

# FCC TEST REPORT (BT\_LE)

**Report No.:** RF160817W003-3

**FCC ID:** O57YBQ501F

**Test Model:** Lenovo YB-Q501F

**Received Date:** Aug. 17, 2016

**Test Date:** Aug. 18, 2016 ~ Sep. 07, 2016

**Issued Date:** Sep. 08, 2016

**Applicant:** Lenovo(Shanghai) Electronics Technology Co., Ltd.

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

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**Test Location:** No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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### RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF160817W003-3	Original release	Sep. 08, 2016

## 1 Certificate of Conformity

**Product:** Portable Tablet Computer

**Brand:** Lenovo

**Test Model:** Lenovo YB-Q501F

**Sample Status:** Production Unit

**Applicant:** Lenovo(Shanghai) Electronics Technology Co., Ltd.

**Test Date:** Aug. 18, 2016 ~ Sep. 07, 2016

**Standards:** 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 :** Yuqiang Yin, **Date:** Sep. 08, 2016  
Yuqiang Yin / Engineer

**Approved by :** Bill Yao, **Date:** Sep. 08, 2016  
Bill Yao / Manager

## 2 Summary of Test Results

FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is 13.16dB at 2.084000MHz.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.12dB at 48.43 MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	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	9kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	9KHZ ~ 30MHZ	2.74 dB
	30MHz ~ 200MHz	2.93 dB
	200MHz ~ 1000MHz	2.95 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	Portable Tablet Computer	
<b>Brand</b>	Lenovo	
<b>Test Model</b>	Lenovo YB-Q501F	
<b>Power Supply Rating</b>	5.2Vdc (adapter or host equipment) 3.8Vdc (battery)	
<b>Modulation Technology</b>	<b>BT LE</b>	DTS
<b>Modulation Type</b>	<b>BT LE</b>	GFSK
<b>Transfer Rate</b>	<b>BT LE</b>	1Mbps
<b>Operating Frequency</b>	2402MHz ~ 2480MHz	
<b>Number of Channel</b>	<b>BT LE</b>	40
<b>Output Power</b>	<b>BT LE</b>	6.124mW
<b>Antenna Type</b>	PCB Antenna with -4dBi gain	
<b>Accessory Device</b>	Refer to note as below	
<b>Data Cable Supplied</b>	USB cable: non-shielded, detachable, 1.0m	

Note:

1. 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.
2. There were Sample A, B, C and D for this project, the difference is as below:

SAMPLE	EUT CONFIGURATION INFORMATION
<b>A</b>	LCD 1+ Battery 1+(Emmc1+DDR1) (32+2G) +speaker 1+motor1+PCB1+ Camera 1
<b>B</b>	LCD 1+ Battery 1+(Emmc2+DDR1) (32+2G) +speaker 1+motor1+PCB2+ Camera 2
<b>C</b>	LCD 1+ Battery 1+(Emmc3+DDR2) (64+4G)+speaker 1+motor1+PCB1+ Camera 1
<b>D</b>	LCD 1+ Battery 1+(Emmc4+DDR3) (64+4G)+speaker 1+motor1+PCB2+ Camera 2

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

**LIST OF ACCESSORIES:**

ACCESSORIES	BRAND	MODEL	SPECIFICATION
AC Adapter 1	Acbel	SC-12	I/P:100-240Vac, 600mA O/P: 5.2Vdc, 2000mA 7Vdc, 2000mA 9Vdc, 2000mA 12Vdc, 2000mA
Battery 1	Sunwoda	Yogi A0	Rating: 3.8Vdc, 10500mAh
USB Cable 1	FUKANGYUAN	F45B-242000100	1.0m non-shielded cable w/o core
USB Cable 2	LIQI	L45B-242000100	1.0m non-shielded cable w/o core
LCD Panel1	BOE	TV122WXM-AL0	12.2"
Emmc 1	Samsung	KLMBG4WEBD-B031	32G
Emmc 2	Toshiba	THGBMFG8C2LBAIL	32G
Emmc 3	Samsung	KLMCG4JENB-B041	64G
Emmc 4	Toshiba	THGBMFG9C4LBAIR	64G
DDR1	Samsung	K3QF1F10EM-AGCE	2G
DDR2	Micron	MT52L256M64D2PP-107WT	4G
DDR3	Samsung	K3QF2F20EM-AGCE	4G
Speaker 1	HAOSHENG	XHB171215B08-08-B-RH	-
Speaker 2	KEYSOUND	QM171219AW06	-
motor1	AWA	LZ-C024	
Photo Camera 1	Chicony	CNFEH7221005802LH	1M
Photo Camera 2	Guangdong Lite Array Co.,Ltd	GNCH160076R	1M
CPU	Intel	Z8550	1380PIN
Main Broad 1	RED BOARD LTD	H103C	-
Main Broad 2	SHENZHEN WUZHU TECH CO LTD	WH-1	-
BT/WLAN Module	BROADCOM	BCM43438KUBG	-



### 3.2 Description of Test Modes

40 channels are provided for BT LE 4.0 mode:

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

#### BT LE

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.  
**NOTE:** "-" 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)
-	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

#### 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	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 CONFIGUURE 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
<b>RE≥1G</b>	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
<b>RE&lt;1G</b>	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
<b>PLC</b>	25deg. C, 68%RH	120Vac, 60Hz	Yuqiang Yin
<b>APCM</b>	21deg. C, 60%RH	120Vac, 60Hz	Wenliang Wu

