

## FCC Test Report

**Report No.:** RF140107C15L-3

**FCC ID:** JNF-Z-224X

**Test Model:** Z-2242

**Series Model:** Z-2240

**Received Date:** Dec. 26, 2013

**Test Date:** Jun. 04 ~ Aug. 26, 2015 (For all tests except AC Power Conducted Emission & Radiated Emissions (Frequency below 1GHz))

Dec. 01, 2015 ~ Jan. 31, 2016 (For AC Power Conducted Emission & Radiated Emissions (Frequency below 1GHz))

**Issued Date:** Feb. 02, 2016

**Applicant:** ZEBEX INDUSTRIES INC.

**Address:** B1F.-1, No. 207, Sec. 3, Beixin Rd, Xindian Dist, New Taipei City 23143, Taiwan

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



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. The report must 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> .....	4
<b>1 Certificate of Conformity</b> .....	5
<b>2 Summary of Test Results</b> .....	6
2.1 Measurement Uncertainty.....	6
2.2 Modification Record .....	6
<b>3 General Information</b> .....	7
3.1 General Description of EUT .....	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 .....	11
3.3.1 Configuration of System under Test .....	11
3.4 General Description of Applied Standards .....	12
<b>4 Test Types and Results</b> .....	13
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.....	16
4.1.4 Deviation from Test Standard .....	16
4.1.5 Test Set Up .....	17
4.1.6 EUT Operating Conditions.....	17
4.1.7 Test Results .....	18
4.2 Conducted Emission Measurement.....	23
4.2.1 Limits of Conducted Emission Measurement .....	23
4.2.2 Test Instruments .....	23
4.2.3 Test Procedures.....	24
4.2.4 Deviation from Test Standard .....	24
4.2.5 TEST SETUP .....	24
4.2.6 EUT Operating Conditions.....	24
4.2.7 Test Results .....	25
4.3 6dB Bandwidth Measurement.....	27
4.3.1 Limits of 6dB Bandwidth Measurement.....	27
4.3.2 Test Setup.....	27
4.3.3 Test Instruments .....	27
4.3.4 Test Procedure .....	27
4.3.5 Deviation from Test Standard .....	27
4.3.6 EUT Operating Conditions.....	27
4.3.7 Test Result.....	28
4.4 Conducted Output Power Measurement.....	29
4.4.1 Limits OF Conducted Output Power Measurement .....	29
4.4.2 Test Setup.....	29
4.4.3 Test Instruments .....	29
4.4.4 Test Procedures.....	29
4.4.5 Deviation from Test Standard .....	29
4.4.6 EUT Operating Conditions.....	29
4.4.7 Test Results .....	29
4.5 Power Spectral Density Measurement.....	30
4.5.1 Limits of Power Spectral Density Measurement .....	30
4.5.2 Test Setup.....	30
4.5.3 Test Instruments .....	30
4.5.4 Test Procedure .....	30
4.5.5 Deviation from Test Standard .....	30
4.5.6 EUT Operating Condition .....	30
4.5.7 Test Results .....	31

4.6	Conducted Out of Band Emission Measurement.....	32
4.6.1	Limits of Conducted Out of Band Emission Measurement .....	32
4.6.2	Test Setup.....	32
4.6.3	Test Instruments .....	32
4.6.4	Test Procedure .....	32
4.6.5	Deviation from Test Standard .....	32
4.6.6	EUT Operating Condition .....	32
4.6.7	Test result .....	33
<b>5</b>	<b>Pictures of Test Arrangements.....</b>	<b>34</b>
<b>Appendix – Information on the Testing Laboratories .....</b>		<b>35</b>



A D T

### Release Control Record

Issue No.	Description	Date Issued
RF140107C15L-3	Original release.	Feb. 02, 2016

## 1 Certificate of Conformity

**Product:** Rugged Mobile Handheld Computer

**Brand:** ZEBEX

**Test Model:** Z-2242

**Series Model:** Z-2240

**Sample Status:** MASS-PRODUCT

**Applicant:** ZEBEX INDUSTRIES INC.

**Test Date:** Jun. 04 ~ Aug. 26, 2015 (For all tests except AC Power Conducted Emission & Radiated Emissions (Frequency below 1GHz))

Dec. 01, 2015 ~ Jan. 31, 2016 (For AC Power Conducted Emission & Radiated Emissions (Frequency below 1GHz))

**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 :** Ivy Lin, **Date:** Feb. 02, 2016  
Ivy Lin / Specialist

**Approved by :** Ken Liu, **Date:** Feb. 02, 2016  
Ken Liu / Senior Manager

## 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 -11.83dB at 0.39609MHz.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -4.7dB at 177.44MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -8.5dB at 2483.50MHz.
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	Antenna connector is ipex not a standard connector.

### 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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.63 dB
	200MHz ~1000MHz	3.64 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Rugged Mobile Handheld Computer
Brand	ZEBEX
Test Model	Z-2242
Series Model	Z-2240
Model Difference	Refer to note as below
Status of EUT	Engineering sample
Power Supply Rating	3.7Vdc (Battery) 5.35Vdc (Adapter) 5.0Vdc (Cradle) 19Vdc (Wireless Power Charger)
Modulation Type	GFSK
Modulation Technology	1Mbps
Transfer Rate	2402 ~ 2480MHz
Operating Frequency	40
Number of Channel	2MHz
Output Power	1.762mW
Antenna Type	PIFA antenna with 2.20dBi gain
Antenna Connector	ipex
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. All brands and models are listed as below. After pretesting, the model of the Z-2242 was worst case and chosen for final test.

