FCC RF Test Report

APPLICANT	:	Sony Mobile Communications Inc.
EQUIPMENT	:	Smart phone
BRAND NAME	:	SONY
TYPE NAME	:	PM-0890-BV
FCC ID	:	PY7-PM0890
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on Apr. 30, 2015 and testing was completed on May 20, 2015. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

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APPENDIX A. TEST RESULT OF RADIATED EMISSION

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR543002B	Rev. 01	Initial issue of report	Jul. 02, 2015

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.2	15.247(b)(1)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 11.69 dB at 2494.520 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 11.20 dB at 2.710. MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Sony Mobile Communications Inc.
Nya Vattentornet, 22188 Lund, Sweden

1.2 Manufacturer

Arima Communications Corp.
6F, No. 866, Jhongjheng Rd., Jhonghe Dist., New Taipei City 23586, Taiwan

1.3 Product Feature of Equipment Under Test

The Equipment Under Test (hereafter called: EUT) is smart phone supporting, GSM/WCDMA/LTE, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n, Bluetooth with FM Receiver, GPS, and NFC features, and below is details of information.

Product Feature	
Equipment	Smart phone
Brand Name	SONY
Type Name	PM-0890-BV
FCC ID	PY7-PM0890
GSM Operating Band(s)	GSM 850/900/1800/1900MHz
GPRS / EGPRS Multi Slot Class	GPRS Class 12, EGPRS Class 12
WCDMA Operating Band(s)	FDD Band I / II / IV / V / VIII
WCDMA Rel. Version	Rel. 8
LTE Operating Band(s)	FDD Band II / IV / V / VII / XII / XIII / XVII / XXVIII
LTE Rel. Version	Rel. 8
Wi-Fi Specification	802.11a/b/g/n (HT20/HT40)
Bluetooth Version	v3.0+EDR / v4.0-LE
NFC Specification	ISO14443A / ISO14443B / Felica
Power Supply	Battery / AC Adapter / Car Charger

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

1.4 Product Specification subjective to this standard

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	1.71 dBm (0.0015 W)
99% Occupied Bandwidth	1.014MHz
Antenna Type	PIFA Antenna type with gain -6.90 dBi
Type of Modulation	Bluetooth LE : GFSK

EUT Information List				
IMEI	HW Version	SW Version	S/N	Performed Test Item
IMEI : 004402454681739	A	29.0.A.0.76	WUJ01HYJ4Y	RF conducted measurement
IMEI : 004402454681804			WUJ01HYJD7	Radiated Spurious Emission
IMEI : 004402454681721			WUJ01HYJ4J	Conducted Emission

Accessory List	
AC Adapter	Model No. : EP800
	Type No. : CAA-0002016-US B
	S/N : 3113W 38 210631 (For Conducted Emission) 3113W 45 108545 (For Radiated Emission)
Battery	Model No. : LIS1579ERPC
Earphone 1	Model No. : MH410c
	Type No. : AG-1100
	S/N : 14371E6600174A0 (For Conducted Emission) 13511E63001BFF6 (For Radiated Emission)
Earphone 2	Model No. : MH410c
	Type No. : AG-1103
	S/N : 14292040011682C (For Conducted Emission) 1428204D011619A (For Radiated Emission)
USB Cable	Model No. : EC450
	Type No. : AI-0700
	S/N : 134912D1000585A (For Conducted Emission) 143412DE1065866 (For Radiated Emission)

Note:

1. Above EUT list and accessory list used are electrically identical per declared by manufacturer.
2. Above the accessories list are used to exercise the EUT during test.
3. For other wireless features of this EUT, test report will be issued separately.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	**Sporton Site No.**	
	TH02-HY	CO05-HY

Note: The test site complies with ANSI C63.4 2009 requirement.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Township, Taoyuan County, Taiwan (R.O.C.) TEL: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH11-HY

Note: The test site complies with ANSI C63.4 2009 requirement.

1.7 Applicable 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 v03r03
- ANSI C63.10-2009

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. FCC permits the use of the 1.5 meter table as an alternative in C63.10-2013 through inquiry tracking number 961829.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power
		Data Rate / Modulation
		GFSK
		1Mbps
Ch00	2402MHz	0.15 dBm
Ch19	2440MHz	**1.71 dBm**
Ch39	2480MHz	0.66 dBm

a. The EUT has been associated with peripherals 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 to determine the final configuration (Z plane as worst plane) from all possible combinations.

b. AC power line Conducted Emission was tested under maximum output power.

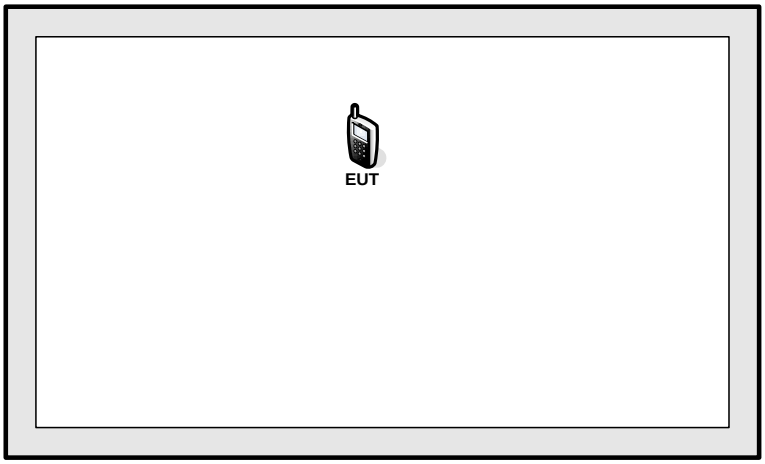
2.2 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

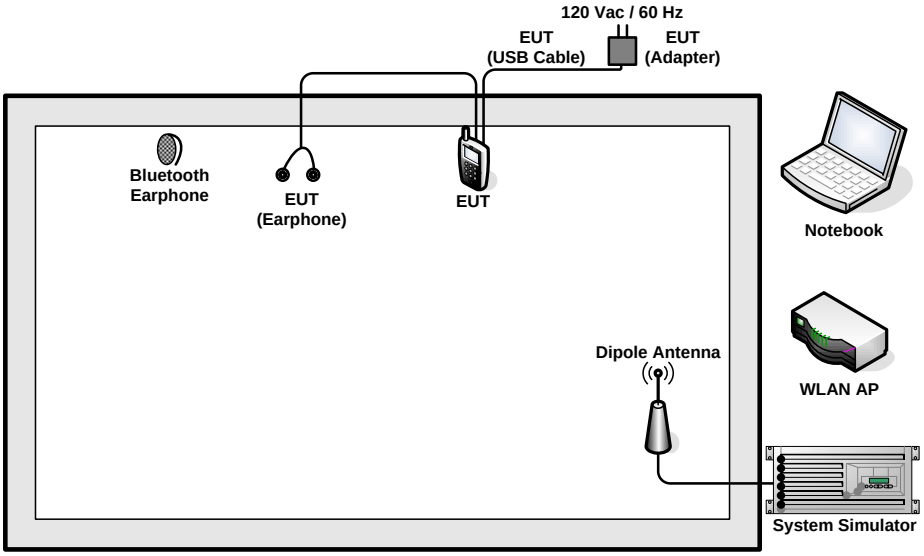
Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + Battery + USB Cable (Charging from Adapter) + MP3

2.3 Connection Diagram of Test System

<Bluetooth 4.0 – LE Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony	SBH20	PY7-RD0010	Unshielded, 0.75m	N/A
3.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

For Bluetooth test items, an engineering test program was provided and enabled to make EUT transmitting and receiving signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

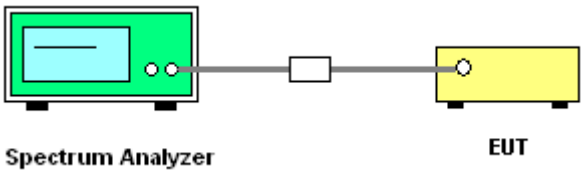
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. 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.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup

