

FCC RF Test Report

APPLICANT : Lenovo (Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT : Tablet PC
BRAND NAME : lenovo
MODEL NAME : 60015, 2298
FCC ID : O57A2107ATT3G
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Jun. 25, 2012 and completely tested on Aug. 16, 2012. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.

Reviewed by:



Jones Tsai / Manager



SPORTON INTERNATIONAL (KUNSHAN) INC.
No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C.



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SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	A8.2(a)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)(1)	A8.1(b)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
3.5	15.247(e)	A8.2(b)	Power Spectral Density	$\leq 8\text{dBm}$	Pass	-
3.4	15.247(d)	A8.5	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.5	15.247(d)	A8.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 11.87 dB at 50.232 MHz
3.6	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 13.64 dB at 1.030 MHz
3.7	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Lenovo (Shanghai) Electronics Technology Co., Ltd.

No. 68, Building, 199 Fenju Road, Wai Gao Qiao FTZ, Shanghai, China

1.2 Manufacturer

Lenovo (Singapore) Pte Ltd.

151, Lorong Chuan, #02-01, New Tech Park, 556741, Singapore

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Tablet PC
Brand Name	lenovo
Model Name	60015, 2298
FCC ID	O57A2107ATT3G
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/ WLAN 11bgn/Bluetooth/Bluetooth4.0 - LE
HW Version	A2-MB-H302-A
SW Version	A2107A_A404_000_002_120612_ATT
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	Bluetooth 4.0 - LE : 2.30 dBm (0.0017 W)
Antenna Type	PIFA Antenna with gain 2.23 dBi
Type of Modulation	Bluetooth 4.0 - LE : GFSK

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL (KUNSHAN) INC.			
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958			
Test Site No.	Sporton Site No.			FCC/IC Registration No.
	TH01-KS	CO01-KS	03CH01-KS	149928/4086E-1

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v01
- ♦ FCC TCB Workshop 2012, April
- ♦ ANSI C63.4-2003
- ♦ IC RSS-210 Issue 8
- ♦ IC RSS-Gen Issue 3

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU200	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
3.	DC Power Supply	GWINSTEK	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	VOSTRO 1450	PPD-AR5B195	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Earphone	Lenovo	LBH301	N/A	N/A	N/A

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 RF Output Power	
		Data Rate / Modulation	
		GFSK	
		1Mbps	
Ch00	2402MHz	1.56 dBm	
Ch19	2440MHz	1.49 dBm	
Ch39	2480MHz	2.30 dBm	

2.2 Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

Pre-scanned tests, X, Y, Z in three orthogonal panels, were conducted to determine the final configuration from all possible combinations.

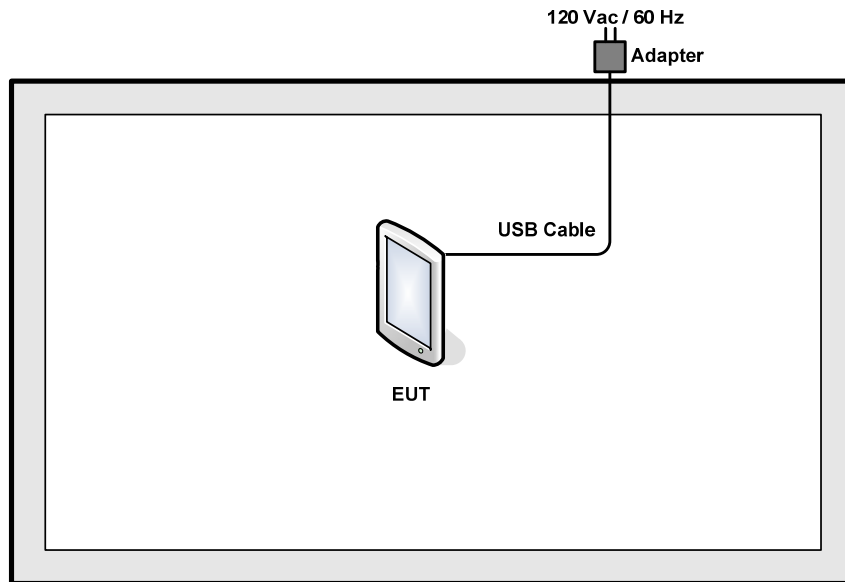
The following tables are showing the test modes as the worst cases (Z plane) and recorded in this report.

The following tables are showing the test modes as the worst cases and recorded in this report.

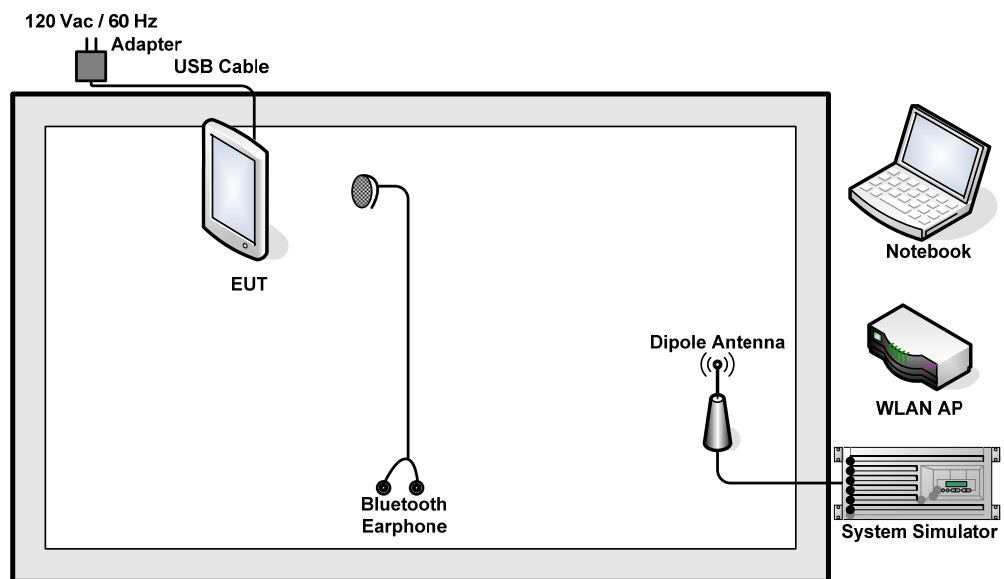
Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1 : GSM850 (GPRS 8) Idle + Bluetooth Link + WLAN Link + USB Cable (Charging from Adapter) + Camera

2.3 Connection Diagram of Test System

<Bluetooth 4.0 Tx Mode>



<AC Conducted Emission Mode>



2.4 RF Utility

For Bluetooth function, key in “* # * # 4636633 # * # *” on the EUT directly. Then, the EUT will get into the engineering modes for continuous transmitting and receiving signals.

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 KHz.

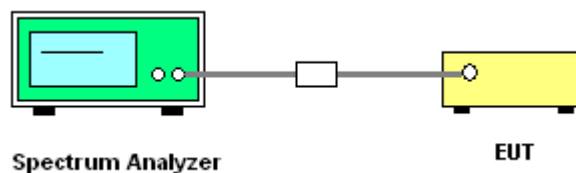
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v01.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 KHz.

3.1.4 Test Setup

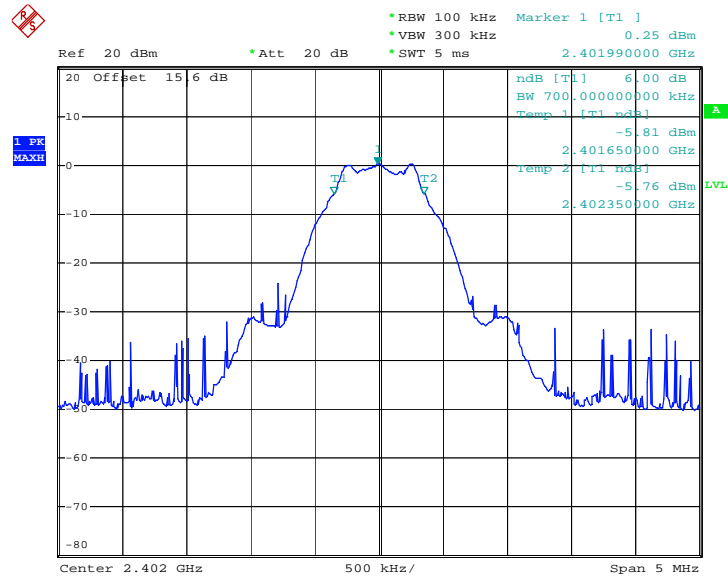


3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth LE 1Mbps GFSK L/M/H channel	Temperature :	23~24°C
Test Engineer :	Zhi Lu	Relative Humidity :	47~48%

Channel	Frequency (MHz)	6dB Bandwidth (MHz)
00	2402	0.70
19	2440	0.70
39	2480	0.69