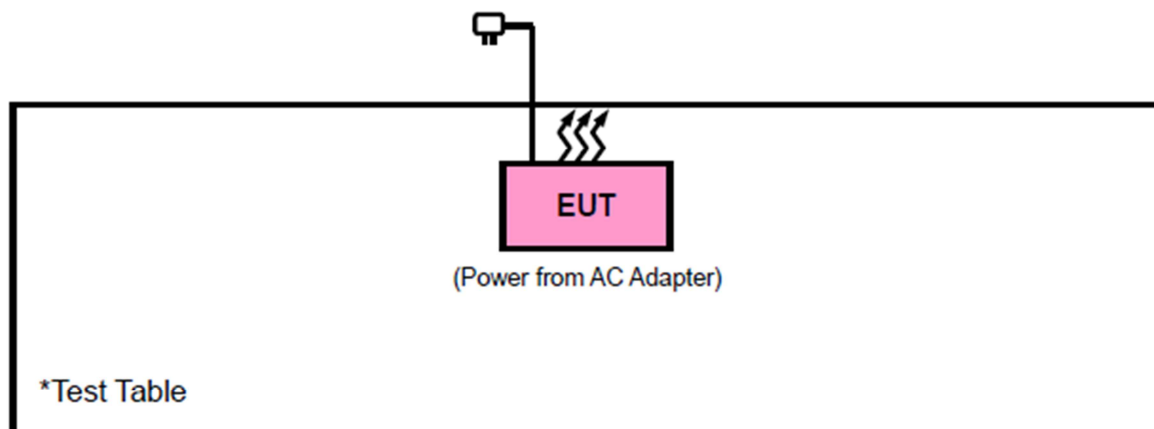
### 3.3 Description of Support Units

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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC source	LONG WEI	PS-6403D	010934269	N/A
2	PC	HP	A6608CN	3CR83825X3	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	DC Line: Unshielded, Detachable 1.0m
2	AC Line: Unshielded, Detachable 1.5m

#### 3.3.1 Configuration of System under Test



### 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)**

**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 is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). 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

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Apr. 05,16	Apr. 04,17
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	Nov. 09,15	Nov. 08,16
Bilog Antenna	Teseq	CBL 6111D	30643	Jul. 14, 16	Jul. 13, 17
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 18,16	May 17,17
GPS Generator+ Antenna	TOJOIN	GNSS-5000A	E1-010119	Aug. 02, 15	Aug. 01, 17
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Mar. 12,16	Mar. 11,18
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170242	Mar. 12,16	Mar. 11,17
Amplifier (9kHz-1GHz)	SONOMA	310D	186955	Mar. 04,16	Mar. 03, 17
Pre-Amplifier(1-18G)	HP	8449B	3008A00409	Apr. 25,16	Apr. 24,17
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 20,15	Nov. 19,16
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	Aug. 29,16	Aug. 28,17

- 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 calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The test was performed in HwaYa Chamber 4.
  4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  5. The FCC Site Registration No. is 460141.
  6. The IC Site Registration No. is IC7450F-4.

#### 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:

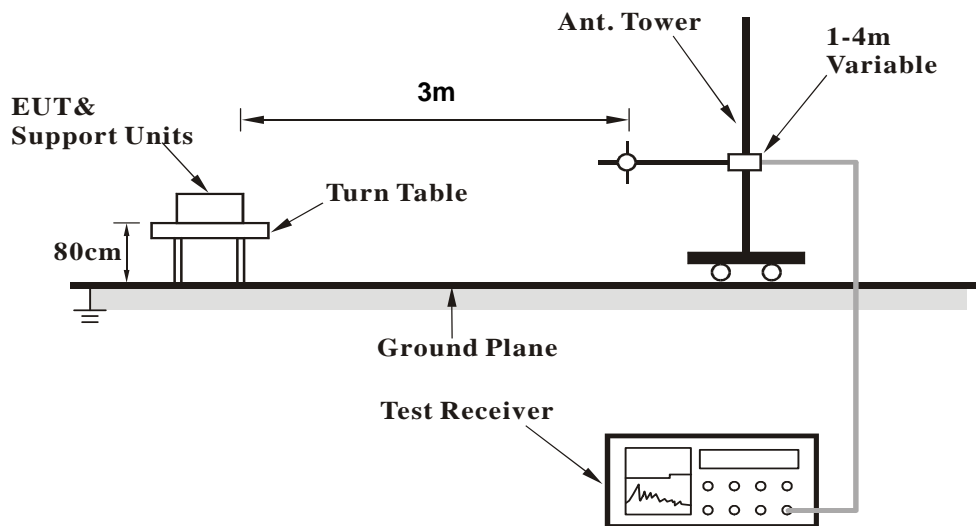
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