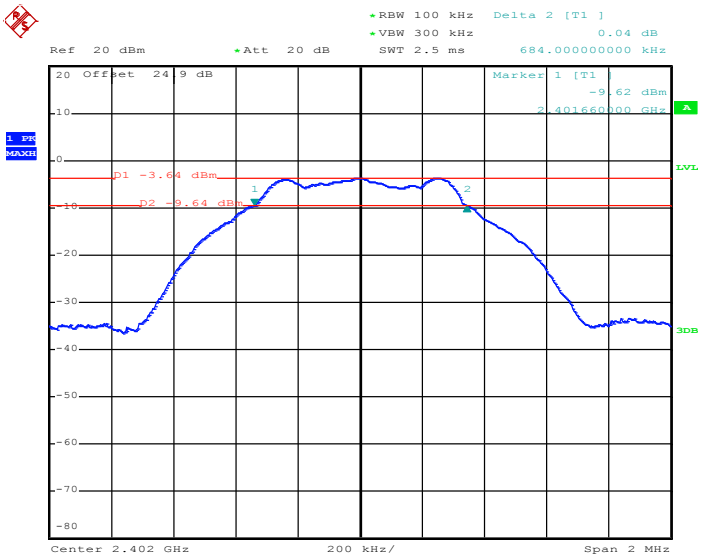


3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Engineer :	Bill Kuo	**Relative Humidity :**	51~55%

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
00	2402	0.684	0.5	Pass
19	2440	0.692	0.5	Pass
39	2480	0.696	0.5	Pass

6 dB Bandwidth Plot on Channel 00



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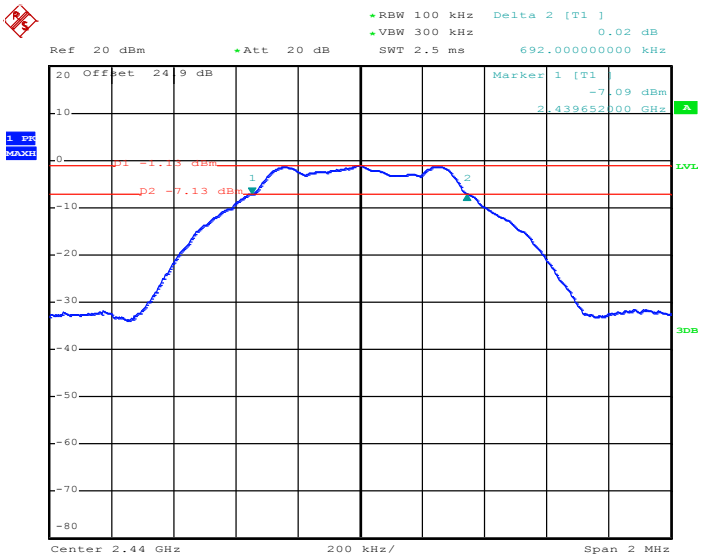
Note: The total loss is 25.2 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.

6 dB Bandwidth Plot on Channel 19



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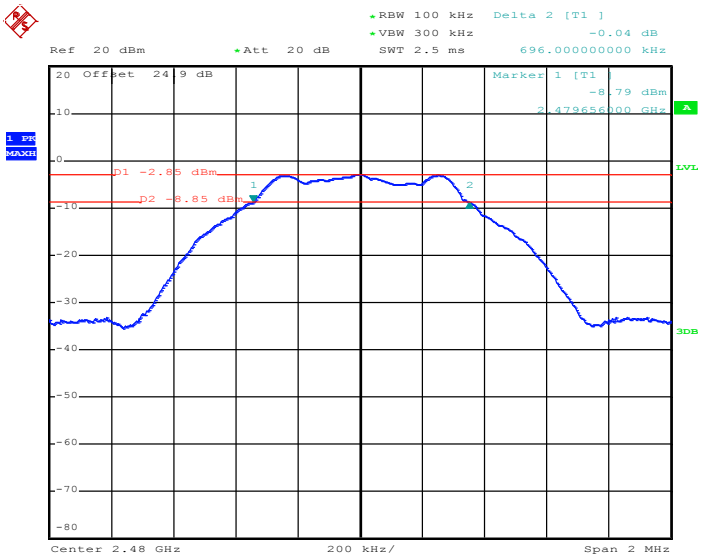
6 dB Bandwidth Plot on Channel 39



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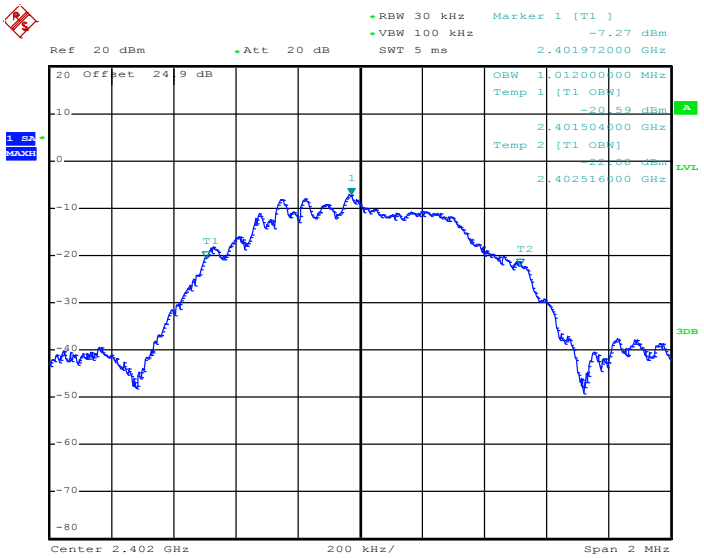
3.1.6 Test Result of 99% Occupied Bandwidth

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Engineer :	Bill Kuo	**Relative Humidity :**	51~55%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.012
19	2440	1.014
39	2480	1.012

99% Bandwidth Plot on Channel 00



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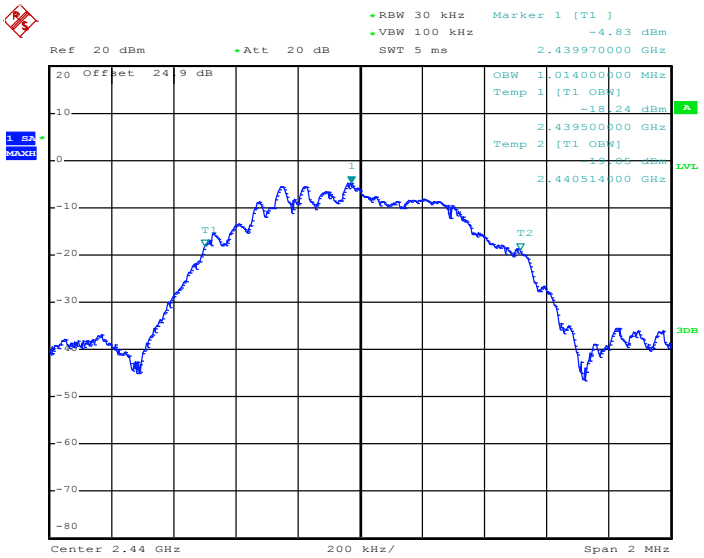
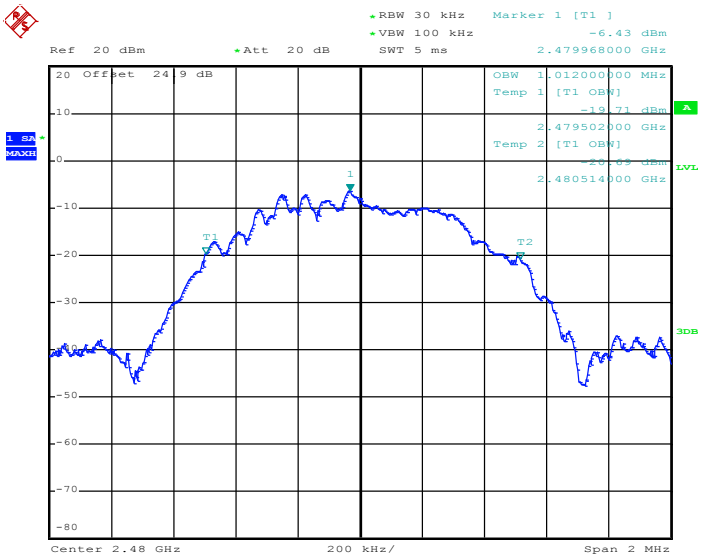
99% Occupied Bandwidth Plot on Channel 19



Date: 16.MAY.2015 14:25:12

99% Occupied Bandwidth Plot on Channel 39



Date: 16.MAY.2015 14:29:56

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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 is 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.