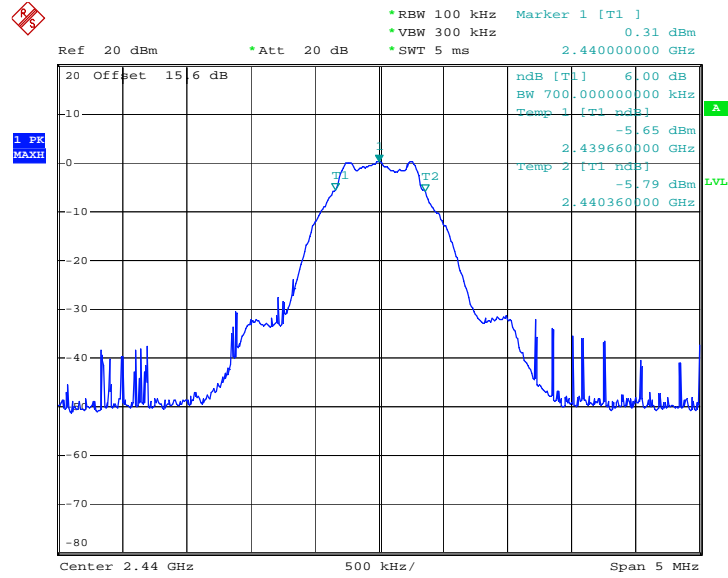
6 dB Bandwidth Plot on Channel 00



Date: 15.AUG.2012 17:11:24

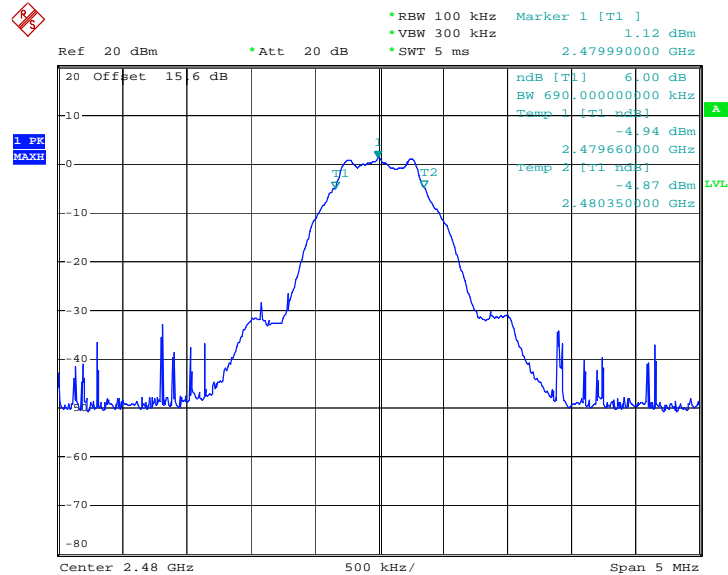


6 dB Bandwidth Plot on Channel 19



Date: 15.AUG.2012 17:11:55

6 dB Bandwidth Plot on Channel 39



Date: 15.AUG.2012 17:12:22

3.2 Peak Output Power Measurement

3.2.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

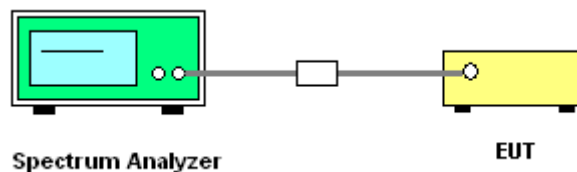
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance and TCB Workshop 2012, April.
2. The RF output of EUT was connected to the power meter by a low loss cable
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



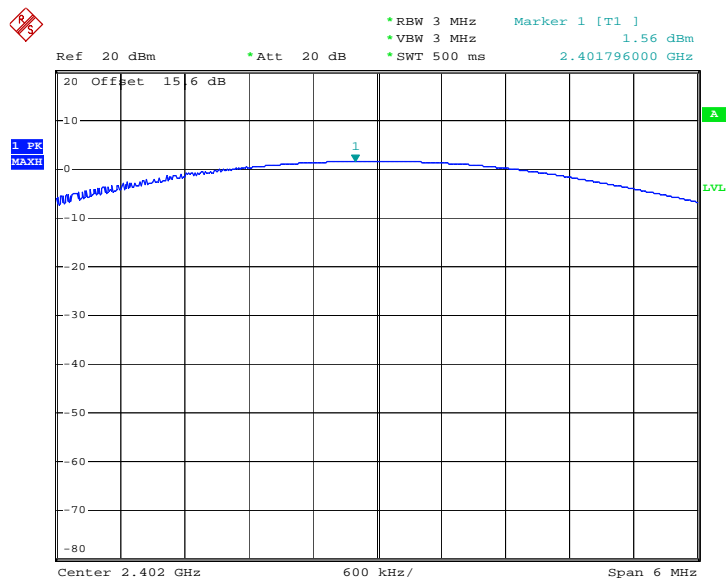


3.2.5 Test Result of Peak Output Power

Test Mode :	Bluetooth LE 1Mbps GFSK L/M/H channel	Temperature :	23~24°C
Test Engineer :	Zhi Lu	Relative Humidity :	47~48%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	1.56	30.00	Pass
19	2440	1.49	30.00	Pass
39	2480	2.30	30.00	Pass

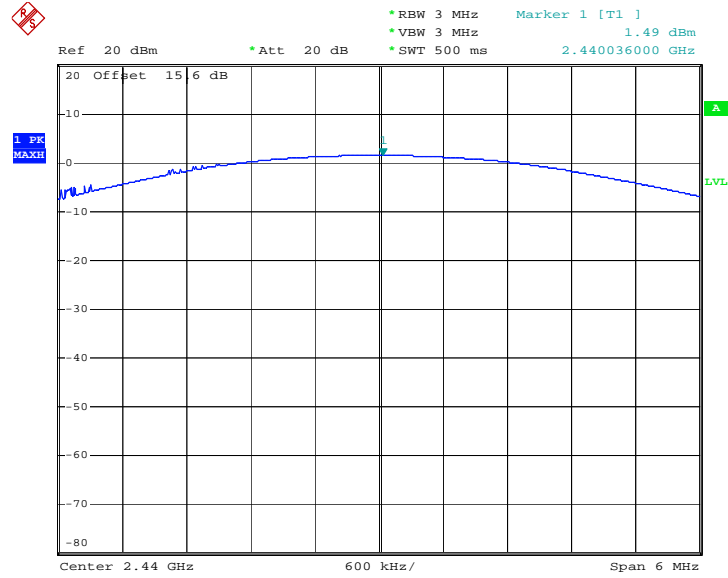
Peak Output Power Plot on Channel 00



Date: 15.AUG.2012 17:03:56

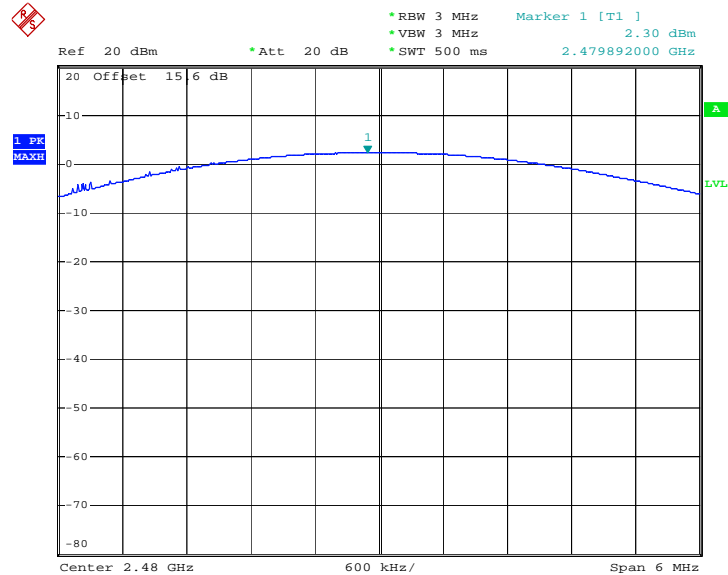


Peak Output Power Plot on Channel 19



Date: 15.AUG.2012 17:04:49

Peak Output Power Plot on Channel 39



Date: 15.AUG.2012 17:05:25

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3KHz band at any time interval of continuous transmission.