Brand	Model	Description	
ZEBEX	Z-2242	Barcode scanner	Marketing Different
	Z-2240	Non-barcode scanner	

## 2. The EUT contains the following accessories.

No.	Product	Brand	Model	Description	Remark
1	Adapter	Sunny COMPUTER TECHNOLOGY CO., LTD.	SYS1561-1105-1	Input: 100-240Vac, 1.0A MAX, 50-60Hz Output: +5.35Vdc/ 2A	Accessory
2	Battery 1	ETI CA Battery inc.	BP13-001080	Rating: 3.7Vdc Capacity, 3450mA Type: Li-ion	Accessory
3	Battery 2		BP14-001160		Accessory
4	Micro USB cable	-	-	1m shielded USB to Micro B cable without core	Accessory
5	Cradle 1	ZEBEX	CRD-40	Input: 5Vdc	Support unit
6	Wireless Power Charger	yardiX	CXT31106	Input: 19Vdc, 0.5A Output: 19Vdc, 0.5A	Support unit
7	Adapter (for Wireless Power Charger)	-	HNC190050U	Input: 100-240Vac, 50/60Hz, 0.35A Max Output: 19.0Vdc, 0.5A 1.55m cable with 1 core attached on adapter	Support unit

\* The Battery models are electrically identical, different model names are for marketing purpose. Battery 1 was chosen for final test.

3. 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)						
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 + adapter
B	-	√	-	-	EUT + Wireless power charger

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

**OTE:**

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane** for adapter mode and **X-plane** for Wireless power charger mode.
2. After pre-tested adapter, cradle and EUT only modes, we found adapter mode was the worst case, therefore chosen for final tests and presented in the test report.
3. "-": Means no effect.

#### 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)
A	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)
A, B	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)
A, B	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)
A	0 to 39	0, 19, 39	GFSK	1

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Ted Chang
RE<1G	18deg. C, 70%RH	120Vac, 60Hz	Nick Hsu
PLC	20deg. C, 70%RH	120Vac, 60Hz	Jones Chang
APCM	25deg. C, 60%RH, 25deg. C, 65%RH	120Vac, 60Hz	Leo Tsai, Bayu Chen

### 3.3 Description of Support Units

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

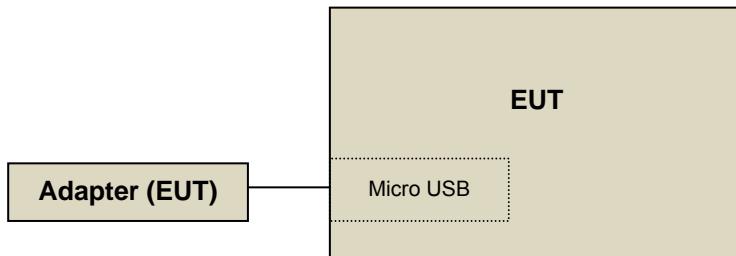
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Wireless Power Charger	yardiX	CXT31106	NA	NA	Provided by the manufacturer
B.	Adapter (for Wireless Power Charger)	NA	HNC190050U	NA	NA	Provided by the manufacturer

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

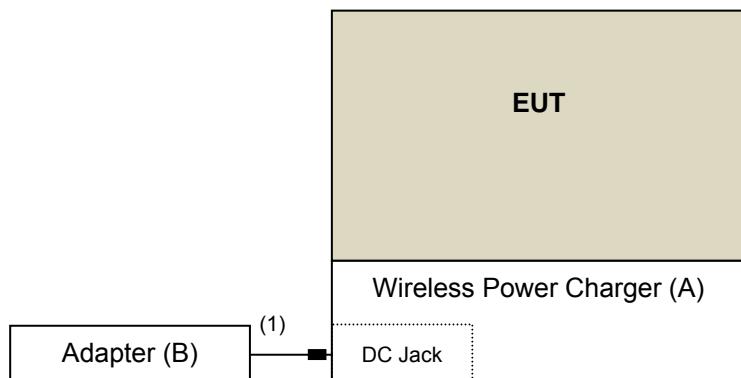
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	1.55	-	1	Provided by the manufacturer

#### 3.3.1 Configuration of System under Test

##### Test Mode A



##### Test Mode B



### 3.4 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)**

**558074 D01 DTS Meas Guidance v03r04**

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 (dB<sub>u</sub>V/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

Test date: Jun. 04 ~ Aug. 25, 2015

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Dec. 01, 2014	Nov. 30, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Mar. 30, 2015	Mar. 29, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Feb. 06, 2015	Feb. 05, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8449B	3008A01911	Aug. 09, 2014	Aug. 08, 2015
Preamplifier Agilent	8447D		Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	248780/4	Aug. 09, 2014	Aug. 08, 2015
RF signal cable		309222/4	Aug. 09, 2015	Aug. 08, 2016
Worken		274092/4	Aug. 11, 2014	Aug. 10, 2015
RF signal cable Worken	8D-FB	Cable-CH9-01	Aug. 11, 2015	Aug. 10, 2016
Software BV ADT	ADT_Radiated_V7.6.15.9.4		NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
High Speed Peak Power Meter	ML2495A	0824011	Jul. 26, 2014	Jul. 25, 2015
Power Sensor	MA2411B		Jul. 09, 2015	Jul. 08, 2016
		0738171	Jul. 26, 2014	Jul. 25, 2015
			Jul. 09, 2015	Jul. 08, 2016

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 215374.
5. The IC Site Registration No. is IC 7450F-9.