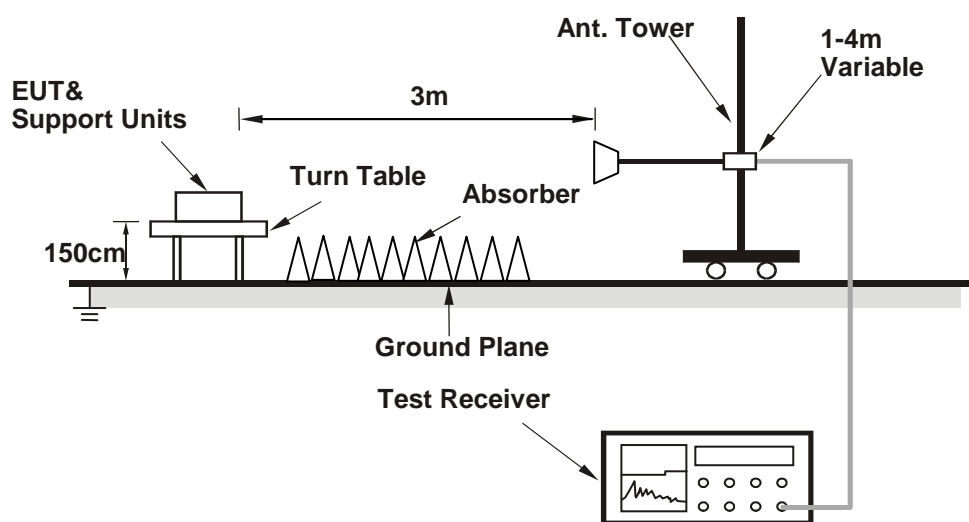
No deviation.

#### 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

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



4.1.7 Test Results

**BELOW 1GHz WORST-CASE DATA:**

**9 KHz – 30 MHz data:** the amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

**30 MHz – 1GHz data:**

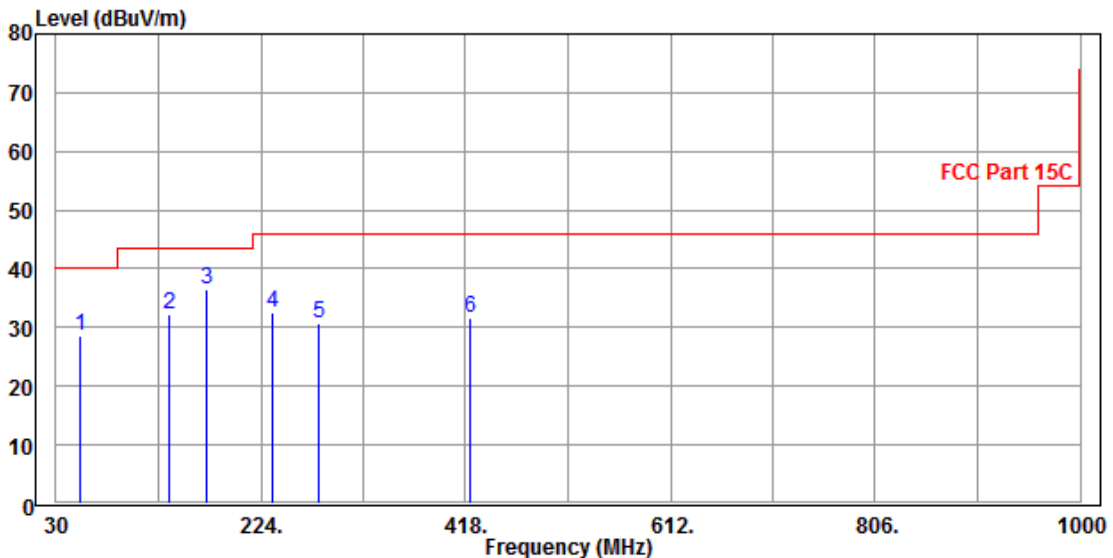
**BT\_LE (GFSK)**

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
53.28	28.53	58.31	40.00	-11.47	6.47	1.11	37.36	200	15	QP
136.7	32.10	59.29	43.50	-11.40	7.87	1.80	36.86	200	48	QP
172.59	36.41	61.10	43.50	-7.09	10.01	2.01	36.71	200	120	QP
234.67	32.66	55.14	46.00	-13.34	11.69	2.36	36.53	200	180	QP
278.32	30.67	51.84	46.00	-15.33	12.74	2.60	36.51	200	250	QP
422.85	31.59	47.67	46.00	-14.41	17.47	3.22	36.77	200	80	QP