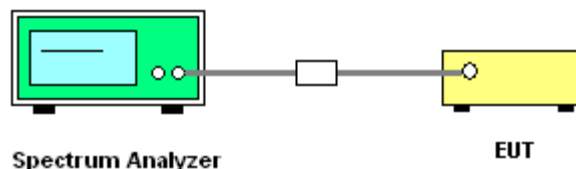
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v01.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 KHz. Video bandwidth (VBW) \geq 300 KHz In order to make an accurate measurement, set the span to 5-30% greater than Emission Bandwidth (EBW)
5. 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.
6. Record the measurement data derived from spectrum analyzer.
7. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3 \text{ kHz}/100 \text{ kHz} = -15.2 \text{ dB})$.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

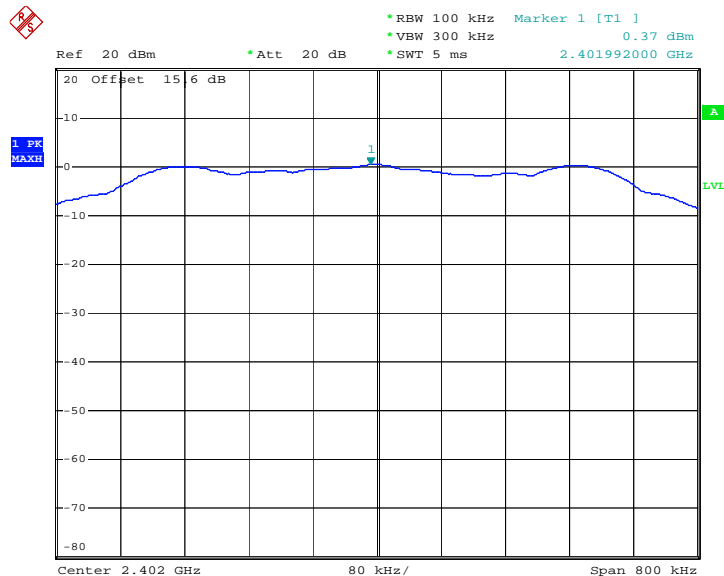
Test Mode :	Bluetooth LE 1Mbps	Temperature :	23~24°C
Test Engineer :	Zhi Lu	Relative Humidity :	47~48%

Channel	Frequency (MHz)	Power Density		Max. Limits (dBm)	Pass/Fail
		Measured PSD/100KHz (dBm)	PSD/3KHz (dBm)		
00	2402	0.37	-14.83	8	Pass
19	2440	0.42	-14.78	8	Pass
39	2480	1.21	-13.99	8	Pass

Note:

1. Measured power density (dBm) has offset with cable loss.
2. BWCF (dB) = $10 \log (3k/100k) = -15.2 \text{ dB}$
3. Power Density/ 3kHz (dBm) = Measured power density/ 100KHz (dBm) + BWCF (dB)

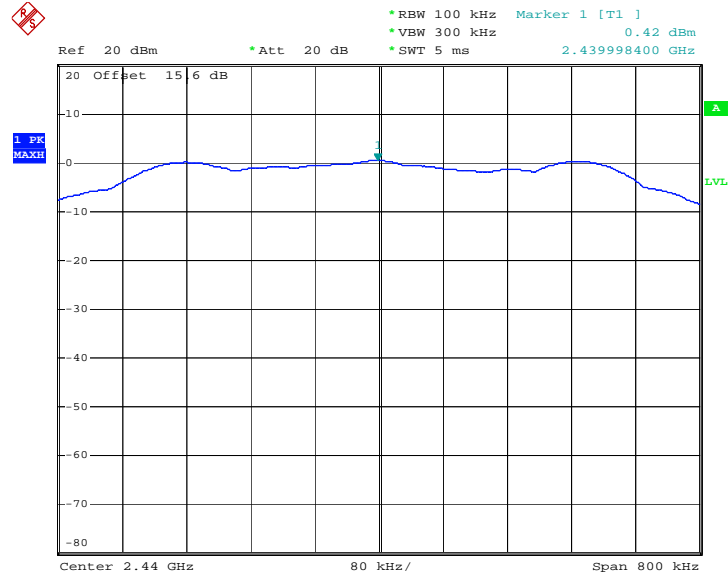
PSD Plot on Channel 00



Date: 15.AUG.2012 17:16:00

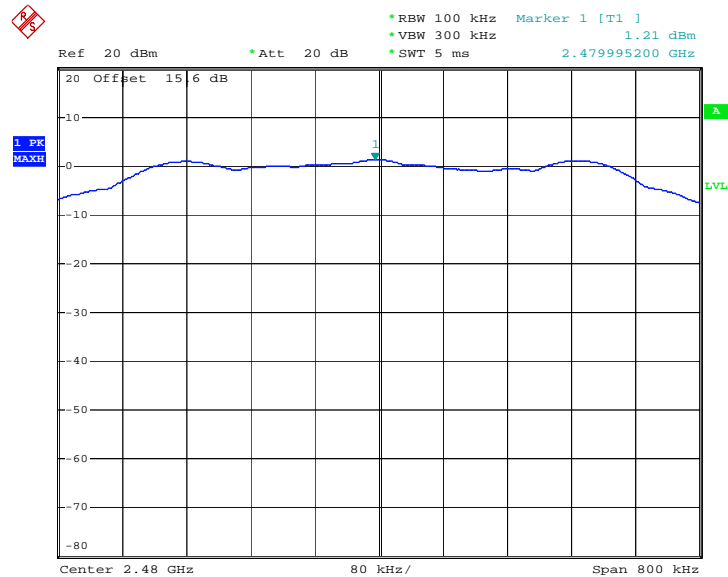


PSD Plot on Channel 19



Date: 15.AUG.2012 17:15:25

PSD Plot on Channel 39



Date: 15.AUG.2012 17:14:50

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

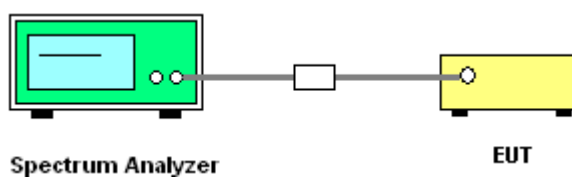
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedure

1. The testing follows the guidelines in ANSI C63.4-2003 and the Measurement Procedure of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v01.
2. The transmitter output was connected to the spectrum analyzer via a low lose cable.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 KHz, Video bandwidth (VBW) \geq RBW. Out of the authorized frequency band emissions must be at least 20 dB lower than the highest emission level within the authorized band as measured with a 100 KHz RBW. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).

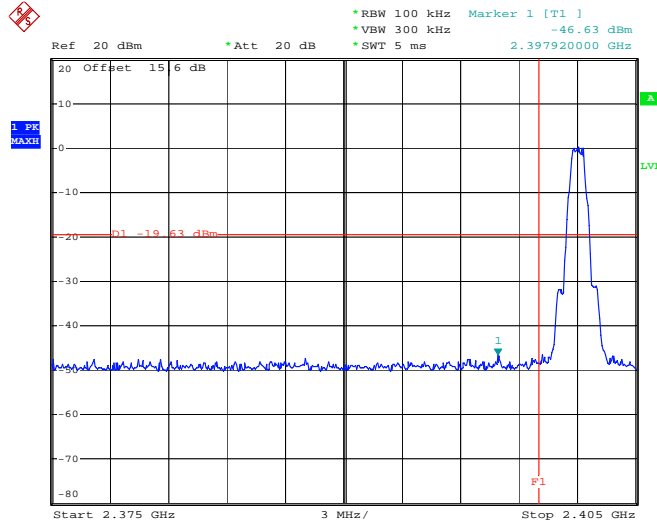
3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges

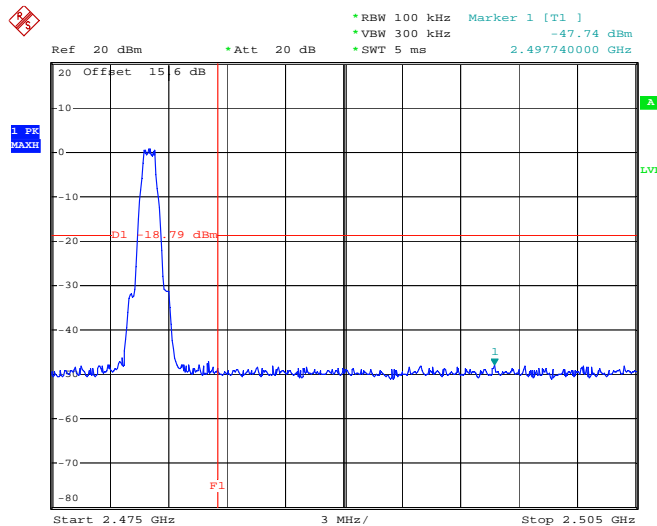
Test Mode :	Bluetooth LE 1Mbps GFSK Low/High channel	Temperature :	23~24°C
Test Channel :	00 and 39	Relative Humidity :	47~48%
		Test Engineer :	Zhi Lu

Low Band Edge Plot on Channel 00



Date: 16.AUG.2012 15:43:06

High Band Edge Plot on Channel 39

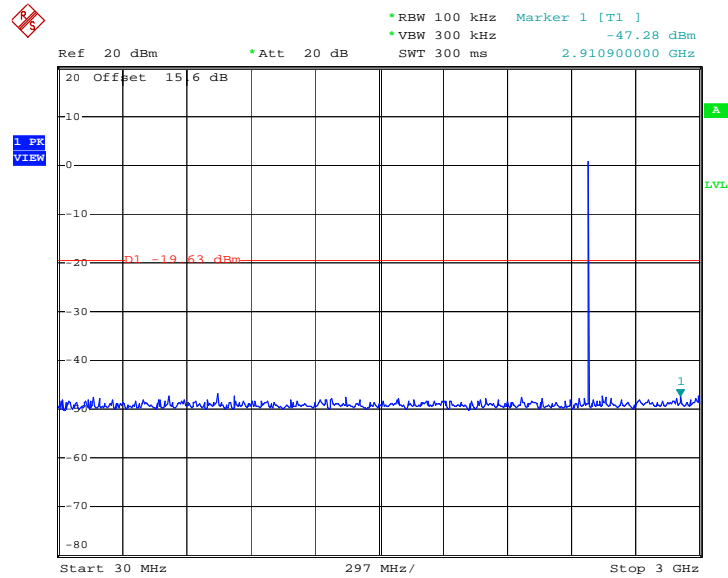


Date: 16.AUG.2012 15:44:02

3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth LE 1Mbps GFSK Low channel	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	47~48%
		Test Engineer :	Zhi Lu