Test date: Dec. 01, 2015 ~ Jan. 31, 2016

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 10, 2015	Apr. 09, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Mar. 30, 2015	Mar. 29, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Feb. 02, 2015	Feb. 01, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8449B	3008A01911	Aug. 09, 2015	Aug. 08, 2016
Preamplifier Agilent	8447D	2944A10638	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-02(309222 +248780)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-03(274092)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 11, 2015	Aug. 10, 2016
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 215374.
5. The IC Site Registration No. is IC 7450F-9.

#### 4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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:**

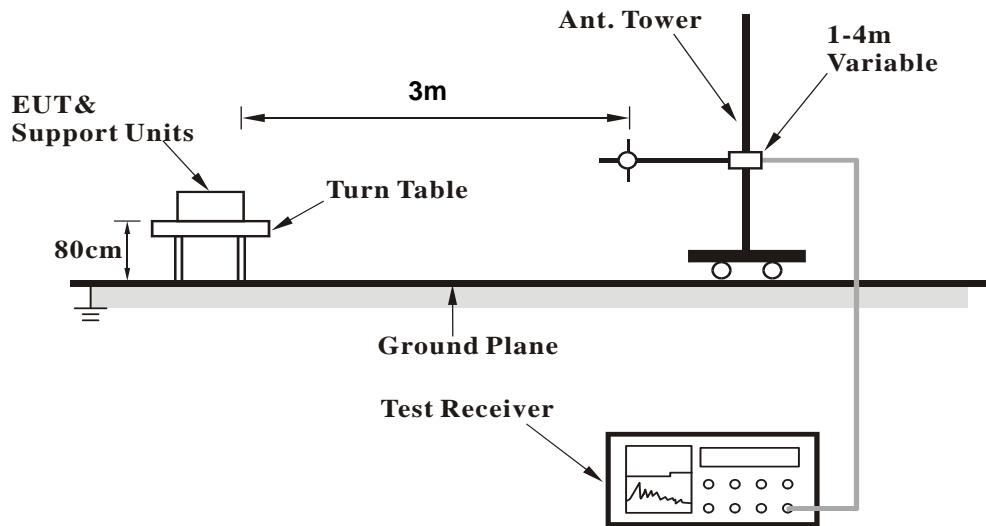
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

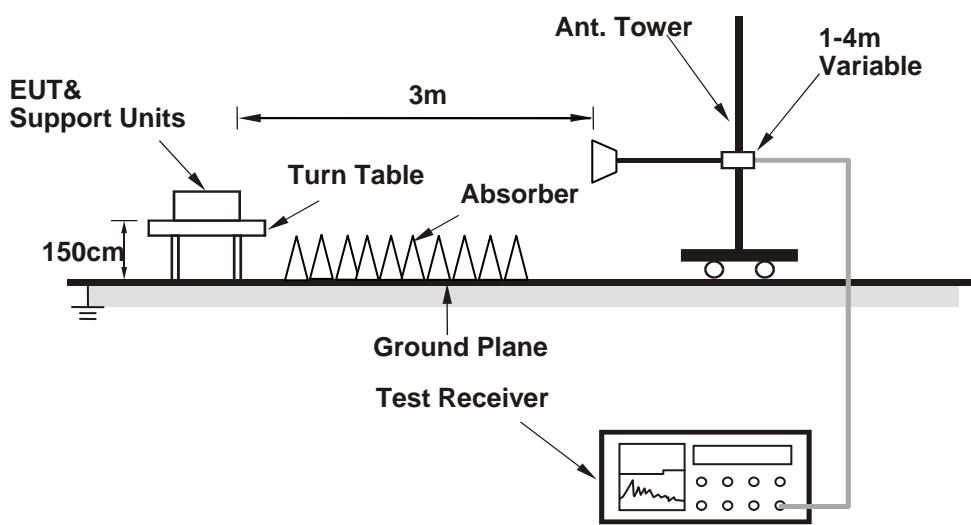
No deviation.

#### 4.1.5 Test Set Up

##### <Frequency Range below 1GHz>



##### <Frequency Range above 1GHz>



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

#### 4.1.6 EUT Operating Conditions

- The EUT powered by adapter and under charging mode.
- 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	58.0 PK	74.0	-16.0	1.17 H	190	25.00	33.00
2	2390.00	45.3 AV	54.0	-8.7	1.17 H	190	12.30	33.00
3	*2402.00	95.6 PK			1.19 H	190	62.60	33.00
4	*2402.00	78.4 AV			1.19 H	190	45.40	33.00
5	4804.00	46.5 PK	74.0	-27.5	1.18 H	207	44.70	1.80
6	4804.00	33.2 AV	54.0	-20.8	1.18 H	207	31.40	1.80
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	58.4 PK	74.0	-15.6	1.31 V	165	25.40	33.00
2	2390.00	45.3 AV	54.0	-8.7	1.31 V	165	12.30	33.00
3	*2402.00	91.8 PK			1.30 V	210	58.80	33.00
4	*2402.00	76.2 AV			1.30 V	210	43.20	33.00
5	4804.00	47.5 PK	74.0	-26.5	1.32 V	191	45.70	1.80
6	4804.00	33.3 AV	54.0	-20.7	1.32 V	191	31.50	1.80