**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

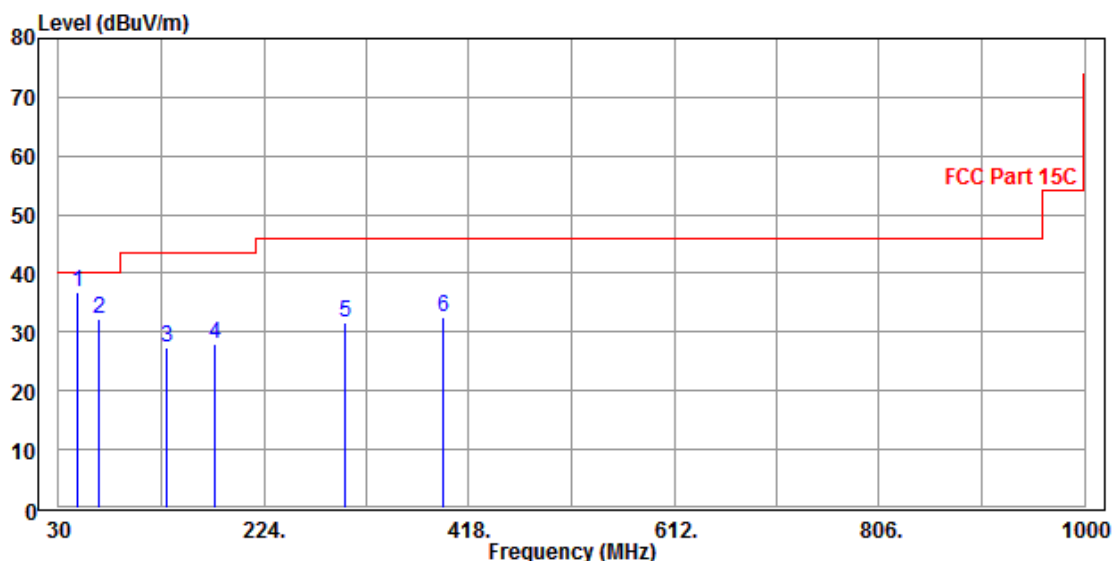


<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
48.43	36.88	66.15	40.00	-3.12	7.08	1.05	37.40	100	32	QP
67.83	32.23	61.45	40.00	-7.77	6.79	1.26	37.27	100	78	QP
131.85	27.31	54.76	43.50	-16.19	7.67	1.76	36.88	100	121	QP
177.44	28.04	52.76	43.50	-15.46	9.94	2.04	36.70	100	148	QP
300.63	31.60	52.35	46.00	-14.40	13.03	2.72	36.50	100	260	QP
392.78	32.49	49.17	46.00	-13.51	16.90	3.12	36.70	100	96	QP

**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



**ABOVE 1GHz WORST-CASE DATA:**

**BT\_LE**

<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**

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	35.77	43.64	54.00	-18.23	32.29	8.15	48.31	126	356	Average
2390	47.71	55.58	74.00	-26.29	32.29	8.15	48.31	126	356	Peak
2402	103.25	111.09			32.30	8.17	48.31	126	356	Average
2402	108.31	116.15			32.30	8.17	48.31	126	356	Peak
2498	35.93	43.48	54.00	-18.07	32.40	8.35	48.30	126	356	Average
2498	47.94	55.49	74.00	-26.06	32.40	8.35	48.30	126	356	Peak
4804	49.93	51.97	54.00	-4.07	34.30	12.55	48.89	100	60	Average
4804	58.51	60.55	74.00	-15.49	34.30	12.55	48.89	100	60	Peak

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

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	35.92	43.79	54.00	-18.08	32.29	8.15	48.31	104	108	Average
2390	56.01	63.88	74.00	-17.99	32.29	8.15	48.31	104	108	Peak
2402	97.83	105.67			32.30	8.17	48.31	104	108	Average
2402	103.16	111.00			32.30	8.17	48.31	104	108	Peak
2499	36.10	43.65	54.00	-17.90	32.40	8.35	48.30	104	108	Average
2499	47.81	55.36	74.00	-26.19	32.40	8.35	48.30	104	108	Peak
4804	49.69	51.73	54.00	-4.31	34.30	12.55	48.89	100	108	Average
4804	59.29	61.33	74.00	-14.71	34.30	12.55	48.89	100	108	Peak

**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. 2402MHz: 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**

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2387.6	35.73	43.60	54.00	-18.27	32.29	8.15	48.31	108	356	Average
2387.6	47.54	55.41	74.00	-26.46	32.29	8.15	48.31	108	356	Peak
2440	103.70	111.43			32.34	8.24	48.31	108	356	Average
2440	109.15	116.88			32.34	8.24	48.31	108	356	Peak
2498	35.99	43.54	54.00	-18.01	32.40	8.35	48.30	108	356	Average
2498	48.28	55.83	74.00	-25.72	32.40	8.35	48.30	108	356	Peak
4880	47.58	49.36	54.00	-6.42	34.30	12.84	48.92	100	110	Average
4880	58.58	60.36	74.00	-15.42	34.30	12.84	48.92	100	320	Peak

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

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2389	36.05	43.92	54.00	-17.95	32.29	8.15	48.31	105	120	Average
2389	47.67	55.54	74.00	-26.33	32.29	8.15	48.31	105	120	Peak
2440	98.12	105.85			32.34	8.24	48.31	105	120	Average
2440	103.39	111.12			32.34	8.24	48.31	105	120	Peak
2499	36.28	43.83	54.00	-17.72	32.4	8.35	48.3	105	120	Average
2499	48.22	55.77	74.00	-25.78	32.4	8.35	48.3	105	120	Peak
4880	48.3	50.08	54.00	-5.70	34.3	12.84	48.92	100	110	Average
4880	59.44	61.22	74.00	-14.56	34.3	12.84	48.92	100	110	Peak

**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. 2440MHz: 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**

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2388	35.83	43.70	54.00	-18.17	32.29	8.15	48.31	155	325	Average
2388	47.43	55.30	74.00	-26.57	32.29	8.15	48.31	155	325	Peak
2480	99.47	107.08			32.38	8.31	48.30	155	325	Average
2480	105.08	112.69			32.38	8.31	48.30	155	325	Peak
2483.5	37.78	45.38	54.00	-16.22	32.38	8.32	48.30	155	325	Average
2483.5	53.20	60.80	74.00	-20.80	32.38	8.32	48.30	155	325	Peak
4960	44.68	46.20	54.00	-9.32	34.30	13.13	48.95	100	330	Average
4960	54.90	56.42	74.00	-19.10	34.30	13.13	48.95	100	330	Peak

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

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	35.97	43.84	54.00	-18.03	32.29	8.15	48.31	100	140	Average
2390	47.37	55.24	74.00	-26.63	32.29	8.15	48.31	100	140	Peak
2480	98.35	105.96			32.38	8.31	48.30	100	140	Average
2480	104.18	111.79			32.38	8.31	48.30	100	140	Peak
2483.5	37.56	45.16	54.00	-16.44	32.38	8.32	48.30	100	140	Average
2483.5	52.28	59.88	74.00	-21.72	32.38	8.32	48.30	100	140	Peak
4960	45.66	47.18	54.00	-8.34	34.30	13.13	48.95	100	90	Average
4960	55.22	56.74	74.00	-18.78	34.30	13.13	48.95	100	90	Peak