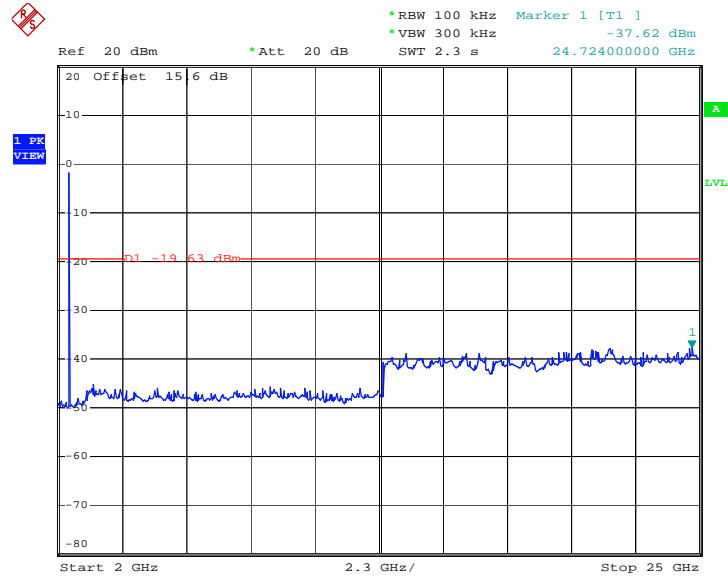
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 00



Date: 15.AUG.2012 17:25:38



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 00

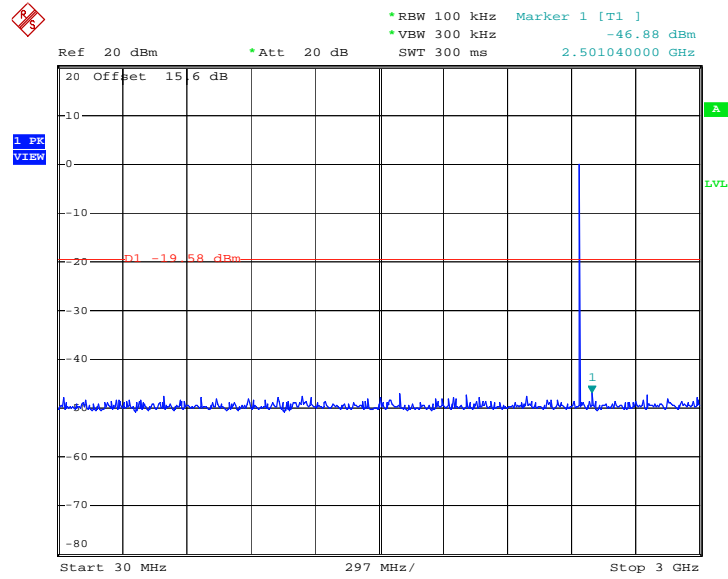


Date: 15.AUG.2012 17:28:15



Test Mode :	Bluetooth LE 1Mbps GFSK Middle channel	Temperature :	23~24°C
Test Channel :	19	Relative Humidity :	47~48%
		Test Engineer :	Zhi Lu

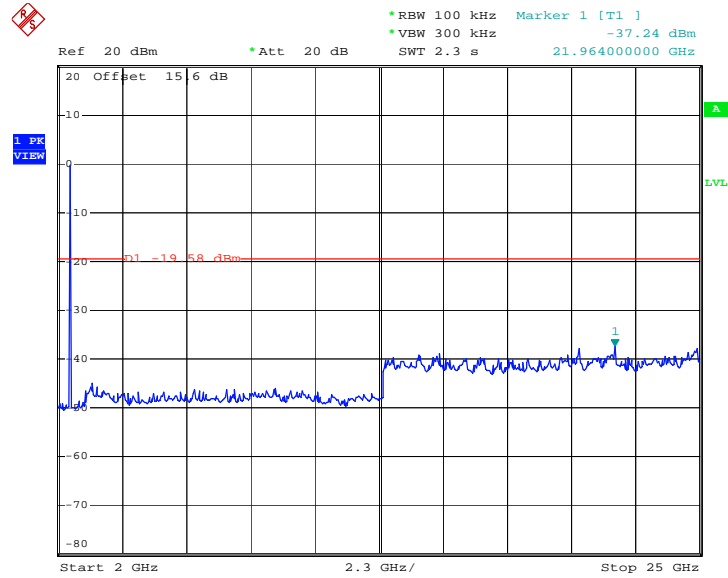
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 15.AUG.2012 17:31:15



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19

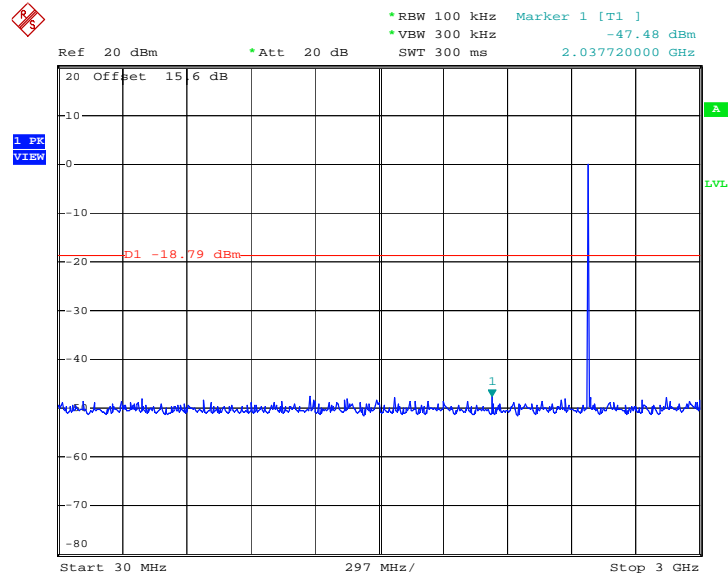


Date: 15.AUG.2012 17:31:49



Test Mode :	Bluetooth LE 1Mbps GFSK High channel	Temperature :	23~24°C
Test Channel :	39	Relative Humidity :	47~48%
		Test Engineer :	Zhi Lu

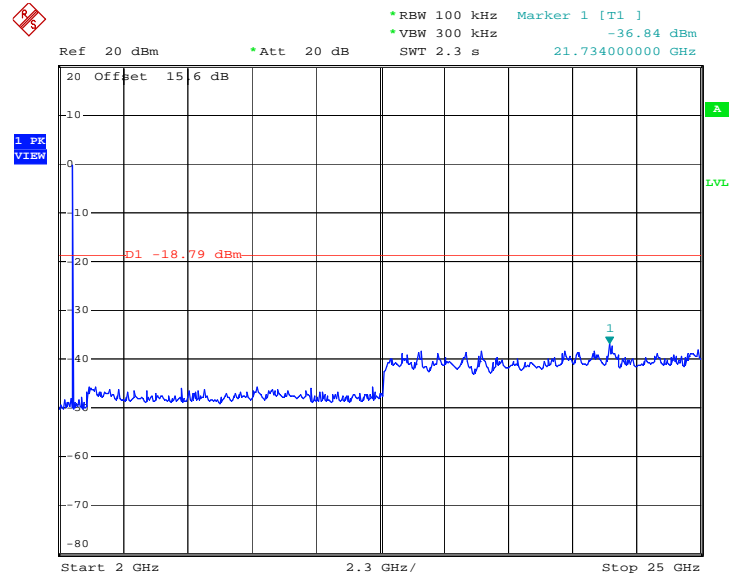
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 15.AUG.2012 17:33:18



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 15.AUG.2012 17:34:48

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (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

3.5.2 Measuring Instruments

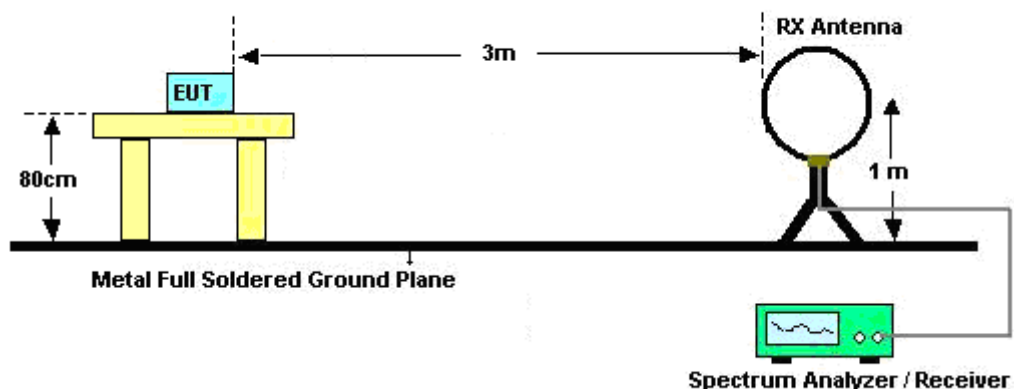
See list of measuring instruments of this test report.