## 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	96.5 PK			1.17 H	191	63.20	33.30
2	*2440.00	79.3 AV			1.17 H	191	46.00	33.30
3	4880.00	47.2 PK	74.0	-26.8	1.17 H	188	45.30	1.90
4	4880.00	33.0 AV	54.0	-21.0	1.17 H	188	31.10	1.90
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	93.3 PK			1.29 V	220	60.00	33.30
2	*2440.00	77.5 AV			1.29 V	220	44.20	33.30
3	4880.00	46.8 PK	74.0	-27.2	1.30 V	219	44.90	1.90
4	4880.00	33.0 AV	54.0	-21.0	1.30 V	219	31.10	1.90

**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	94.4 PK			1.00 H	193	61.00	33.40
2	*2480.00	78.1 AV			1.00 H	193	44.70	33.40
3	2483.50	57.7 PK	74.0	-16.3	1.16 H	178	24.30	33.40
4	2483.50	45.4 AV	54.0	-8.6	1.16 H	178	12.00	33.40
5	4960.00	46.7 PK	74.0	-27.3	1.38 H	191	44.50	2.20
6	4960.00	32.7 AV	54.0	-21.3	1.38 H	191	30.50	2.20
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	92.5 PK			1.31 V	216	59.10	33.40
2	*2480.00	76.6 AV			1.31 V	216	43.20	33.40
3	2483.50	58.2 PK	74.0	-15.8	1.08 V	220	24.80	33.40
4	2483.50	45.5 AV	54.0	-8.5	1.08 V	220	12.10	33.40
5	4960.00	46.2 PK	74.0	-27.8	1.25 V	240	44.00	2.20
6	4960.00	32.7 AV	54.0	-21.3	1.25 V	240	30.50	2.20

**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 Data:

<b>CHANNEL</b>	TX Channel 19	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		
<b>TEST MODE</b>	A		

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	30.00	26.3 QP	40.0	-13.7	1.00 H	4	42.30	-16.00
2	57.12	31.0 QP	40.0	-9.0	2.00 H	271	45.70	-14.70
3	134.89	24.5 QP	43.5	-19.0	1.00 H	299	39.40	-14.90
4	160.17	25.3 QP	43.5	-18.2	1.50 H	109	38.90	-13.60
5	189.33	33.9 QP	43.5	-9.6	1.50 H	81	49.70	-15.80
6	304.04	27.3 QP	46.0	-18.7	1.00 H	301	39.40	-12.10
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	30.00	28.1 QP	40.0	-11.9	1.49 V	8	44.10	-16.00
2	57.12	30.4 QP	40.0	-9.6	1.00 V	201	45.10	-14.70
3	111.56	25.6 QP	43.5	-17.9	1.00 V	349	42.70	-17.10
4	134.89	23.0 QP	43.5	-20.5	1.49 V	8	37.90	-14.90
5	189.33	31.3 QP	43.5	-12.2	1.00 V	295	47.10	-15.80
6	304.04	24.2 QP	46.0	-21.8	1.49 V	8	36.30	-12.10

## 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

<b>CHANNEL</b>	TX Channel 19	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)	
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz			
<b>TEST MODE</b>	B			

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	30.00	31.1 QP	40.0	-8.9	1.99 H	23	46.70	-15.60
2	82.38	32.1 QP	40.0	-7.9	1.49 H	55	50.80	-18.70
3	<b>177.44</b>	<b>38.8 QP</b>	<b>43.5</b>	<b>-4.7</b>	<b>1.49 H</b>	<b>280</b>	<b>53.50</b>	<b>-14.70</b>
4	272.50	30.4 QP	46.0	-15.6	1.00 H	302	43.70	-13.30
5	707.06	32.8 QP	46.0	-13.2	1.24 H	130	37.40	-4.60
6	891.36	34.6 QP	46.0	-11.4	1.49 H	120	35.80	-1.20
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	49.40	33.7 QP	40.0	-6.3	1.26 V	16	47.50	-13.80
2	82.38	32.5 QP	40.0	-7.5	1.00 V	240	51.20	-18.70
3	<b>177.44</b>	<b>35.1 QP</b>	<b>43.5</b>	<b>-8.4</b>	<b>2.00 V</b>	<b>6</b>	<b>49.80</b>	<b>-14.70</b>
4	315.18	26.6 QP	46.0	-19.4	1.26 V	52	38.60	-12.00
5	707.06	31.3 QP	46.0	-14.7	1.51 V	6	35.90	-4.60
6	778.84	36.8 QP	46.0	-9.2	1.26 V	322	39.60	-2.80

**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

## 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

Test date: Dec. 10, 2015

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS 30	100288	Apr. 27, 2015	Apr. 26, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2014	Dec. 29, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 21, 2015	Jul. 20, 2016
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 2.