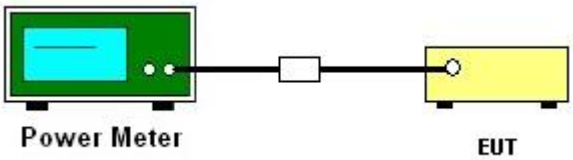
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r03.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. 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. 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 4.0 - LE	**Temperature :**	22~25℃
Test Engineer :	Bill Kuo	**Relative Humidity :**	51~55%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	0.15	30.00	Pass
19	2440	1.71	30.00	Pass
39	2480	0.66	30.00	Pass

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.

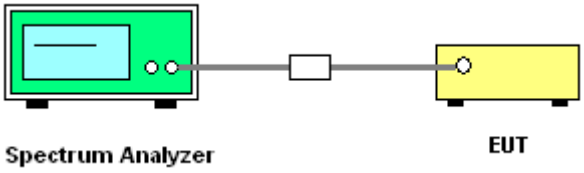
3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. 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) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
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.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Engineer :	Bill Kuo	**Relative Humidity :**	51~55%

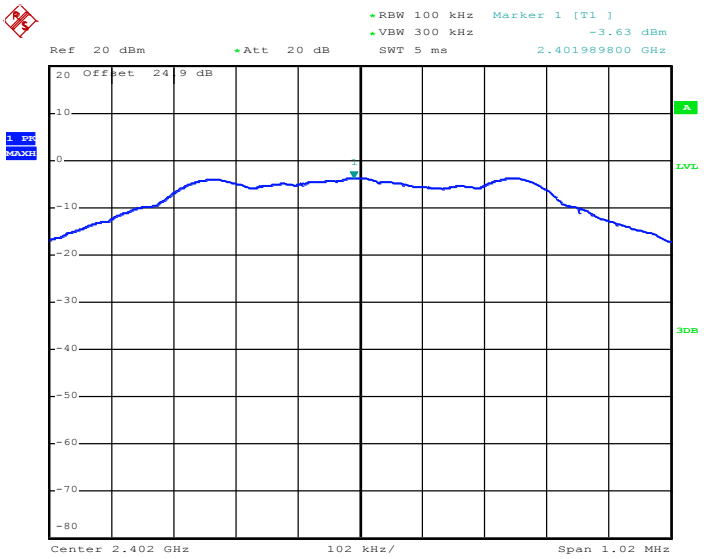
Channel	Frequency (MHz)	Power Density		Max. Limits (dBm/3kHz)	Pass/Fail
		PSD/100kHz (dBm)	PSD/3kHz (dBm)		
00	2402	-3.63	-18.33	8	Pass
19	2440	-1.11	-15.88	8	Pass
39	2480	-2.82	-17.58	8	Pass

Note:

1. *The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.*
2. *Measured power density (dBm) has offset with cable loss.*
3. *The Measured power density (dBm)/ 100kHz is reference level and used as 20dBc down for Conducted Band Edges and Conducted Spurious Emission limit line.*

3.3.6 Test Result of Power Spectral Density Plots (100kHz)

PSD 100kHz Plot on Channel 00



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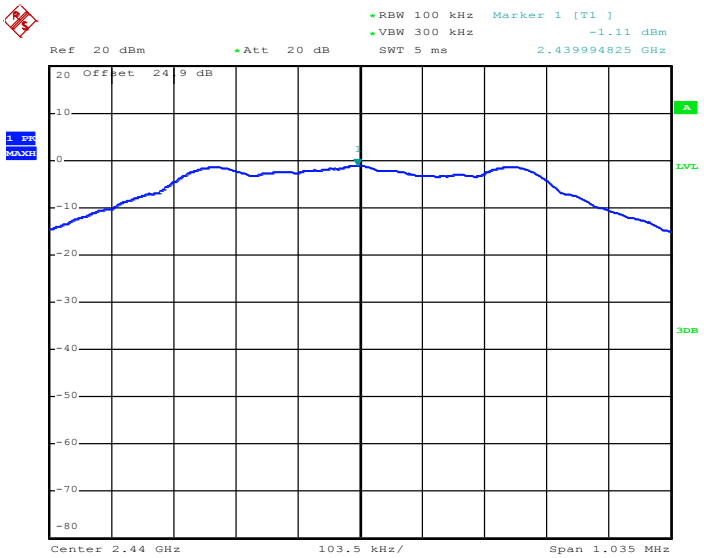
PSD 100kHz Plot on Channel 19



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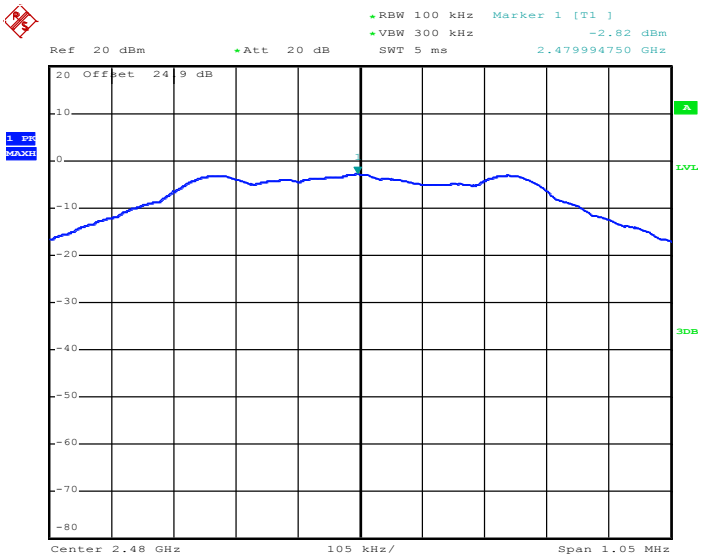
PSD 100kHz Plot on Channel 39



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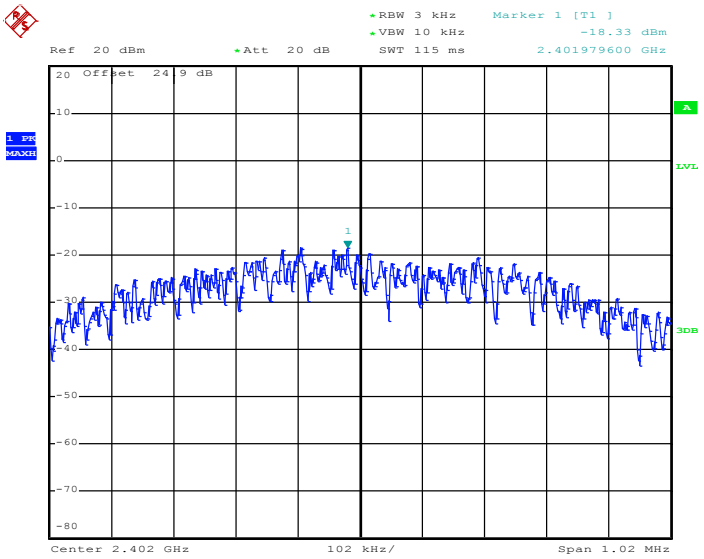
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