3.5.3 Test Procedures

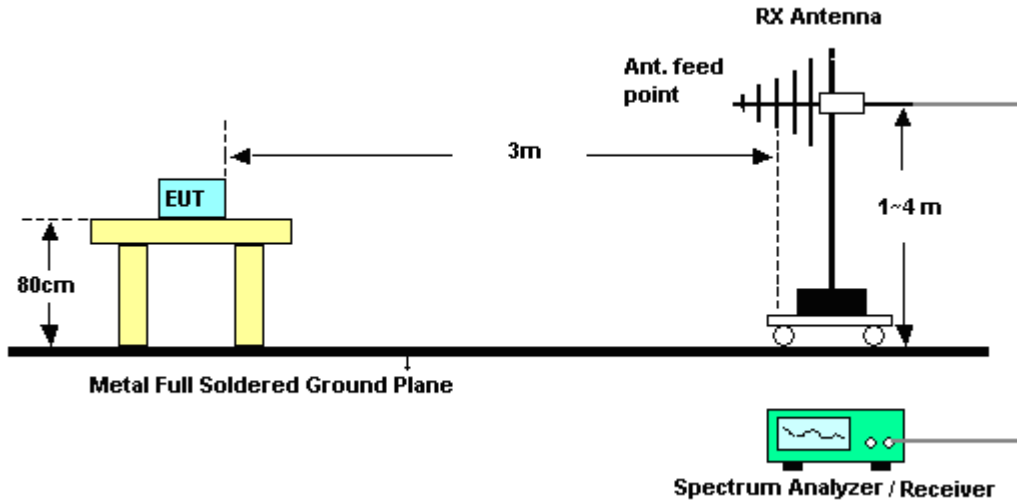
1. The testing follows TCB Workshop 2012, April and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test site requirement. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving Antenna, which was mounted on the top of a variable height Antenna tower.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 KHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for Peak measurement, and then set VBW=10Hz, while maintaining all of the other instrument settings for Average measurement.
6. If the emission level of the EUT measured by the peak detector is more than 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be reported by using the quasi-peak detector.

3.5.4 Test Setup

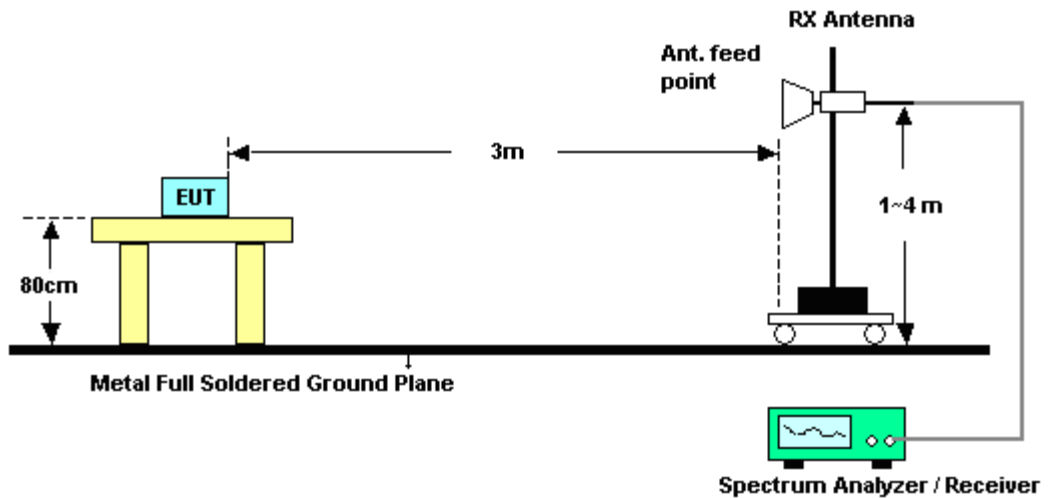
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



3.5.6 Test Result of Radiated Band Edges

Test Mode :	Mode 1	Temperature :	21~22°C
Test Channel :	00	Relative Humidity :	46~47%
		Test Engineer :	Chenmy Cheng

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2369.09	53.52	-20.48	74	45.57	32.83	4.22	29.1	200	145	Peak
2369.09	39.1	-14.9	54	31.15	32.83	4.22	29.1	200	145	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2357.12	53.95	-20.05	74	46.06	32.81	4.21	29.13	105	245	Peak
2357.12	39.05	-14.95	54	31.16	32.81	4.21	29.13	105	245	Average



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
		Test Engineer :	Chenmy Cheng

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	48.55	-25.45	74	40.25	33.01	4.29	29	112	0	Peak
2483.5	25.32	-28.68	54	17.02	33.01	4.29	29	112	0	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBµV/m)	Delta Result (dB)	Average Result (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
Single Carrier Mode	76.13	50.81	25.32	54	-28.68	Pass

Note: Average result = Maximum field strength – Delta result

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.536	46.88	-27.12	74	38.58	33.01	4.29	29	122	173	Peak
2483.536	25.69	-28.31	54	17.39	33.01	4.29	29	122	173	Average

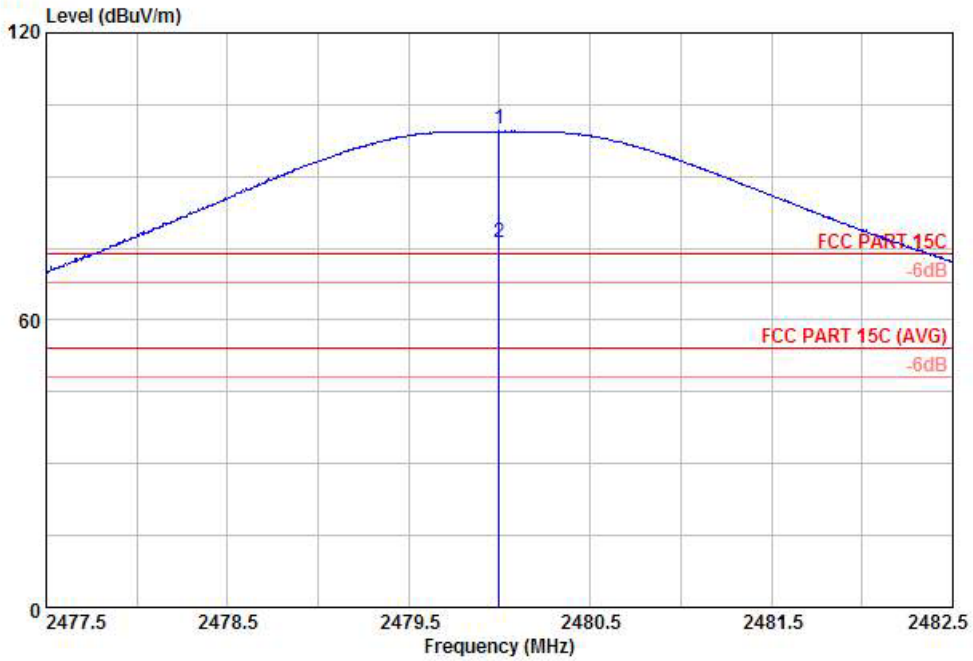
Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBµV/m)	Delta Result (dB)	Average Result (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
Single Carrier Mode	72.3	46.61	25.69	54	-28.31	Pass

Note: Average result = Maximum field strength – Delta result



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Horizontal



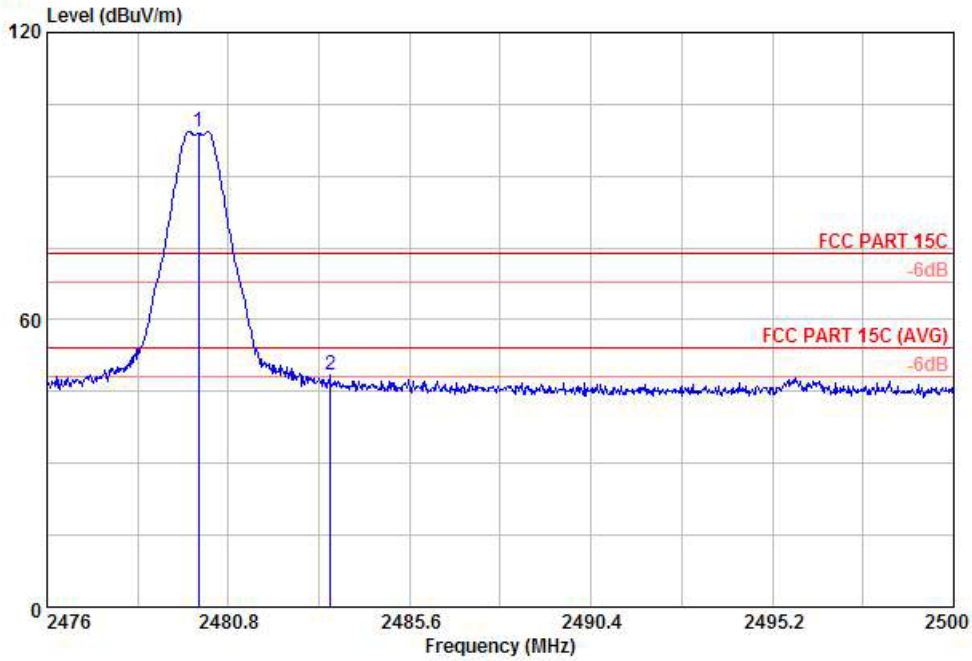
Site : 03CH01-KS
 Condition: FCC PART 15C 3m HF ANT-100803 HORIZONTAL