3. The VCCI Site Registration No. is C-2047.

#### 4.2.3 Test Procedures

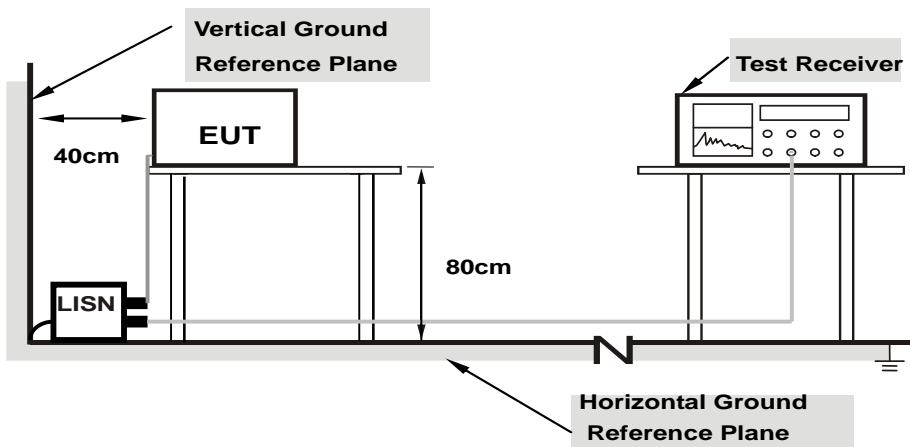
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

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

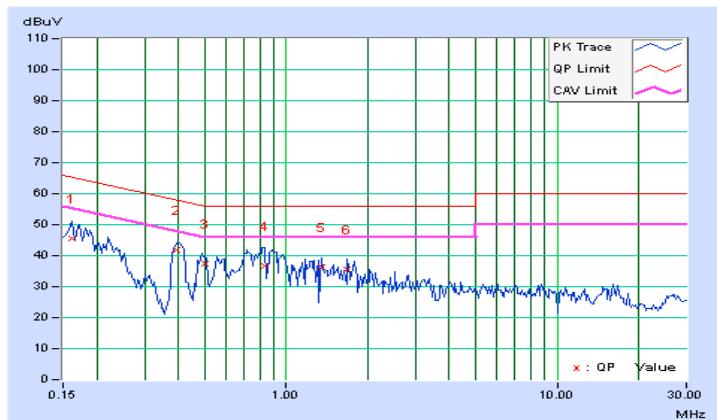
#### CONDUCTED WORST-CASE DATA

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	0.16172	9.94	35.68	27.09	45.62	37.03	65.38	55.38	-19.75	-18.34
2	<b>0.39609</b>	<b>9.95</b>	<b>31.78</b>	<b>26.15</b>	<b>41.73</b>	<b>36.10</b>	<b>57.93</b>	<b>47.93</b>	<b>-16.20</b>	<b>-11.83</b>
3	0.50156	9.97	27.55	18.34	37.52	28.31	56.00	46.00	-18.48	-17.69
4	0.82969	10.03	26.70	15.45	36.73	25.48	56.00	46.00	-19.27	-20.52
5	1.34375	10.10	26.02	16.71	36.12	26.81	56.00	46.00	-19.88	-19.19
6	1.67578	10.13	25.47	17.35	35.60	27.48	56.00	46.00	-20.40	-18.52

#### 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.

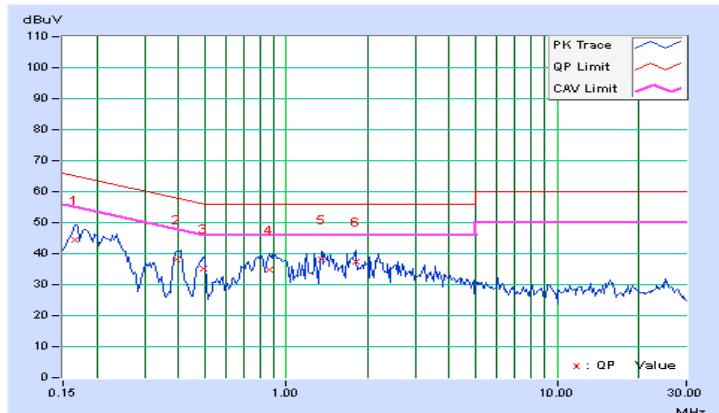


Phase	Neutral (N)		Detector Function		Quasi-Peak (QP) / Average (AV)	
-------	-------------	--	-------------------	--	--------------------------------	--

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	0.16562	9.95	34.42	24.39	44.37	34.34	65.18	55.18	-20.80	-20.83
2	0.39219	10.00	28.21	19.78	38.21	29.78	58.02	48.02	-19.81	-18.24
3	0.49766	10.01	25.13	16.34	35.14	26.35	56.04	46.04	-20.90	-19.69
4	0.86875	10.06	24.87	15.43	34.93	25.49	56.00	46.00	-21.07	-20.51
5	1.34766	10.12	27.89	18.80	38.01	28.92	56.00	46.00	-17.99	-17.08
6	1.80859	10.17	27.07	20.12	37.24	30.29	56.00	46.00	-18.76	-15.71

**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.

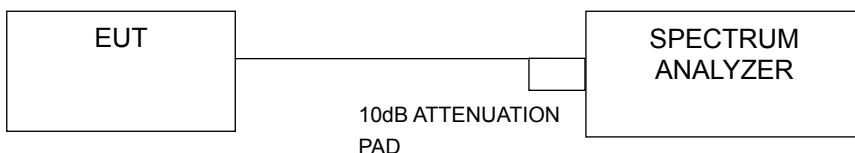


### 4.3 6dB Bandwidth Measurement

#### 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

- a. Set resolution bandwidth (RBW) = 100kHz
- 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