**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. 2480MHz: Fundamental frequency.

## 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.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.2.2 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101588	Jan. 22,16	Jan. 21,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 04,16	Mar. 03,17
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Apr. 05,16	Apr. 04,17
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Jan. 08,16	Jan. 07,17
Test software	ADT	ADT_Cond_V7.3.7	N/A	N/A	N/A

**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

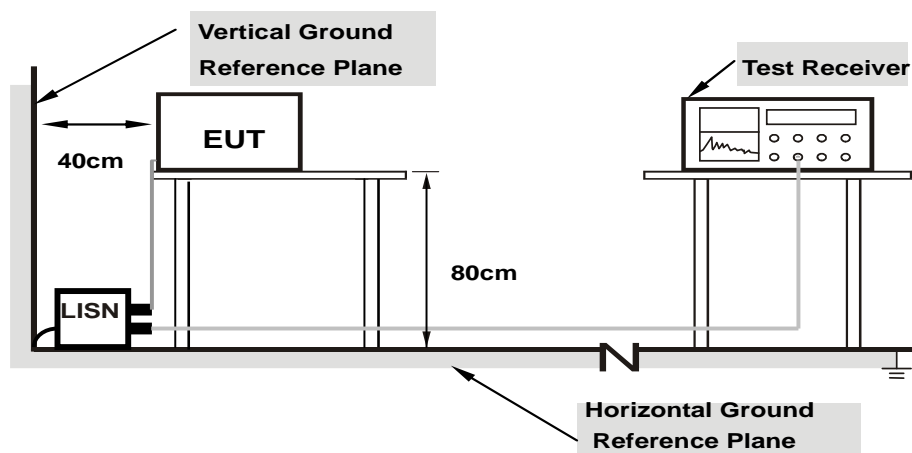
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

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

#### 4.2.6 EUT Operating Conditions

Same as section 4.1.6.

#### 4.2.7 Test Results

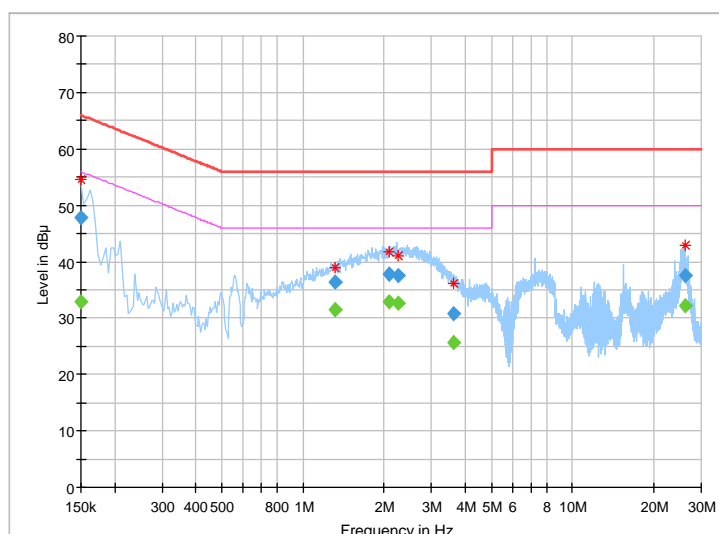
#### CONDUCTED WORST-CASE DATA

<b>TEST VOLTAGE</b>	DC 5.2V From Adapter Input 230 Vac, 50 Hz	<b>6dB BANDWIDTH</b>	9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 55RH	<b>TESTED BY</b>	Eric

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	32.87	56.00	23.13	L	ON	9.6
0.150000	47.87	---	66.00	18.13	L	ON	9.6
1.318000	---	31.46	46.00	14.54	L	ON	9.7
1.318000	36.38	---	56.00	19.62	L	ON	9.7
<b>2.084000</b>	---	<b>32.84</b>	<b>46.00</b>	<b>13.16</b>	<b>L</b>	<b>ON</b>	<b>9.7</b>
2.084000	37.78	---	56.00	18.22	L	ON	9.7
2.268000	---	32.57	46.00	13.43	L	ON	9.7
2.268000	37.54	---	56.00	18.46	L	ON	9.7
3.616000	---	25.55	46.00	20.45	L	ON	9.7
3.616000	30.69	---	56.00	25.31	L	ON	9.7
26.120000	---	32.20	50.00	17.80	L	ON	10.1
26.120000	37.62	---	60.00	22.38	L	ON	10.1

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



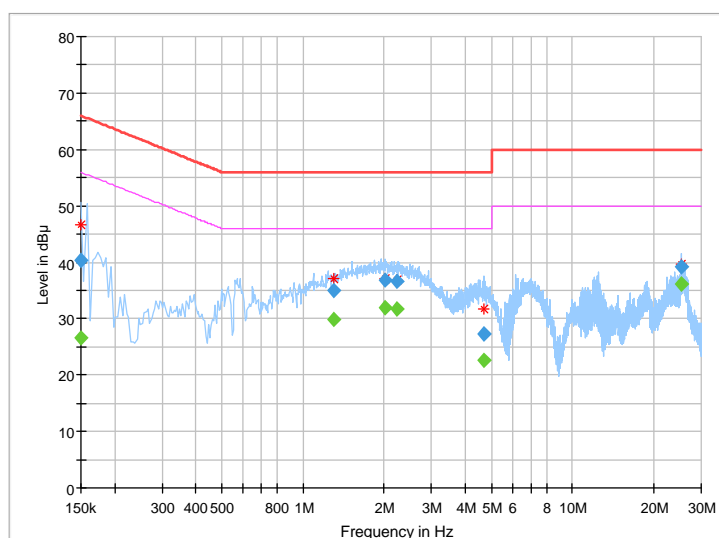


<b>TEST VOLTAGE</b>	DC 5.2V From Adapter Input 230 Vac, 50 Hz	<b>6dB BANDWIDTH</b>	9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 55RH	<b>TESTED BY</b>	Eric