PSD 3kHz Plot on Channel 00



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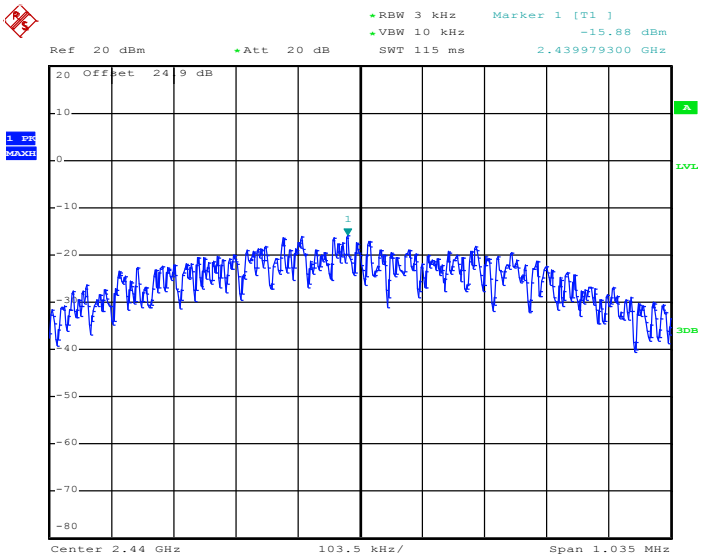
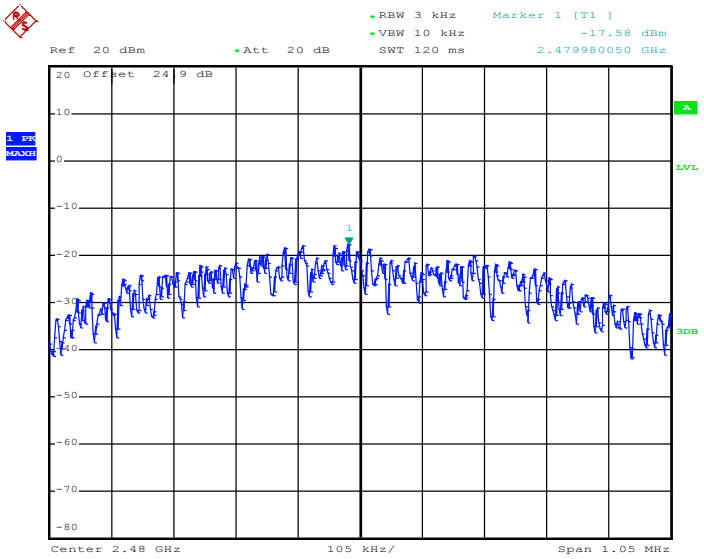
PSD 3kHz Plot on Channel 19



Date: 16.MAY.2015 14:23:54

PSD 3kHz Plot on Channel 39



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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.

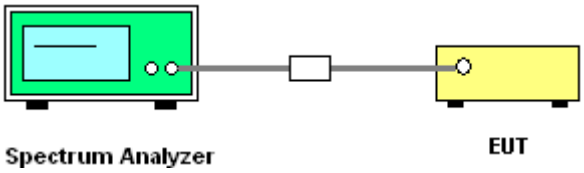
3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.4.3 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. 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. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. 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).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

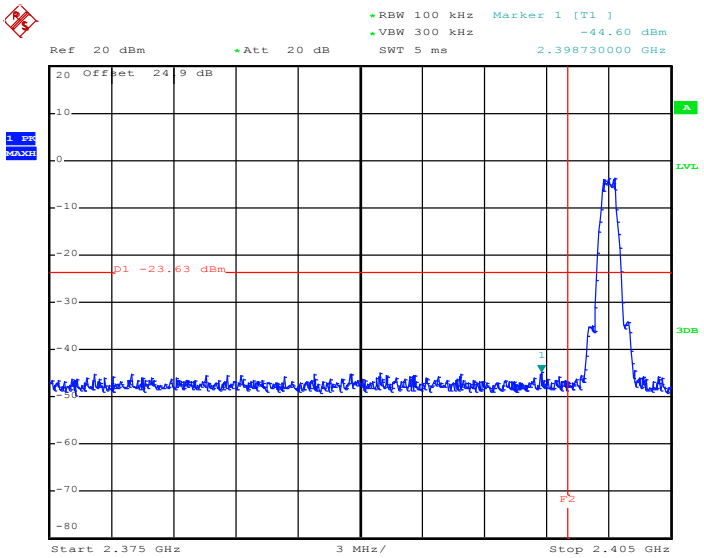
3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges

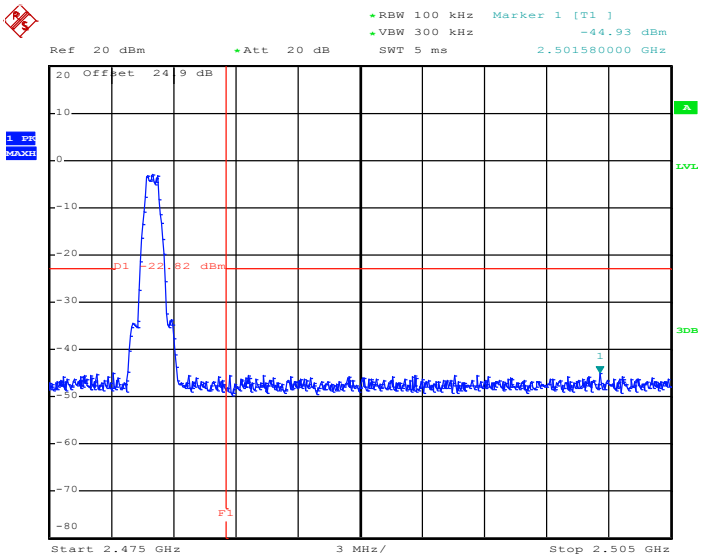
Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Channel :	00 and 39	**Relative Humidity :**	51~55%
		Test Engineer :	Bill Kuo

Low Band Edge Plot on Channel 00



Date: 16.MAY.2015 14:21:01

High Band Edge Plot on Channel 39



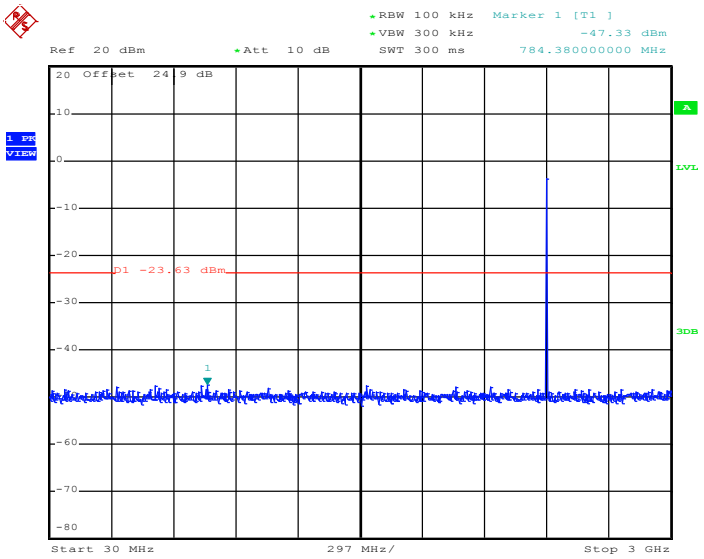
Date: 16.MAY.2015 14:28:13

3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Channel :	00	**Relative Humidity :**	51~55%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 00