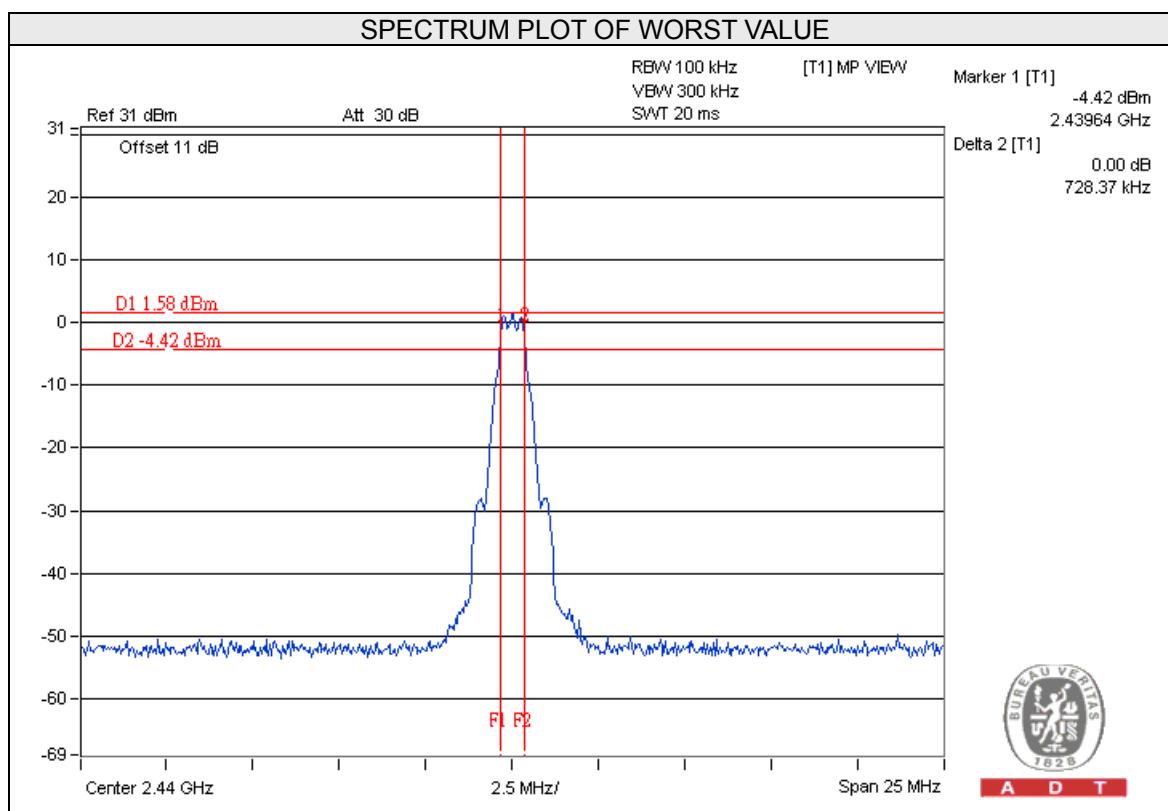
No deviation.

#### 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 Result

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.71	0.5	PASS
19	2440	0.73	0.5	PASS
39	2480	0.73	0.5	PASS

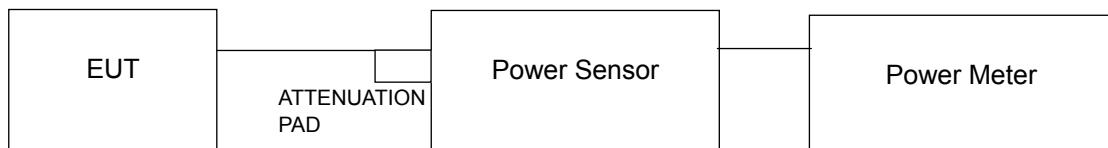


#### 4.4 Conducted Output Power Measurement

##### 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

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.

##### 4.4.5 Deviation from Test Standard

No deviation.

##### 4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

##### 4.4.7 Test Results

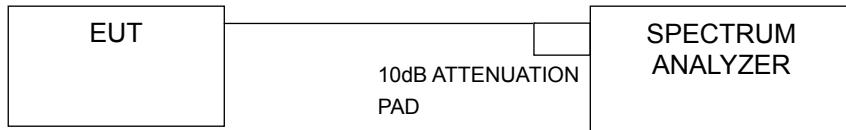
CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	1.199	0.79	30	PASS
19	2440	<b>1.762</b>	2.46	30	PASS
39	2480	1.247	0.96	30	PASS

## 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

- 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.

