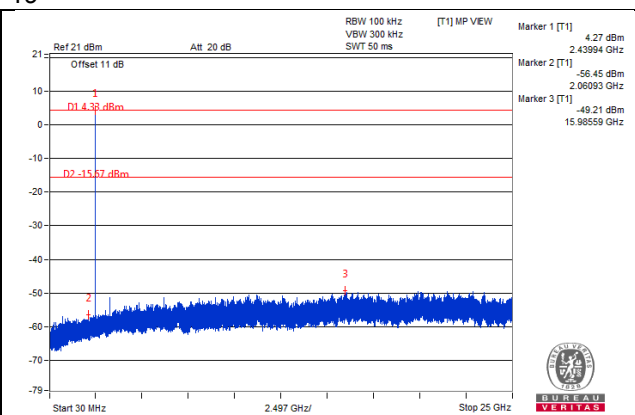
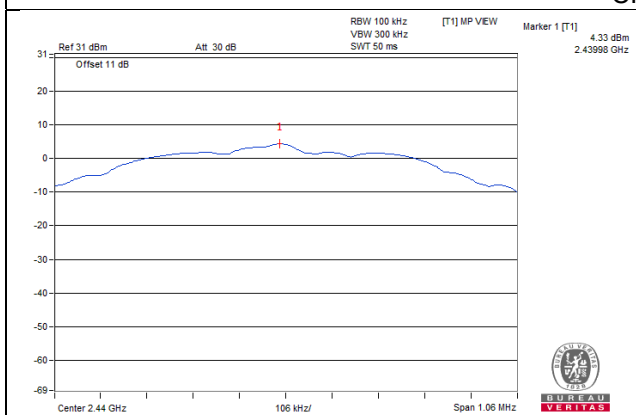
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



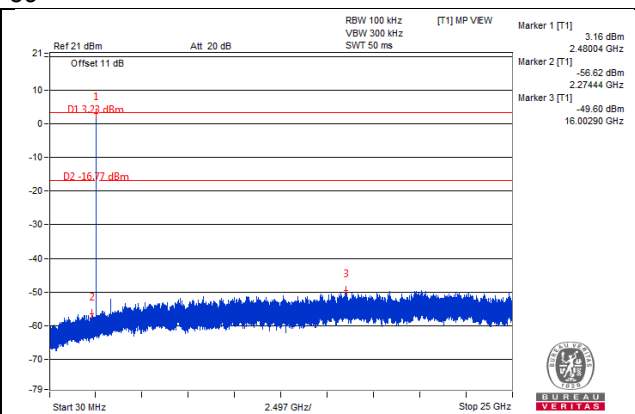
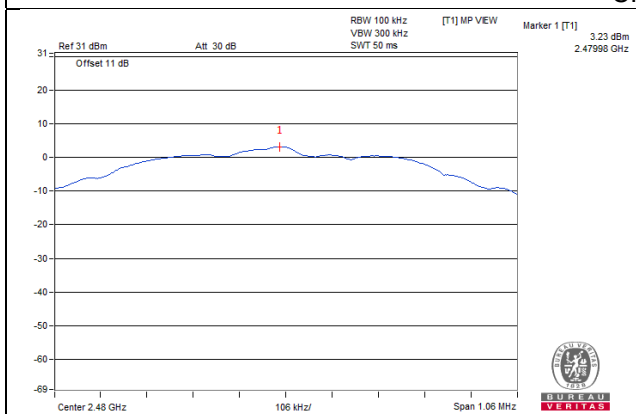
## CH 0



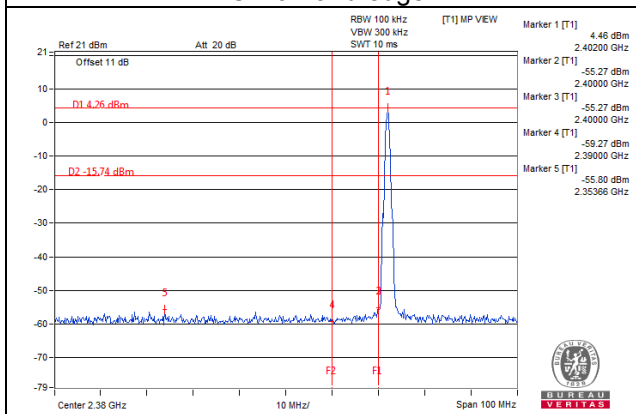
## CH 19



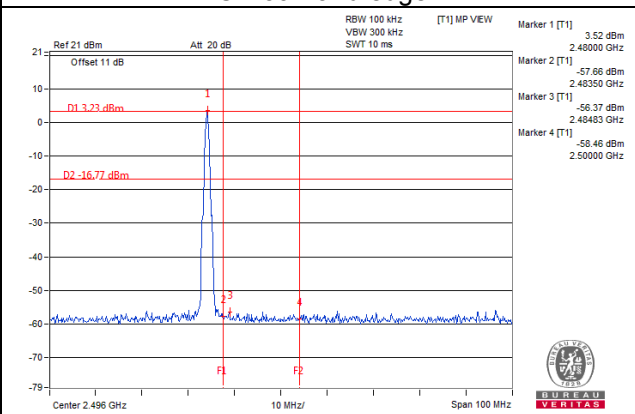
## CH 39



## CH 0 Band edge



## CH 39 Band edge



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

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

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

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-6668565

Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety Lab**

Tel: 886-3-3183232

Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

--- END ---