	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 X	2480.00	99.87	25.87	74.00	91.57	33.01	4.29	29.00	108	103	Peak
2 X	2480.00	76.13	22.13	54.00	67.83	33.01	4.29	29.00	108	103	Average

* Maximum field strength of the fundamental emission



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Horizontal



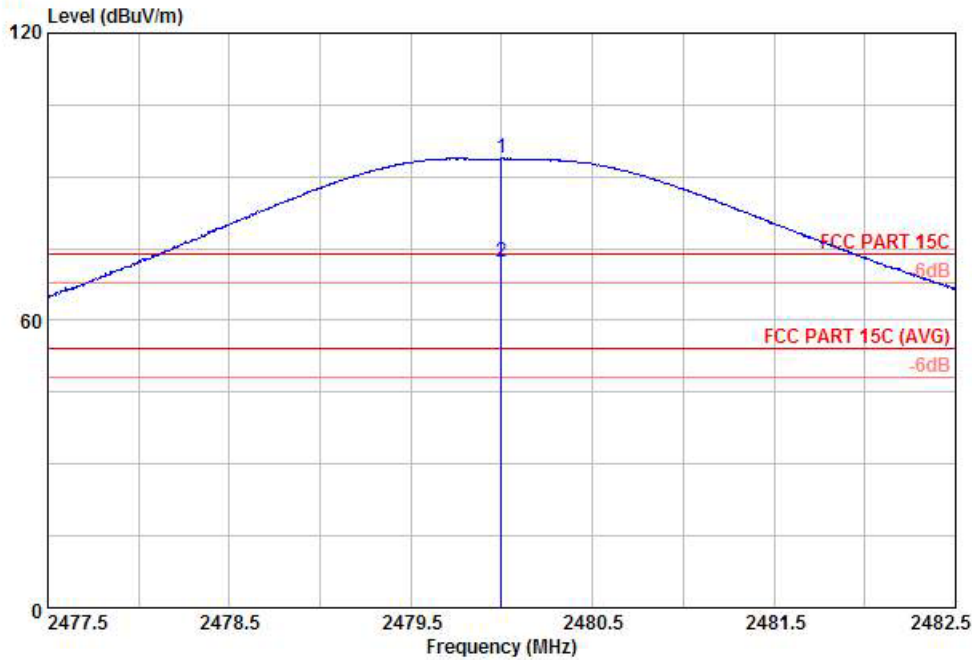
Site : 03CH01-KS
 Condition: FCC PART 15C 3m HF ANT-100803 HORIZONTAL

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	Ant	Table	
	MHz	dBuV/m	dB	dBuV/m	dBuV	Loss	Factor	Pos	Pos	Remark
					dB/m	dB	dB	cm	deg	
1 X	2480.00	99.36	25.36	74.00	91.06	4.29	29.00	108	101	Peak
2	2483.50	48.55	-25.45	74.00	40.25	4.29	29.00	112	0	Peak

* Marker-Delta Method (RBW/VBW=100KHz): 50.81 dB , single carrier Mode



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Vertical



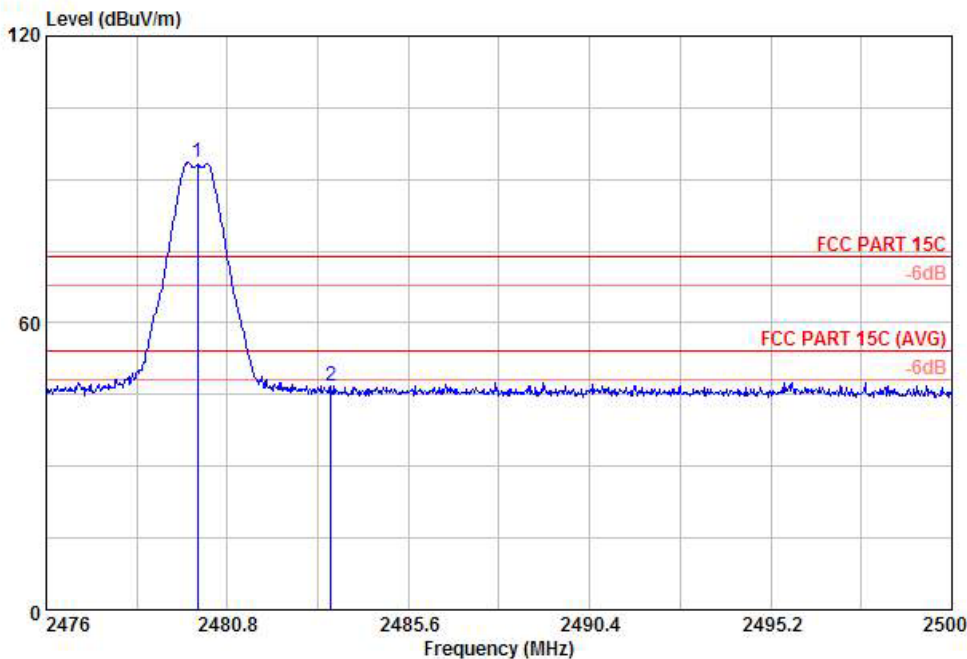
Site : 03CH01-KS
 Condition: FCC PART 15C 3m HF ANI-100803 VERTICAL

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Remark
	MHz	dBUV/m	dB	dBUV/m	dBuV	dB/m	dB	dB	cm	deg	
1 X	2480.00	93.83	19.83	74.00	85.53	33.01	4.29	29.00	101	260	Peak
2 X	2480.00	72.30	18.30	54.00	64.00	33.01	4.29	29.00	101	260	Average

* Maximum field strength of the fundamental emission



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Vertical



Site : 03CH01-KS
 Condition: FCC PART 15C 3m HF ANI-100803 VERTICAL

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	cm	deg	
1 X	2480.00	93.49	19.49	74.00	85.19	33.01	4.29	29.00	100	259 Peak
2	2483.54	46.88	-27.12	74.00	38.58	33.01	4.29	29.00	122	173 Peak

* Marker-Delta Method (RBW/VBW=100KHz): 46.61 dB , single carrier Mode



3.5.7 Test Result of Radiated Emission (30 MHz ~ 10th Harmonic)

Test Mode :	Mode 1	Temperature :	21~22°C
Test Channel :	00	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Horizontal
Remark :	2402 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
30.638	19.38	-20.62	40	31.92	17.29	0.25	30.08	-	-	Peak
99.528	20.29	-23.21	43.5	39.34	10.5	0.41	29.96	-	-	Peak
356.676	27.29	-18.71	46	41.75	14.65	0.82	29.93	-	-	Peak
782.345	24.71	-21.29	46	33.2	19.86	1.23	29.58	-	-	Peak
878.322	25.95	-20.05	46	33.74	20.47	1.29	29.55	-	-	Peak
942.131	30.42	-15.58	46	37.92	20.7	1.33	29.53	152	203	Peak
2369.09	53.52	-20.48	74	45.57	32.83	4.22	29.1	200	145	Peak
2369.09	39.1	-14.9	54	31.15	32.83	4.22	29.1	200	145	Average
2402	96.89	-	-	88.86	32.86	4.23	29.06	189	264	Peak
2402	74.43	-	-	66.4	32.86	4.23	29.06	189	264	Average
2484.23	53.96	-20.04	74	45.66	33.01	4.29	29	100	301	Peak
2484.23	39.19	-14.81	54	30.89	33.01	4.29	29	100	301	Average



Test Mode :	Mode 1	Temperature :	21~22°C
Test Channel :	00	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Vertical
Remark :	2402 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
40.559	24.63	-15.37	40	42.79	11.64	0.25	30.05	-	-	Peak
42.007	21.43	-18.57	40	40.3	10.95	0.26	30.08	-	-	Peak
70.09	26.57	-13.43	40	51.01	5.3	0.34	30.08	200	0	Peak
84.702	23.35	-16.65	40	45.47	7.53	0.37	30.02	-	-	Peak
782.345	25.81	-20.19	46	34.3	19.86	1.23	29.58	-	-	Peak
942.131	29.42	-16.58	46	36.92	20.7	1.33	29.53	-	-	Peak
2357.12	53.95	-20.05	74	46.06	32.81	4.21	29.13	105	245	Peak
2357.12	39.05	-14.95	54	31.16	32.81	4.21	29.13	105	245	Average
2402	92.78	-	-	84.75	32.86	4.23	29.06	100	244	Peak
2402	71.71	-	-	63.68	32.86	4.23	29.06	100	244	Average
2491.83	52.73	-21.27	74	44.37	33.05	4.3	28.99	200	0	Peak
2491.83	39.37	-14.63	54	31.01	33.05	4.3	28.99	200	0	Average