### 4.5.5 Deviation from Test Standard

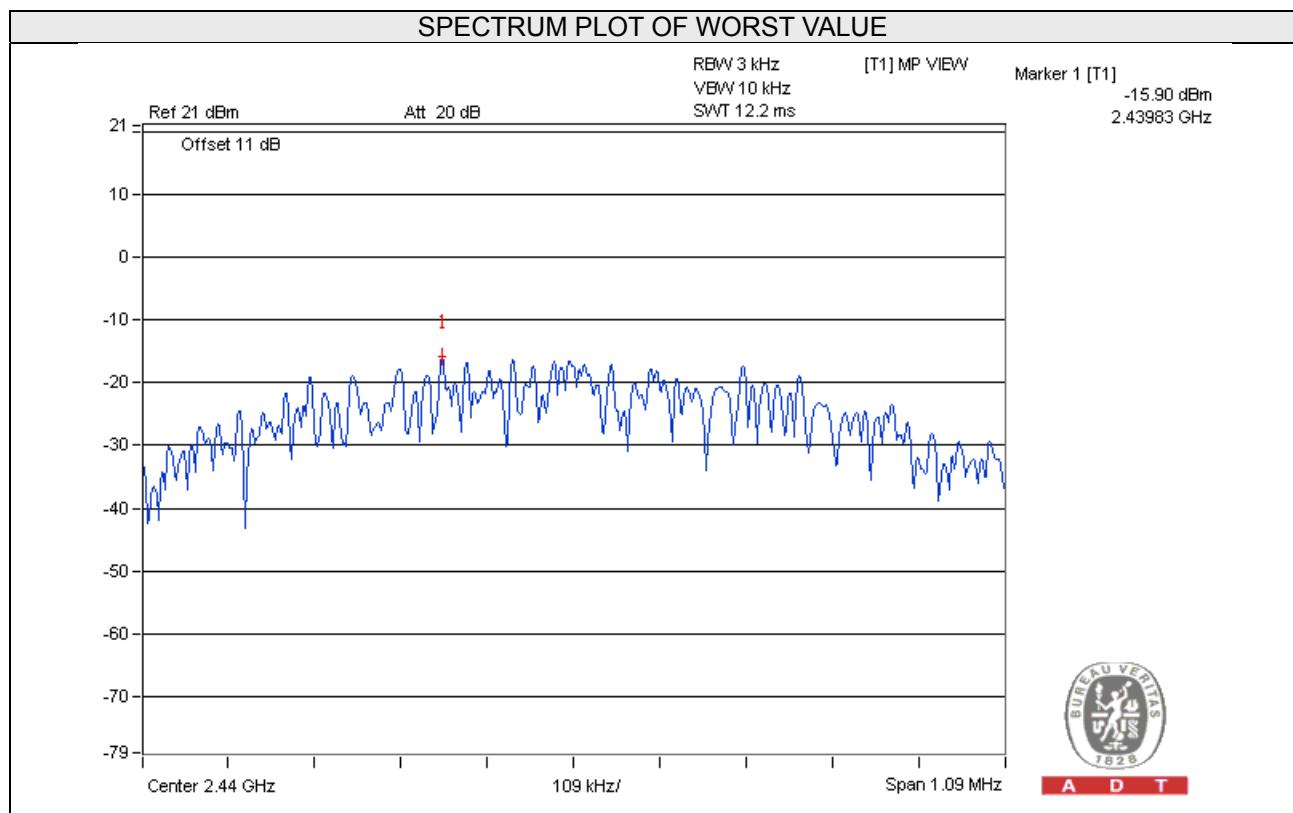
No deviation.

### 4.5.6 EUT Operating Condition

Same as Item 4.3.6

#### 4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-17.93	8	PASS
19	2440	-15.90	8	PASS
39	2480	-17.39	8	PASS

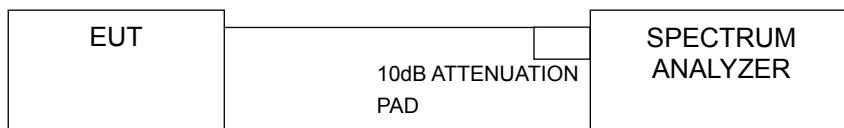


## 4.6 Conducted Out of Band Emission Measurement

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

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

1. Set the RBW =  $100\text{ kHz}$ .
2. Set the VBW  $\geq 300\text{ kHz}$ .
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  $100\text{ kHz}$  band segment within the fundamental EBW.

#### MEASUREMENT PROCEDURE OOB

1. Set RBW =  $100\text{ kHz}$ .
2. Set VBW  $\geq 300\text{ kHz}$ .
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.

### 4.6.5 Deviation from Test Standard

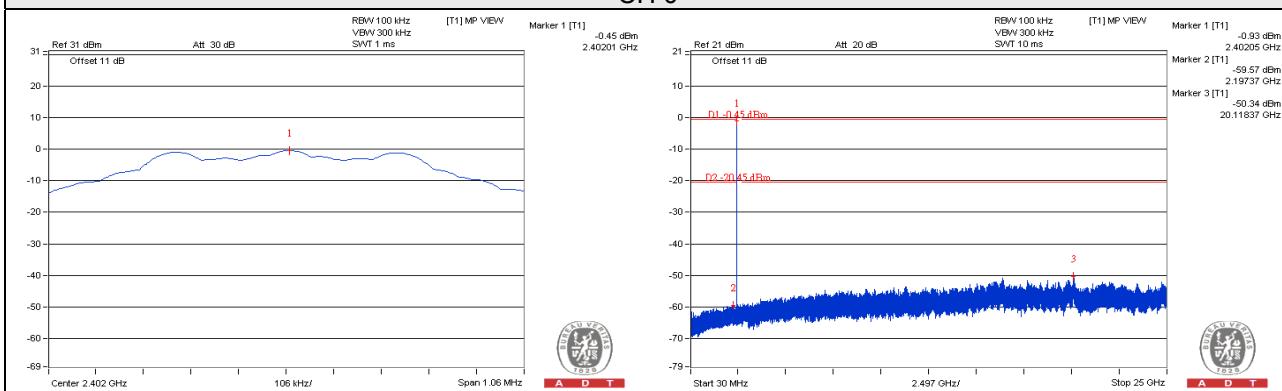
No deviation.