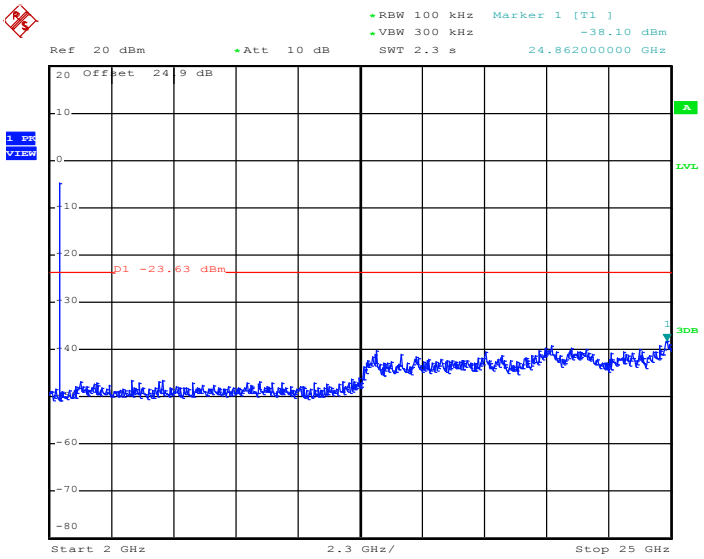


Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 00



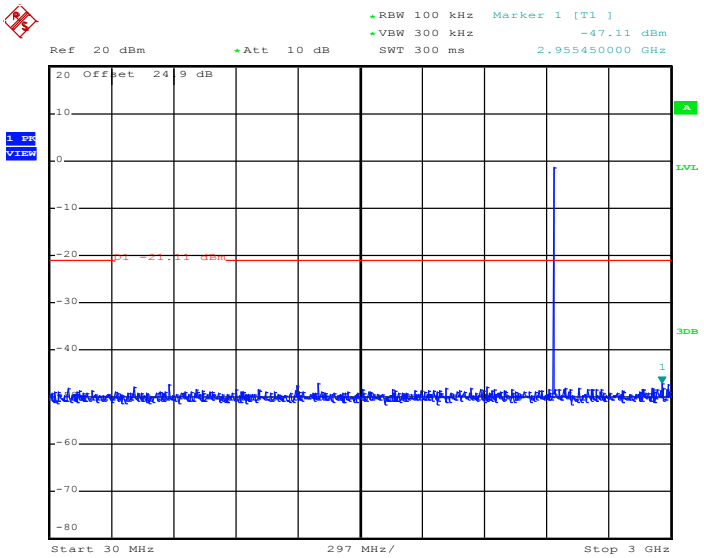
Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Channel :	19	**Relative Humidity :**	51~55%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 19



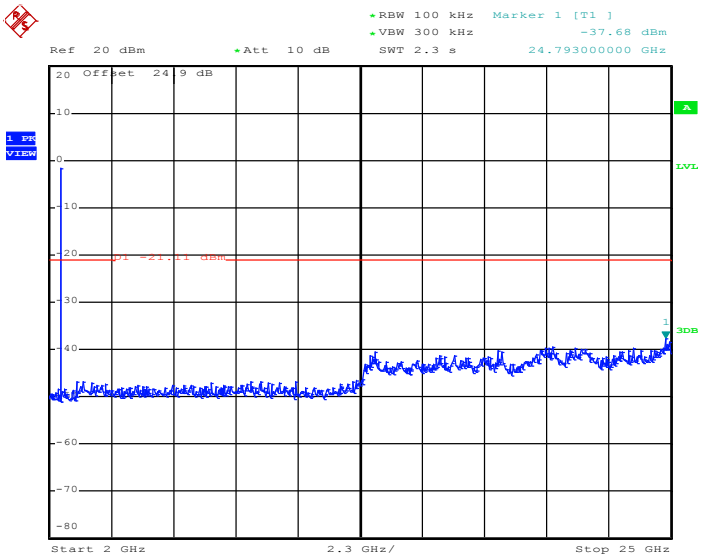
Date: 16.MAY.2015 14:24:39

Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 19



Date: 16.MAY.2015 14:24:57

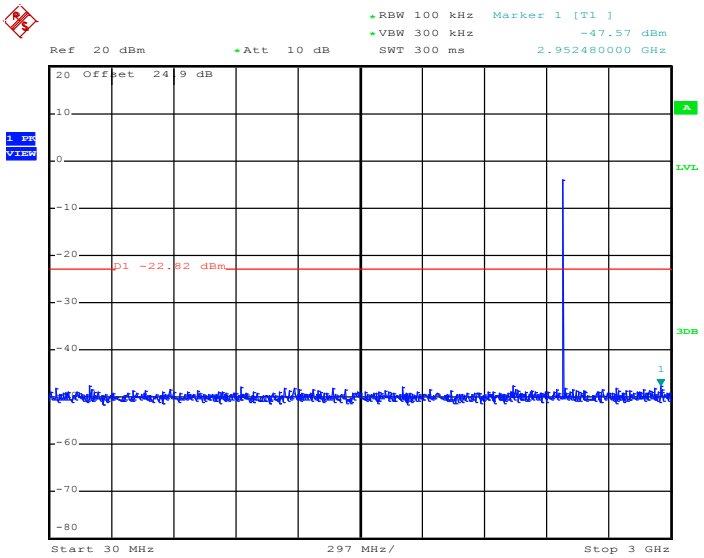
Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Test Mode :	Bluetooth 4.0 - LE	**Temperature :**	22~25℃
Test Channel :	39	**Relative Humidity :**	51~55%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39

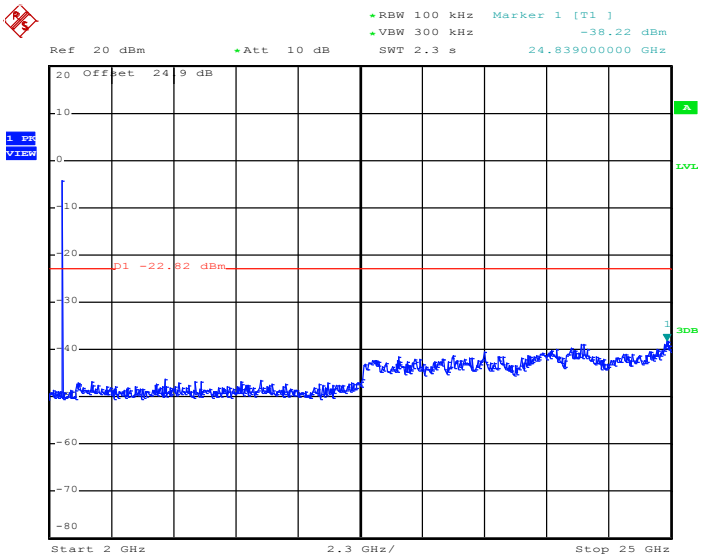


Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39



Note:

1. The total loss is 24.9 dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer offset.
2. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. 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

The section 4.0 of List of Measuring Equipment of this test report is used for test.

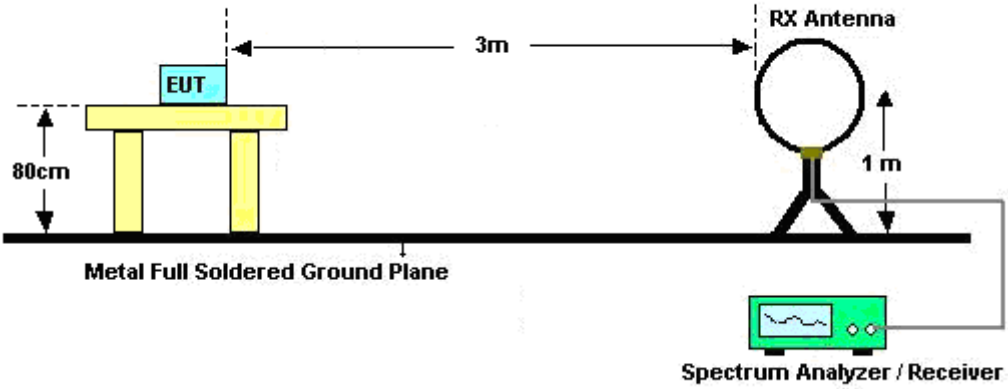
3.5.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. 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.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