Test Mode :	Mode 2	Temperature :	21~22°C
Test Channel :	19	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Horizontal
Remark :	2440 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
32.406	18.53	-21.47	40	31.83	16.55	0.24	30.09	-	-	Peak
99.528	21.7	-21.8	43.5	40.75	10.5	0.41	29.96	-	-	Peak
356.676	23.69	-22.31	46	38.15	14.65	0.82	29.93	-	-	Peak
714.173	24.78	-21.22	46	33.89	19.44	1.14	29.69	-	-	Peak
878.322	24.55	-21.45	46	32.34	20.47	1.29	29.55	-	-	Peak
942.131	30.54	-15.46	46	38.04	20.7	1.33	29.53	100	0	Peak
2382.96	54.98	-19.02	74	47.02	32.83	4.22	29.09	200	97	Peak
2382.96	39.21	-14.79	54	31.25	32.83	4.22	29.09	200	97	Average
2440	97.53	-	-	89.36	32.95	4.25	29.03	143	100	Peak
2440	74.83	-	-	66.66	32.95	4.25	29.03	143	100	Average
2488.79	53.29	-20.71	74	44.95	33.05	4.29	29	113	206	Peak
2488.79	39.37	-14.63	54	31.03	33.05	4.29	29	113	206	Average



Test Mode :	Mode 2	Temperature :	21~22°C
Test Channel :	19	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Vertical
Remark :	2440 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
31.18	21.01	-18.99	40	33.55	17.29	0.25	30.08	-	-	Peak
38.481	25.9	-14.1	40	42.71	12.98	0.25	30.04	122	314	Peak
40.702	25.82	-14.18	40	43.98	11.64	0.25	30.05	-	-	Peak
99.528	22.02	-21.48	43.5	41.07	10.5	0.41	29.96	-	-	Peak
782.345	27.71	-18.29	46	36.2	19.86	1.23	29.58	-	-	Peak
942.131	31.33	-14.67	46	38.83	20.7	1.33	29.53	-	-	Peak
2350.85	53.71	-20.29	74	45.87	32.78	4.21	29.15	100	0	Peak
2350.85	39.01	-14.99	54	31.17	32.78	4.21	29.15	100	0	Average
2440	94.58	-	-	86.41	32.95	4.25	29.03	197	48	Peak
2440	72.98	-	-	64.81	32.95	4.25	29.03	197	48	Average
2497.15	52.77	-21.23	74	44.41	33.05	4.3	28.99	115	224	Peak
2497.15	38.6	-15.4	54	30.24	33.05	4.3	28.99	115	224	Average



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Horizontal
Remark :	2480 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
50.232	28.13	-11.87	40	50.58	7.4	0.28	30.13	102	114	Peak
88.033	30.6	-12.9	43.5	51.92	8.3	0.38	30	-	-	Peak
254.728	20.99	-25.01	46	38.1	12.07	0.67	29.85	-	-	Peak
356.676	24.63	-21.37	46	39.09	14.65	0.82	29.93	-	-	Peak
766.057	25.21	-20.79	46	33.67	19.89	1.2	29.55	-	-	Peak
942.131	31.02	-14.98	46	38.52	20.7	1.33	29.53	-	-	Peak
2362	52.96	-21.04	74	45.06	32.81	4.21	29.12	167	245	Peak
2362	39.15	-14.85	54	31.25	32.81	4.21	29.12	167	245	Average
2480	99.87	-	-	91.57	33.01	4.29	29	108	103	Peak
2480	76.13	-	-	67.83	33.01	4.29	29	108	103	Average
2483.5	48.55	-25.45	74	40.25	33.01	4.29	29	112	0	Peak
2483.5	25.32	-28.68	54	17.02	33.01	4.29	29	112	0	Average



Test Mode :	Mode 3	Temperature :	21~22°C
Test Channel :	39	Relative Humidity :	46~47%
Test Engineer :	Chenmy Cheng	Polarization :	Vertical
Remark :	2480 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
37.812	25.08	-14.92	40	41.2	13.7	0.24	30.06	200	147	Peak
39.854	25.06	-14.94	40	42.53	12.3	0.25	30.02	-	-	Peak
54.071	18.69	-21.31	40	42.04	6.49	0.29	30.13	-	-	Peak
99.528	21.82	-21.68	43.5	40.87	10.5	0.41	29.96	-	-	Peak
782.345	25.63	-20.37	46	34.12	19.86	1.23	29.58	-	-	Peak
942.131	30.74	-15.26	46	38.24	20.7	1.33	29.53	-	-	Peak
2346	52.38	-21.62	74	44.54	32.78	4.21	29.15	200	0	Peak
2346	38.37	-15.63	54	30.53	32.78	4.21	29.15	200	0	Average
2480	93.83	-	-	85.53	33.01	4.29	29	101	260	Peak
2480	72.3	-	-	64	33.01	4.29	29	101	260	Average
2483.536	46.88	-27.12	74	38.58	33.01	4.29	29	122	173	Peak
2483.536	25.69	-28.31	54	17.39	33.01	4.29	29	122	173	Average

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

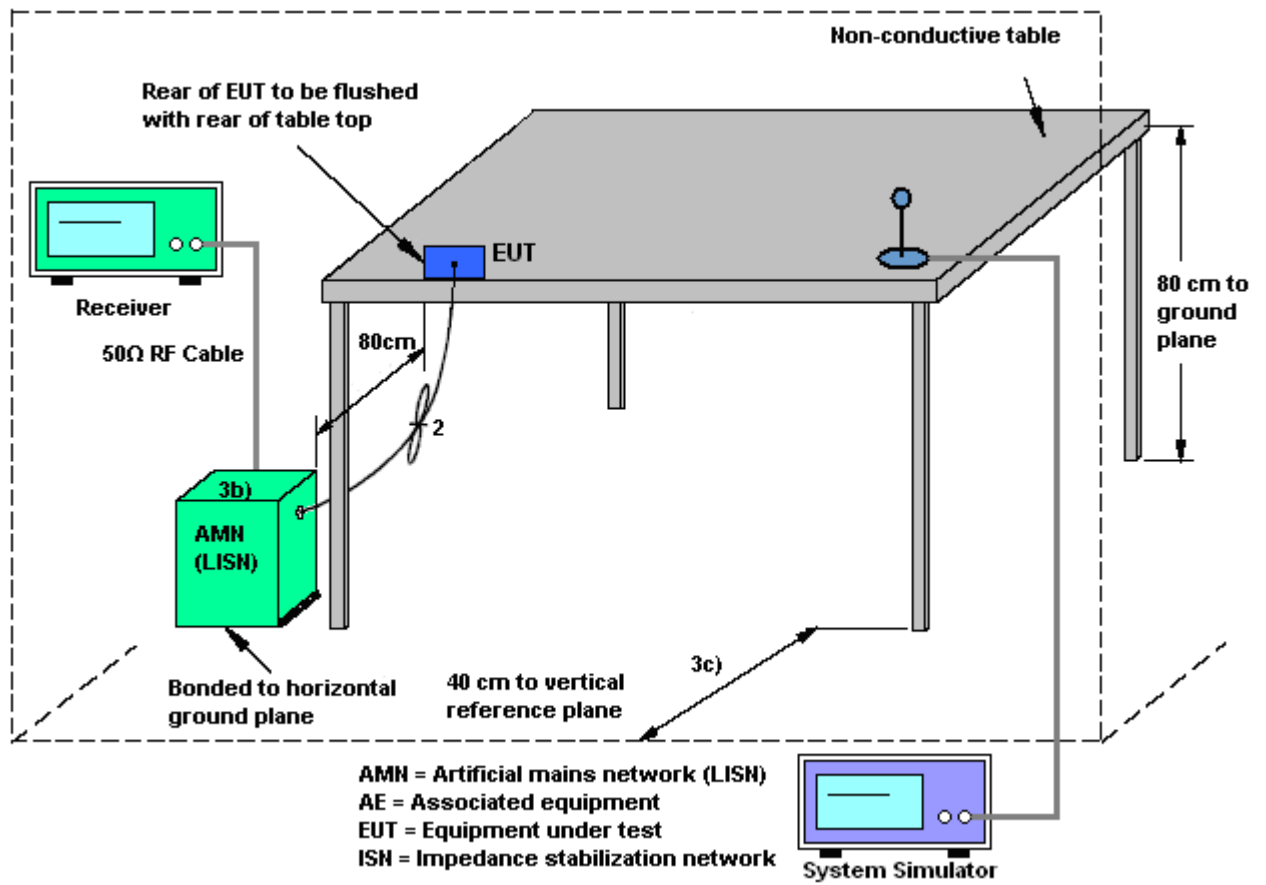
3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

3.6.3 Test Procedures

1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
1. Connect EUT to the power mains through a line impedance stabilization network (LISN).
2. All the support units are connecting to the other LISN.
3. The LISN provides 50 ohm coupling impedance for the measuring instrument.
4. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