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	CAverage (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	26.63	56.00	29.37	N	ON	9.8
0.150000	40.45	---	66.00	25.55	N	ON	9.8
1.300000	---	29.88	46.00	16.12	N	ON	9.9
1.300000	35.04	---	56.00	20.96	N	ON	9.9
2.018000	---	31.89	46.00	14.11	N	ON	9.8
2.018000	36.79	---	56.00	19.21	N	ON	9.8
2.232000	---	31.68	46.00	14.32	N	ON	9.8
2.232000	36.64	---	56.00	19.36	N	ON	9.8
4.684000	---	22.55	46.00	23.45	N	ON	9.8
4.684000	27.28	---	56.00	28.72	N	ON	9.8
25.372000	---	36.14	50.00	13.86	N	ON	10.2
25.372000	39.23	---	60.00	20.77	N	ON	10.2

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum

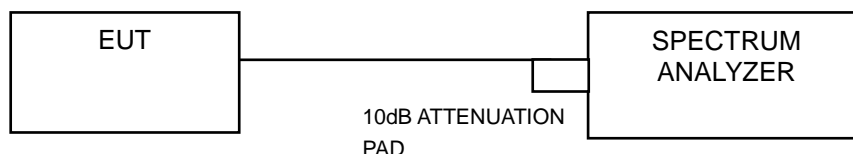


### 4.3 6dB Bandwidth Measurement

#### 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

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 04,16	May 03,17
Power Sensor	Keysight	U2021XA	MY55060018	May 04,16	May 03,17
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jul. 27, 16	Jul. 26, 17
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 12, 15	Oct.11, 16
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Sep.05,16	Sep. 04,17
Oscilloscope	Agilent	DSO9254A	MY51260160	Nov. 28,15	Nov. 27,16
Signal Analyzer	Rohde & Schwarz	FSV7	102331	Nov. 09,15	Nov. 08,16
Signal Generator	Agilent	N5183A	MY50140980	Nov. 09,15	Nov. 08,16
Agile Signal Generator	Agilent	8645A	Agilent	Aug.08, 16	Aug.07, 17
ESG Vector Signal Generator	Agilent	E4438C	MY49072505	Apr. 22, 16	Apr. 21, 17
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	Aug.08, 16	Aug. 07, 17

**NOTE:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.

#### 4.3.4 Test Procedure

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW) ≥ 3 x 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

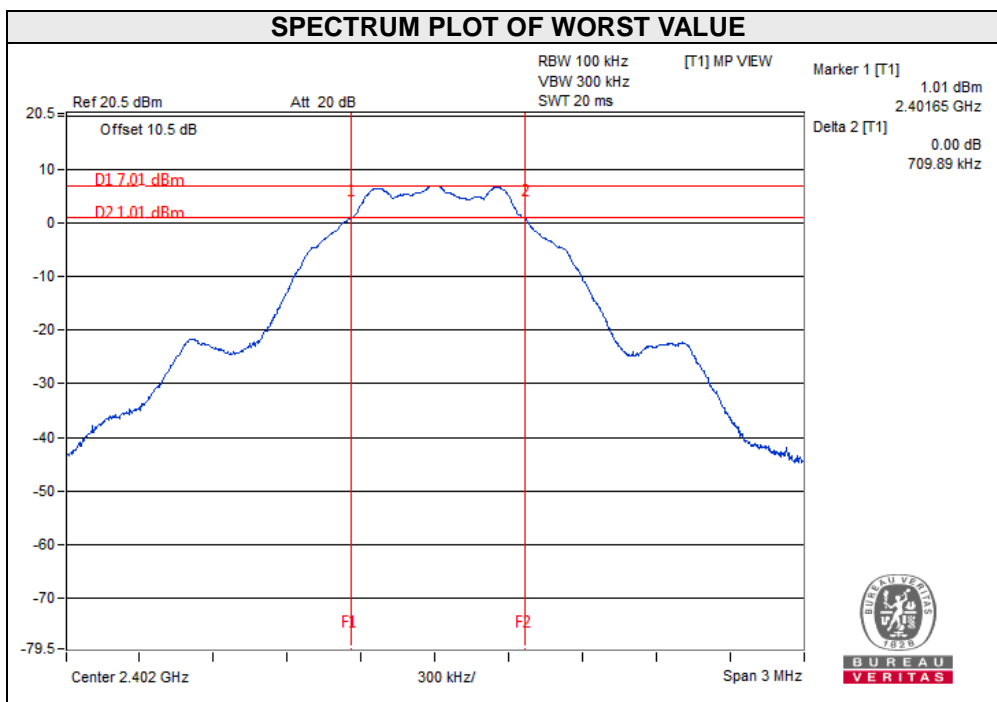
No deviation.