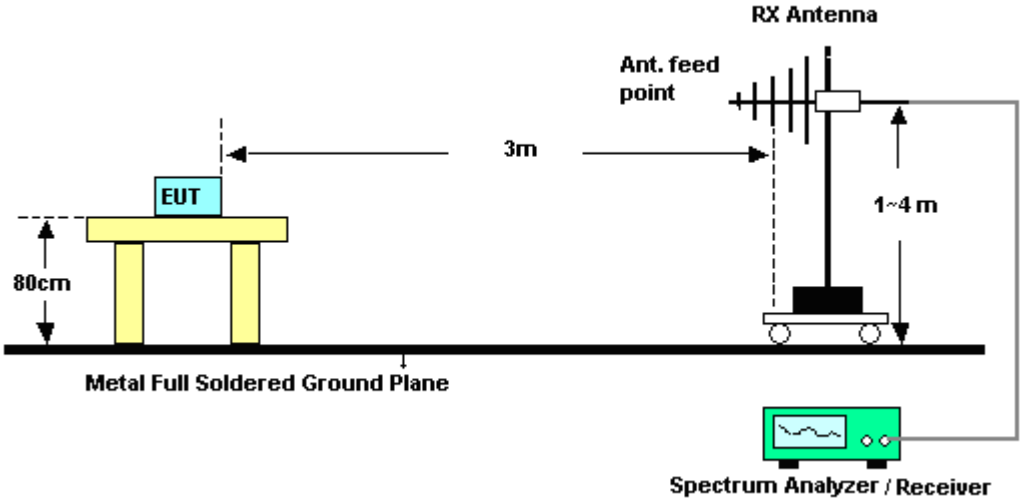
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
Bluetooth 4.0 - LE	60.51	380	2.63	3kHz

3.5.4 Test Setup

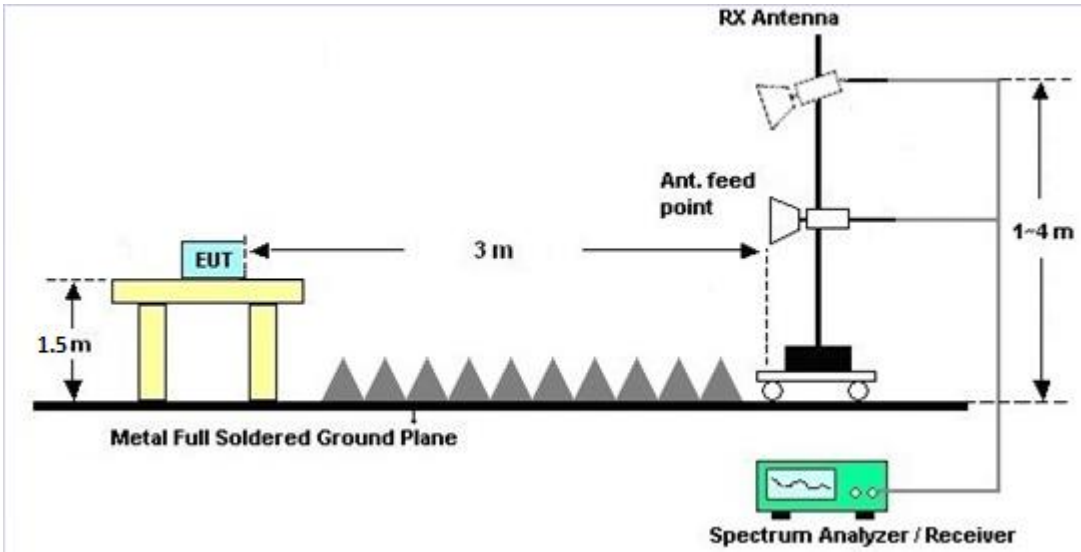
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Spurious 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 Spurious at Band Edges

Please refer to Appendix A.

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

Please refer to Appendix A.

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 (dBμV)	
	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.

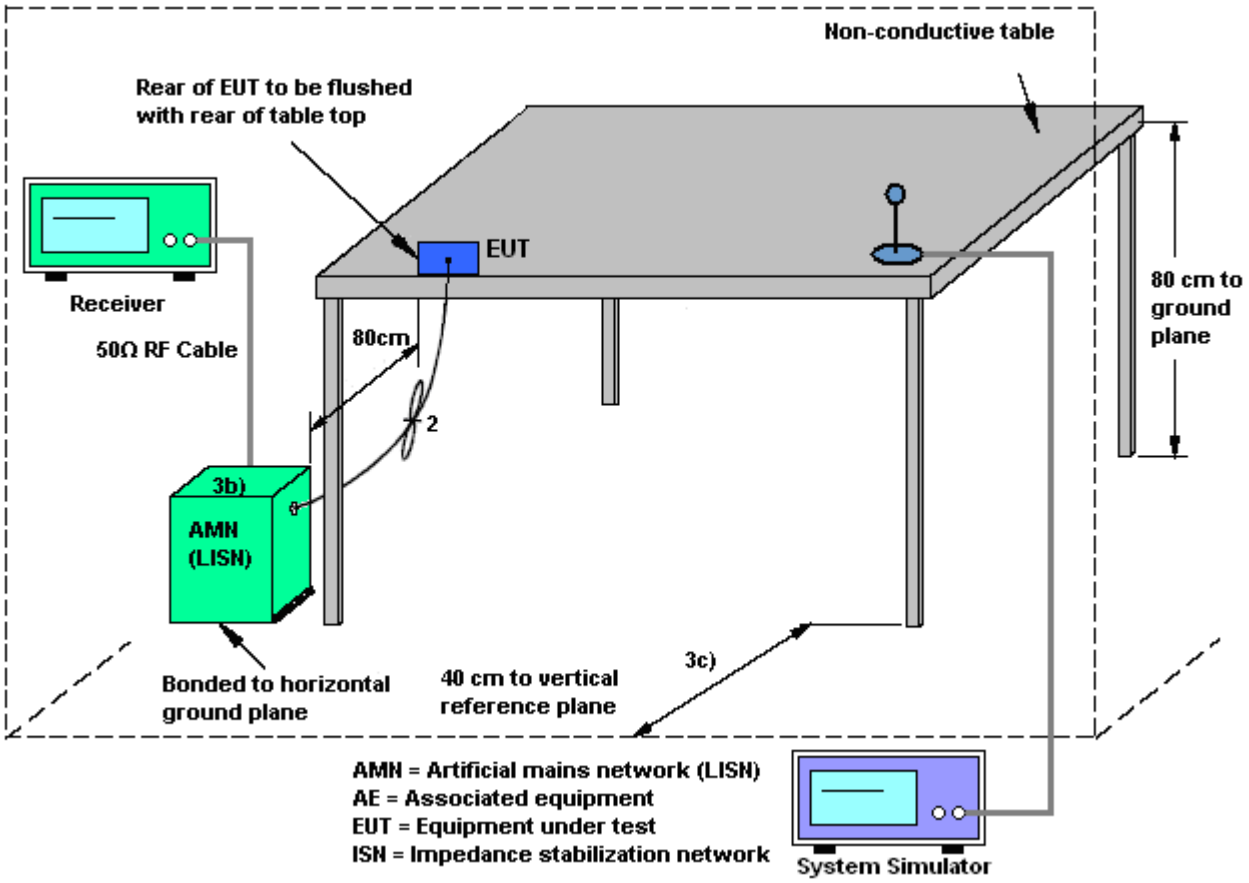
3.6.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.6.3 Test Procedures

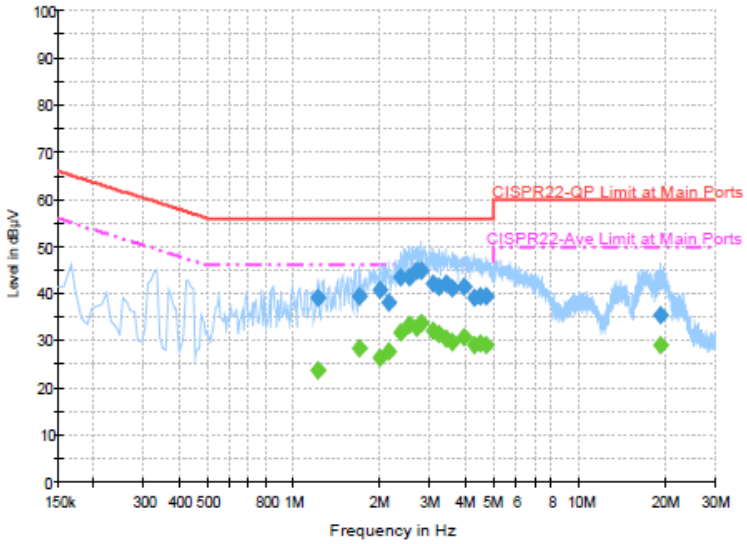
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