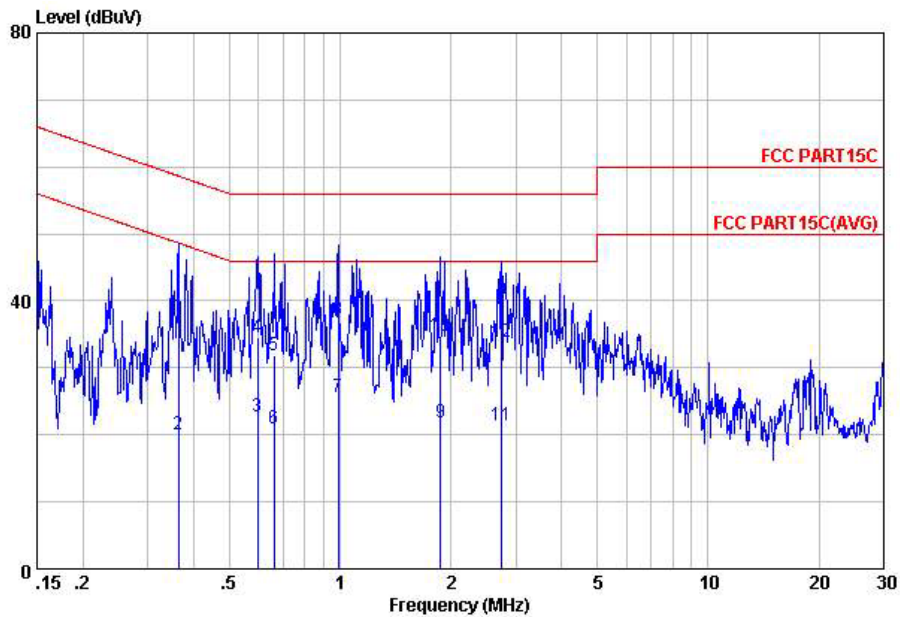
3.6.4 Test Setup





3.6.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	19~20°C
Test Engineer :	Tom Wang	Relative Humidity :	39~40%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 (GPRS 8) Idle + Bluetooth Link + WLAN Link + USB Cable (Charging from Adapter) + Camera		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		

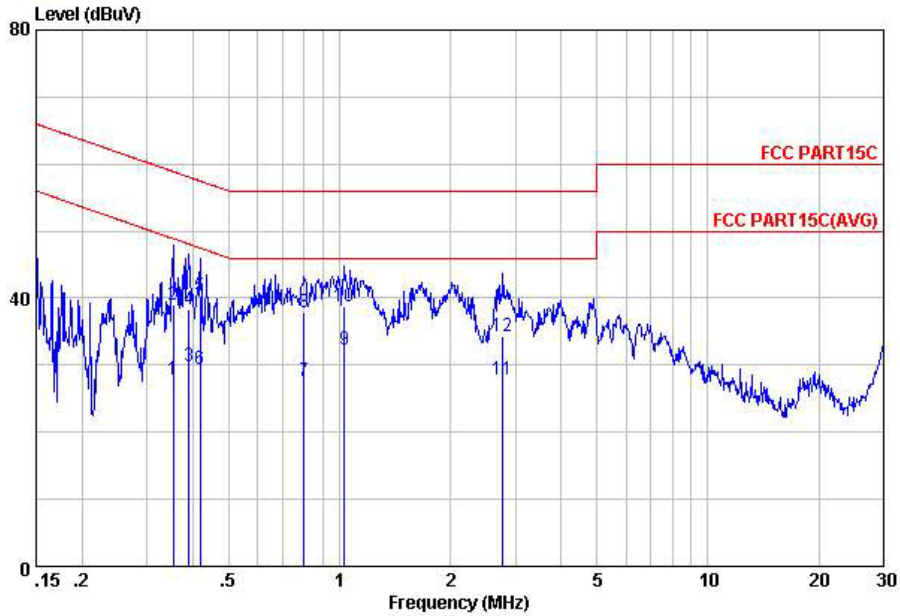


Site : C001-KS
 Condition: FCC PART15C LISN-111230 LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.36	37.63	-21.02	58.65	27.10	-0.08	10.61	QP
2	0.36	20.03	-28.62	48.65	9.50	-0.08	10.61	Average
3	0.60	22.65	-23.35	46.00	12.11	-0.09	10.63	Average
4	0.60	34.55	-21.45	56.00	24.01	-0.09	10.63	QP
5	0.66	31.95	-24.05	56.00	21.40	-0.09	10.64	QP
6	0.66	21.05	-24.95	46.00	10.50	-0.09	10.64	Average
7	0.99	25.65	-20.35	46.00	15.10	-0.10	10.65	Average
8	0.99	37.15	-18.85	56.00	26.60	-0.10	10.65	QP
9	1.88	21.79	-24.21	46.00	11.20	-0.11	10.70	Average
10	1.88	34.69	-21.31	56.00	24.10	-0.11	10.70	QP
11	2.74	21.44	-24.56	46.00	10.81	-0.12	10.75	Average
12	2.74	33.84	-22.16	56.00	23.21	-0.12	10.75	QP



Test Mode :	Mode 1	Temperature :	19~20°C
Test Engineer :	Tom Wang	Relative Humidity :	39~40%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 (GPRS 8) Idle + Bluetooth Link + WLAN Link + USB Cable (Charging from Adapter) + Camera		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : C001-KS
 Condition: FCC PART15C LISN-111230 NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.35	27.93	-20.94	48.87	17.40	-0.08	10.61	Average
2	0.35	39.03	-19.84	58.87	28.50	-0.08	10.61	QP
3	0.39	29.94	-18.14	48.08	19.40	-0.08	10.62	Average
4	0.39	38.24	-19.84	58.08	27.70	-0.08	10.62	QP
5	0.42	40.44	-17.02	57.46	29.90	-0.08	10.62	QP
6	0.42	29.34	-18.12	47.46	18.80	-0.08	10.62	Average
7	0.80	27.66	-18.34	46.00	17.09	-0.08	10.65	Average
8	0.80	37.96	-18.04	56.00	27.39	-0.08	10.65	QP
9	1.03	32.36	-13.64	46.00	21.80	-0.09	10.65	Average
10	1.03	38.86	-17.14	56.00	28.30	-0.09	10.65	QP
11	2.78	27.84	-18.16	46.00	17.20	-0.12	10.76	Average
12	2.78	34.34	-21.66	56.00	23.70	-0.12	10.76	QP



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.7.2 Antenna Connected Construction

Non-standard connector used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100319	9kHz~40GHz	Dec. 30, 2011	Aug. 15, 2012~ Aug. 16, 2012	Dec. 29, 2012	Conducted (TH01-KS)
Power Meter	Agilent	E4416A	MY45101555	N/A	Aug. 23, 2011	Aug. 15, 2012~ Aug. 16, 2012	Aug. 22, 2012	Conducted (TH01-KS)
Power Sensor	Agilent	E9327A	MY44421198	N/A	Aug. 23, 2011	Aug. 15, 2012~ Aug. 16, 2012	Aug. 22, 2012	Conducted (TH01-KS)
DC Power Supply	GWINSTEK	GPS-3030D	E1884515	N/A	Aug. 23, 2011	Aug. 15, 2012~ Aug. 16, 2012	Aug. 22, 2012	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	N/A	Dec. 30, 2011	Aug. 15, 2012~ Aug. 16, 2012	Dec. 29, 2012	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESCI	100534	9kHz~3GHz	Nov. 09, 2011	Aug. 16, 2012	Nov. 08, 2012	Radiation (03CH01-KS)
Spectrum Analyzer	R&S	FSP40	100319	9kHz~40GHz	Dec. 30, 2011	Aug. 16, 2012	Dec. 29, 2012	Radiation (03CH01-KS)
Bilog Antenna	SCHAFFNER	CBL6112D	23182	25MHz~2GHz	Dec. 08, 2011	Aug. 16, 2012	Dec. 07, 2012	Radiation (03CH01-KS)
Loop Antenna	R&S	HFH2-Z2	860004/00	9 kHz~30 MHz	Jul. 28, 2012	Aug. 16, 2012	Jul. 27, 2013	Radiation (03CH01-KS)
Double Ridge Horn Antenna	EMCO	3117	00075959	1GHz~18GHz	Jan. 06, 2012	Aug. 16, 2012	Jan. 05, 2013	Radiation (03CH01-KS)
Amplifier	Wireless	FPA-6592G	060004	30MHz~2GHz	Dec. 30, 2011	Aug. 16, 2012	Dec. 29, 2012	Radiation (03CH01-KS)
Amplifier	Agilent	8449B	3008A02370	1GHz~26.5GHz	Dec. 30, 2011	Aug. 16, 2012	Dec. 29, 2012	Radiation (03CH01-KS)
Active Horn Antenna	com-power	AHA-118	701023	1GHz~18GHz	Nov. 07, 2011	Aug. 16, 2012	Nov. 06, 2012	Radiation (03CH01-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Oct. 11, 2011	Aug. 16, 2012	Oct. 10, 2012	Radiation (03CH01-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz	Jun. 01, 2012	Jun. 27, 2012	May 31, 2013	Conduction (CO01-KS)
LISN	MessTec	AN3016	60103	9kHz~30MHz	Dec. 30, 2011	Jun. 27, 2012	Dec. 29, 2012	Conduction (CO01-KS)
LISN	MessTec	AN3016	60105	9kHz~30MHz	Dec. 30, 2011	Jun. 27, 2012	Dec. 29, 2012	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	N/A	Nov. 16, 2011	Jun. 27, 2012	Nov. 15, 2012	Conduction (CO01-KS)
System Simulator	R&S	CMU200	837587/066	2G Full-Band	Dec. 30, 2011	Jun. 27, 2012	Dec. 29, 2012	Conduction (CO01-KS)



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.26
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.54
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.72
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Appendix A. Photographs of EUT

Please refer to Sporton report number EP262503 as below.