#### 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	0.70	0.5	PASS
39	2480	0.71	0.5	PASS

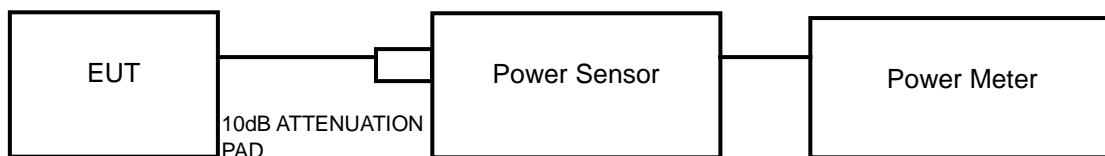


## 4.4 Conducted Output Power Measurement

### 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 4.3.3 to get information of above instrument.

### 4.4.4 Test Procedures

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

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

#### 4.4.7 Test Results

##### 4.4.7.1 Maximum Peak Output Power

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	5.495	7.40	30	PASS
19	2440	<b>6.124</b>	7.87	30	PASS
39	2480	4.121	6.15	30	PASS

##### 4.4.7.2 Average Output Power (For Reference)

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

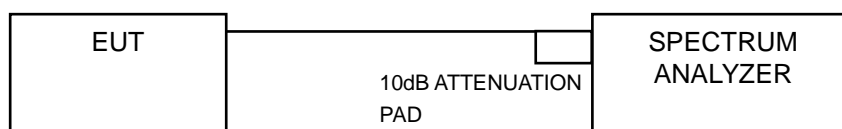
CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	PASS/FAIL
0	2402	7.32	N/A
19	2440	7.82	N/A
39	2480	6.04	N/A

## 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 4.3.3 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

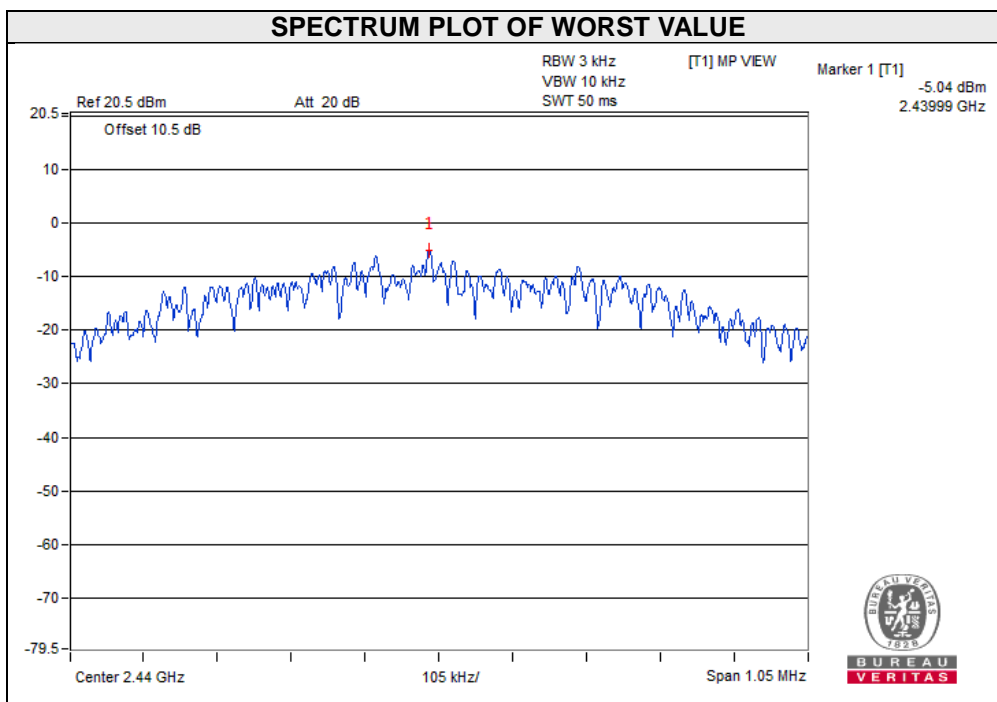
No deviation.

### 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	-5.36	8	PASS
19	2440	-5.04	8	PASS
39	2480	-6.61	8	PASS

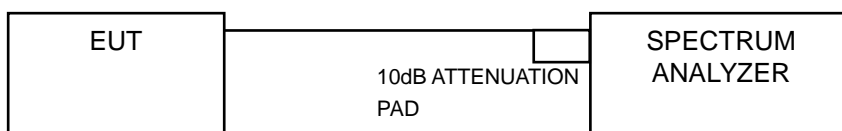


#### 4.6 Conducted Out of Band Emission Measurement

##### 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 4.3.3 to get information of above instrument.

##### 4.6.4 Test Procedure

#### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 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 ≥ 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.