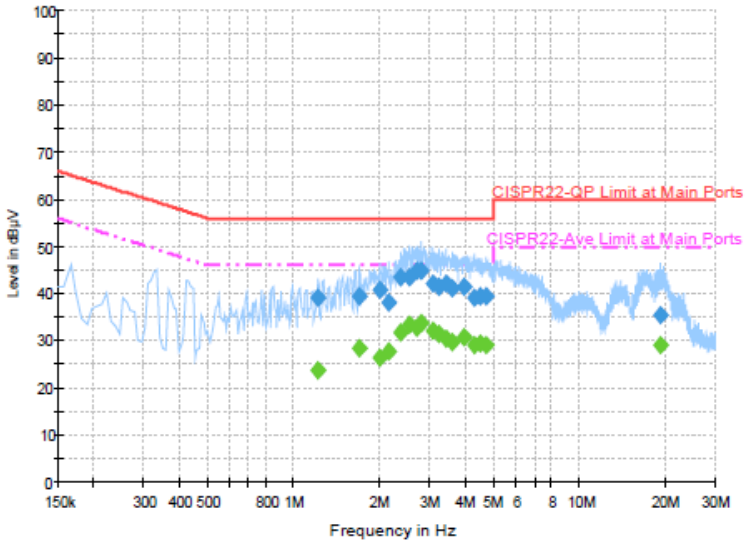
Test Mode :	Mode 1	**Temperature :**	22~23℃
Test Engineer :	Kai-Chun Chu	**Relative Humidity :**	53~54%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + Battery + USB Cable (Charging from Adapter) + MP3		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.222000	39.2	Off	L1	19.6	16.8	56.0
1.710000	39.5	Off	L1	19.6	16.5	56.0
2.014000	40.9	Off	L1	19.6	15.1	56.0
2.158000	38.1	Off	L1	19.7	17.9	56.0
2.374000	43.3	Off	L1	19.7	12.7	56.0
2.542000	43.5	Off	L1	19.7	12.5	56.0
2.710000	44.8	Off	L1	19.7	11.2	56.0
2.814000	44.7	Off	L1	19.7	11.3	56.0
3.086000	42.3	Off	L1	19.7	13.7	56.0
3.254000	41.3	Off	L1	19.7	14.7	56.0
3.446000	42.1	Off	L1	19.7	13.9	56.0
3.622000	41.0	Off	L1	19.7	15.0	56.0
3.966000	41.6	Off	L1	19.7	14.4	56.0
4.318000	39.0	Off	L1	19.7	17.0	56.0
4.534000	39.4	Off	L1	19.8	16.6	56.0
4.750000	39.5	Off	L1	19.8	16.5	56.0
19.230000	35.6	Off	L1	20.0	24.4	60.0

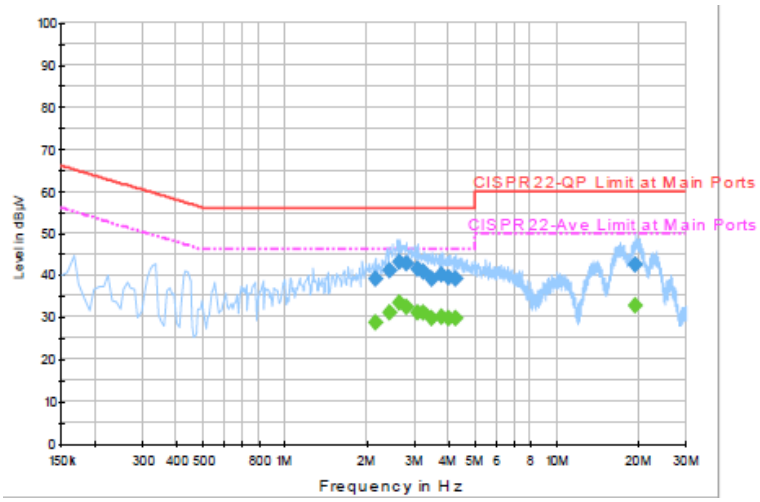
Test Mode :	Mode 1	**Temperature :**	22~23℃
Test Engineer :	Kai-Chun Chu	**Relative Humidity :**	53~54%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + Battery + USB Cable (Charging from Adapter) + MP3		



Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.222000	23.9	Off	L1	19.6	22.1	46.0
1.710000	28.4	Off	L1	19.6	17.6	46.0
2.014000	26.6	Off	L1	19.6	19.4	46.0
2.158000	27.8	Off	L1	19.7	18.2	46.0
2.374000	31.8	Off	L1	19.7	14.2	46.0
2.542000	33.6	Off	L1	19.7	12.4	46.0
2.710000	32.8	Off	L1	19.7	13.2	46.0
2.814000	33.8	Off	L1	19.7	12.2	46.0
3.086000	32.1	Off	L1	19.7	13.9	46.0
3.254000	31.4	Off	L1	19.7	14.6	46.0
3.446000	30.4	Off	L1	19.7	15.6	46.0
3.622000	29.9	Off	L1	19.7	16.1	46.0
3.966000	30.8	Off	L1	19.7	15.2	46.0
4.318000	29.1	Off	L1	19.7	16.9	46.0
4.534000	29.4	Off	L1	19.8	16.6	46.0
4.750000	29.1	Off	L1	19.8	16.9	46.0
19.230000	29.0	Off	L1	20.0	21.0	50.0

Test Mode :	Mode 1	**Temperature :**	22~23℃
Test Engineer :	Kai-Chun Chu	**Relative Humidity :**	53~54%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Function Type :	GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + Battery + USB Cable (Charging from Adapter) + MP3		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
2.150000	39.1	Off	N	19.7	16.9	56.0
2.422000	41.2	Off	N	19.7	14.8	56.0
2.646000	43.1	Off	N	19.6	12.9	56.0
2.814000	42.9	Off	N	19.7	13.1	56.0
3.094000	41.6	Off	N	19.7	14.4	56.0
3.254000	40.8	Off	N	19.7	15.2	56.0
3.462000	39.2	Off	N	19.7	16.8	56.0
3.758000	40.0	Off	N	19.7	16.0	56.0
4.030000	39.4	Off	N	19.7	16.6	56.0
4.254000	39.1	Off	N	19.7	16.9	56.0
19.646000	42.3	Off	N	20.1	17.7	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
2.150000	28.7	Off	N	19.7	17.3	46.0
2.422000	31.0	Off	N	19.7	15.0	46.0
2.646000	33.3	Off	N	19.6	12.7	46.0
2.814000	32.4	Off	N	19.7	13.6	46.0
3.094000	31.1	Off	N	19.7	14.9	46.0
3.254000	31.1	Off	N	19.7	14.9	46.0
3.462000	29.8	Off	N	19.7	16.2	46.0
3.758000	30.1	Off	N	19.7	15.9	46.0
4.030000	29.8	Off	N	19.7	16.2	46.0
4.254000	29.6	Off	N	19.7	16.4	46.0
19.646000	32.8	Off	N	20.1	17.2	50.0

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 Anti-Replacement Construction