### 4.6.6 EUT Operating Condition

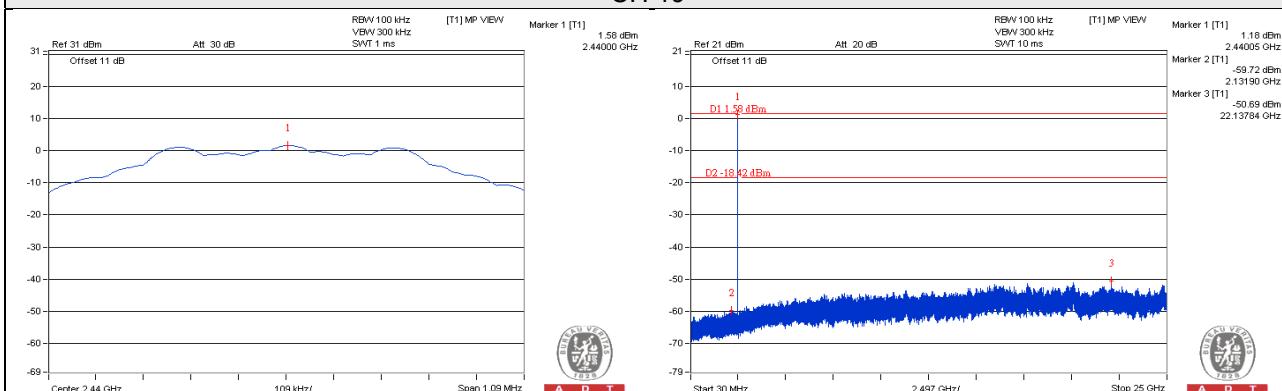
Same as Item 4.3.6

#### 4.6.7 Test result

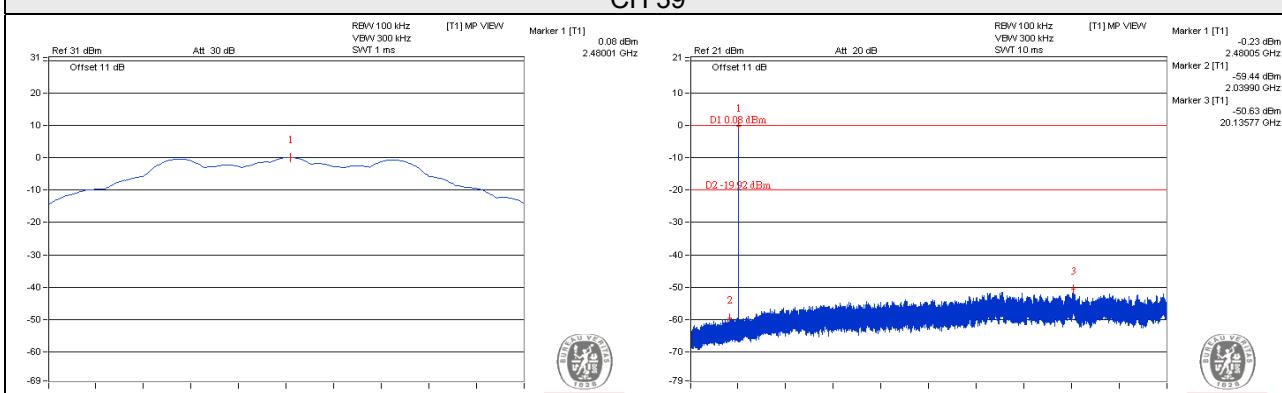
##### CH 0



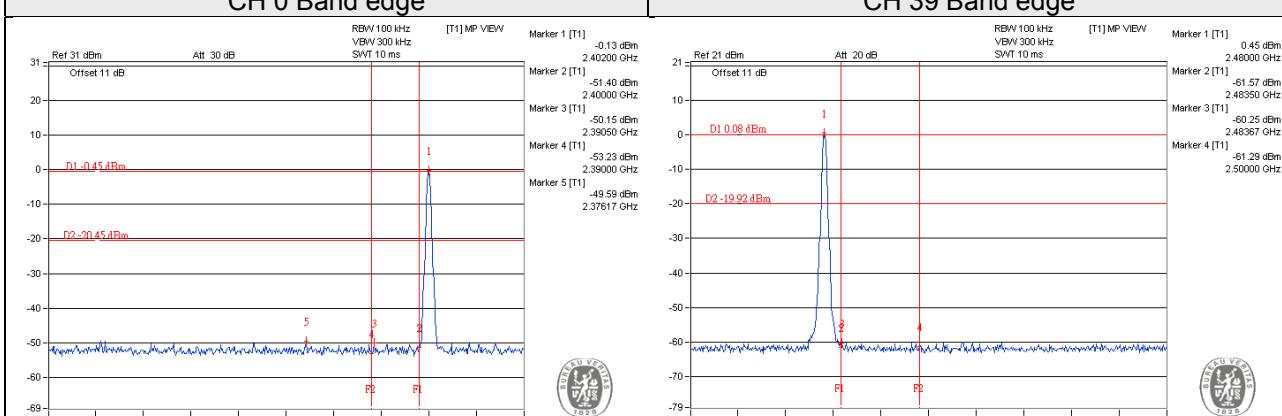
##### CH 19



##### CH 39



##### CH 0 Band edge





A D T

## 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:

**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**

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 ---