##### 4.6.5 Deviation from Test Standard

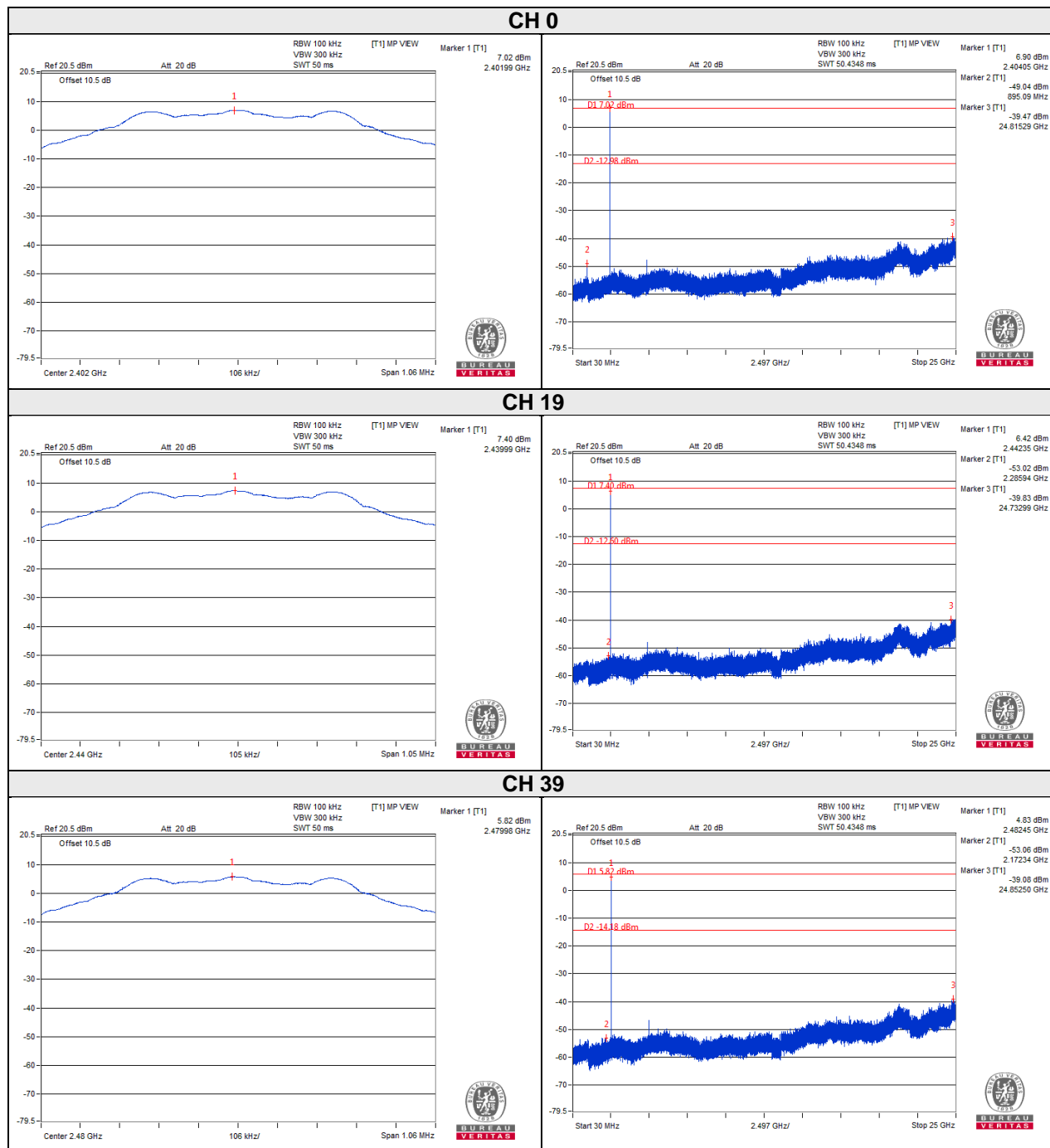
No deviation.

##### 4.6.6 EUT Operating Condition

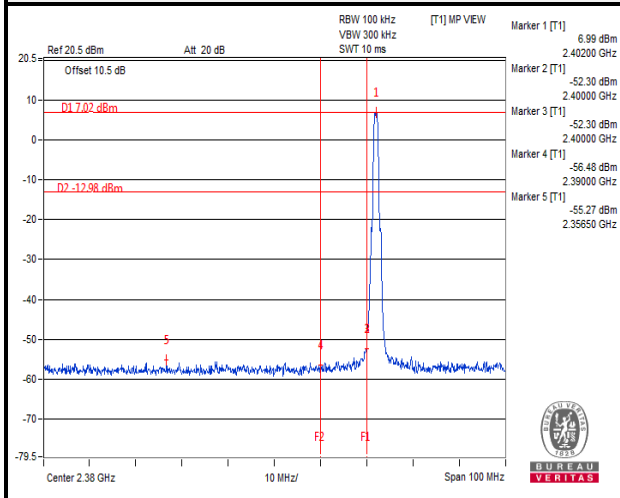
Same as Item 4.3.6



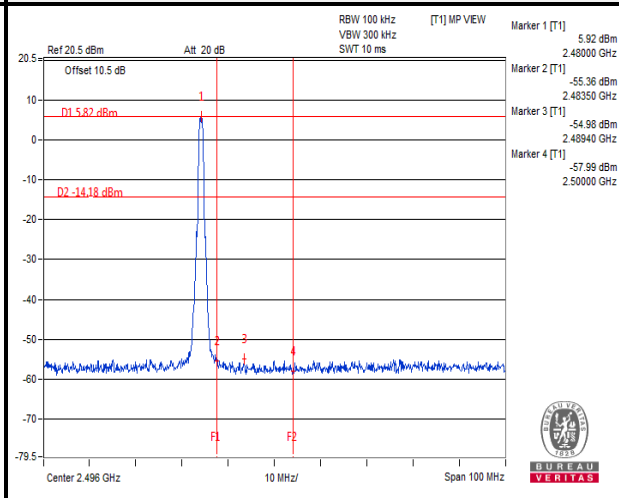
### 4.6.7 TEST RESULTS



### 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 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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