An embedded-in antenna design is 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
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Aug. 09, 2014	May 16, 2015	Aug. 08, 2015	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 11, 2014	May 16, 2015	Aug. 10, 2015	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	May 16, 2015	Jun. 08, 2015	Conducted (TH02-HY)
Hygrometer	Testo	608-H2	41410069	N/A	Jul. 17, 2014	May 16, 2015	Jul. 16, 2015	Conducted (TH02-HY)
RF Cable	HARBOUR INDUSTRIES	LL142	Infinet CA3601-360 1-DLL	0.1MHz~40GHz	Mar. 06, 2015	May 16, 2015	Mar. 05, 2016	Conducted (TH02-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 24, 2014	May 18, 2015~ May 20, 2015	Nov. 23, 2015	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D	35414	30MHz~1GHz	Oct. 24, 2014	May 18, 2015~ May 20, 2015	Oct. 23, 2015	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 03, 2014	May 18, 2015~ May 20, 2015	Oct. 02, 2015	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP140325	N/A	Nov. 19, 2014	May 18, 2015~ May 20, 2015	Nov. 18, 2015	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 20, 2014	May 18, 2015~ May 20, 2015	Nov. 19, 2015	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHZ	Sep. 24, 2014	May 18, 2015~ May 20, 2015	Sep. 23, 2015	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24967/4 MY28419/4 MY28654/4	25GHz~40GHz	Nov. 06, 2014	May 18, 2015~ May 20, 2015	Nov. 05, 2015	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24967/4 MY28419/4 MY28654/4	30MHz~1GHz	Nov. 06, 2014	May 18, 2015~ May 20, 2015	Nov. 05, 2015	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24967/4 MY28419/4 MY28654/4	1GHz~25GHz	Nov. 06, 2014	May 18, 2015~ May 20, 2015	Nov. 05, 2015	Radiation (03CH11-HY)
Filter	Wainwright	WLKS1200-8S S	SN3	1.2G Low Pass	Oct. 01, 2014	May 18, 2015~ May 20, 2015	Sep. 30, 2015	Radiation (03CH11-HY)
Filter	Microwave	H3G018G1	SN477220	3.0G High Pass	Oct. 01, 2014	May 18, 2015~ May 20, 2015	Sep. 30, 2015	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	May 18, 2015~ May 20, 2015	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	May 18, 2015~ May 20, 2015	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0-360 degree	N/A	May 18, 2015~ May 20, 2015	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	JS44-1800400 0-33-8P	1840917	18GHz ~ 40GHz	Jun. 09, 2014	May 18, 2015~ May 20, 2015	Jun. 08, 2015	Radiation (03CH11-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jul. 28, 2014	May 18, 2015~ May 20, 2015	Jul. 27, 2015	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 03, 2014	May 18, 2015~ May 20, 2015	Nov. 02, 2015	Radiation (03CH11-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz – 2.75GHz	Dec. 01, 2014	May 14, 2015	Nov. 30, 2015	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Apr. 20, 2015	May 14, 2015	Apr. 19, 2016	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 02, 2014	May 14, 2015	Dec. 01, 2015	Conduction (CO05-HY)
LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 08, 2014	May 14, 2015	Dec. 07, 2015	Conduction (CO05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	May 14, 2015	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2015	May 14, 2015	Jan. 01, 2016	Conduction (CO05-HY)

Note: Test equipment calibration is traceable to the procedure of ISO17025.

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**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.90**

Appendix A. Radiated Spurious Emission

Test Engineer :	Jesse Wang and Derreck Chen	Temperature :	22~24°C
		Relative Humidity :	45~48%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2378.49	50.8	-23.2	74	51.64	27.19	6.01	34.04	341	299	P	H
		2368.77	41.82	-12.18	54	42.66	27.19	6.01	34.04	341	299	A	H
	*	2402.25	89.37	-	-	90.17	27.23	6.01	34.04	341	299	P	H
	*	2402	88.74	-	-	89.54	27.23	6.01	34.04	341	299	A	H
													H
													H
		2375.25	51.05	-22.95	74	51.89	27.19	6.01	34.04	115	137	P	V
		2382.18	41.82	-12.18	54	42.66	27.19	6.01	34.04	115	137	A	V
	*	2402	89.89	-	-	90.69	27.23	6.01	34.04	115	137	P	V
	*	2402	89.2	-	-	90	27.23	6.01	34.04	115	137	A	V
													V
													V
BLE CH 19 2440MHz		2352.57	51.24	-22.76	74	52.2	27.14	5.95	34.05	369	304	P	H
		2380.11	42.12	-11.88	54	42.96	27.19	6.01	34.04	369	304	A	H
	*	2440.25	92.76	-	-	93.38	27.37	6.04	34.03	369	304	P	H
	*	2440.08	92.25	-	-	92.87	27.37	6.04	34.03	369	304	A	H
		2499.08	51.64	-22.36	74	52.05	27.5	6.09	34	369	304	P	H
		2494.12	42.28	-11.72	54	42.69	27.5	6.09	34	369	304	A	H
		2362.2	50.99	-23.01	74	51.95	27.14	5.95	34.05	256	144	P	V
		2390	41.75	-12.25	54	42.55	27.23	6.01	34.04	256	144	A	V
	*	2439.75	92.17	-	-	92.79	27.37	6.04	34.03	256	144	P	V
	*	2440	91.41	-	-	92.03	27.37	6.04	34.03	256	144	A	V
		2491.48	51.29	-22.71	74	51.71	27.5	6.09	34.01	256	144	P	V
		2494.52	42.31	-11.69	54	42.72	27.5	6.09	34	256	144	A	V

BLE CH 39 2480MHz	*	2479.74	89.92	-	-	90.4	27.46	6.07	34.01	321	297	P	H
	*	2479.99	89.41	-	-	89.89	27.46	6.07	34.01	321	297	A	H
		2491.84	51.15	-22.85	74	51.56	27.5	6.09	34	321	297	P	H
		2493.88	42.17	-11.83	54	42.58	27.5	6.09	34	321	297	A	H
													H
													H
	*	2479.83	91.57	-	-	92.05	27.46	6.07	34.01	100	245	P	V
	*	2480.08	91.02	-	-	91.5	27.46	6.07	34.01	100	245	A	V
		2484.04	51.31	-22.69	74	51.77	27.46	6.09	34.01	100	245	P	V
		2499.2	42.24	-11.76	54	42.65	27.5	6.09	34	100	245	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4804	41	-33	74	34.6	31.3	8.65	33.55	100	0	P	H
													H
													H
													H
		4804	40.38	-33.62	74	33.98	31.3	8.65	33.55	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	40.46	-33.54	74	33.9	31.41	8.69	33.54	100	0	P	H
		7320	46.59	-27.41	74	34.34	36.32	10.39	34.46	100	0	P	H
													H
													H
		4880	41.6	-32.4	74	35.04	31.41	8.69	33.54	100	0	P	V
		7320	46.41	-27.59	74	34.16	36.32	10.39	34.46	100	0	P	V
													V
													V
BLE CH 39 2480MHz		4960	42.99	-31.01	74	36.2	31.54	8.79	33.54	100	0	P	H
		7440	46.35	-27.65	74	33.76	36.59	10.52	34.52	100	0	P	H
													H
													H
		4960	41.3	-32.7	74	34.51	31.54	8.79	33.54	100	0	P	V
		7440	46.09	-27.91	74	33.5	36.59	10.52	34.52	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		81.57	18.31	-21.69	40	42.15	6.91	1.04	31.79	117	308	H	H
		206.31	11.73	-31.77	43.5	33.32	8.4	1.79	31.78	-	-	H	H
		292.44	13.32	-32.68	46	30.17	12.8	2.11	31.76	-	-	H	H
		435.8	16.02	-29.98	46	29.06	16.38	2.41	31.83	-	-	H	H
		658.4	21.32	-24.68	46	31.32	19.02	3.02	32.04	-	-	H	H
		888	20.21	-25.79	46	28.07	20.08	3.55	31.49	-	-	H	H
													H
													H
													H
													H
													H
													H
		64.83	12.45	-27.55	40	38.3	4.9	1.04	31.79	-	-	P	V
		81.84	22.64	-17.36	40	46.42	6.97	1.04	31.79	143	29	P	V
		245.19	10.75	-35.25	46	29.16	11.42	1.94	31.77	-	-	P	V
		335	13.34	-32.66	46	29.24	13.7	2.17	31.77	-	-	P	V
		618.5	19.98	-26.02	46	30.09	18.97	2.96	32.04	-	-	P	V
		830.6	21.68	-24.32	46	29.94	20.11	3.4	31.77	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".