

FCC/IC RF Test Report

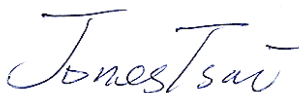
APPLICANT : VERTU Corporation Limited
EQUIPMENT : Cellular Telephone
BRAND NAME : VERTU
MODEL NAME : ASTER
TYPE NAME (LTE) : VM-01
TYPE NAME (WCDMA) : VM-01C
FCC ID : P7QVM-01
IC : 4299A-VM01
STANDARD : FCC Part 15 Subpart C §15.247
IC RSS-210 issue 8
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Jun. 23, 2014 and testing was completed on Jul. 25, 2014. 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



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FCC ID : P7QVM-01

IC : 4299A-VM01

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Report Issued Date : Jul. 30, 2014

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Report Template No.: BU5-CR210BT Version 1.0



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR462340A	Rev. 01	Initial issue of report	Jul. 30, 2014



SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
-	15.247(a)(1)	RSS-210 A8.4(2)	Number of Channels	$\geq 15\text{Chs}$	Not Performed	Please refer to Sporton Report No. : FR430314A
-	15.247(a)(1)	RSS-210 A8.1(b)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Not Performed	Please refer to Sporton Report No. : FR430314A
-	15.247(a)(1)	RSS-210 A8.1(d)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Not Performed	Please refer to Sporton Report No. : FR430314A
-	15.247(a)(1)	RSS-210 A8.1(a)	20dB Bandwidth	NA	Not Performed	Please refer to Sporton Report No. : FR430314A
-	-	RSS-Gen 4.6.1	99% Bandwidth	-	Not Performed	Please refer to Sporton Report No. : FR430314A
-	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
-	15.247(d)	RSS-210 A8.5	Conducted Band Edges	$\leq 20\text{dBc}$	Not Performed	Please refer to Sporton Report No. : FR430314A
-	15.247(d)	RSS-210 A8.5	Conducted Spurious Emission	$\leq 20\text{dBc}$	Not Performed	Please refer to Sporton Report No. : FR430314A
3.1	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.94 dB at 42.960 MHz
3.2	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 9.00 dB at 0.182 MHz
3.3	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

VERTU Corporation Limited

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.2 Manufacturer

VERTU Corporation Limited

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Cellular Telephone
Brand Name	VERTU
Model Name	ASTER
Type Name (LTE)	VM-01
Type Name (WCDMA)	VM-01C
Sample 1	LTE Sku
Sample 2	WCDMA Sku
FCC ID	P7QVM-01
IC	4299A-VM01
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth v4.0 EDR/LE
HW Version	F2
SW Version	000C_1_420
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are two different types of EUT sample #1, and sample #2. For WWAN bands, Sample 1 support GSM, WCDMA and LTE bands. Sample #2 only support GSM and WCDMA bands, and LTE band is disabled by software.

List of Accessory:

Specification of Accessory		
AC Adapter	Brand Name	VERTU
	Model Name	AC-32V
Battery	Brand Name	VERTU
	Model Name	BP-9V
Car Charger	Brand Name	VERTU
	Model Name	DC-30V
Portable Power Charger	Brand Name	VERTU
	Model Name	DC-15V
Earphone 1	Brand Name	VERTU
	Model Name	WH-4V
Earphone 2	Brand Name	VERTU
	Model Name	WH-5V
Earphone 3	Brand Name	VERTU
	Model Name	HP-1V
USB Cable	Brand Name	VERTU
	Model Name	CA-225DV
Wireless Charger	Brand Name	VERTU
	Model Name	AC-35V
Wireless Speaker	Brand Name	VERTU
	Model Name	SP-1V

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	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	Bluetooth BR(1Mbps) : 9.19 dBm (0.0083 W) Bluetooth EDR (2Mbps) : 10.05 dBm (0.0101 W) Bluetooth EDR (3Mbps) : 10.40 dBm (0.0110 W)
Antenna Type	PIFA Antenna type with gain -2.00 dBi
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π /4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

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 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
Test Site No.	Sporton Site No.			IC Registration No.
	TH02-HY	CO05-HY	03CH05-HY	4086B-1

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 Public Notice DA 00-705
- ♦ ANSI C63.4-2003
- ♦ IC RSS-210 Issue 8
- ♦ IC RSS-Gen Issue 3
- ♦ NOTICE 2012-DRS0126

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.
3. Per the section 2.2.3 of Notice of 2012-DRS0126, " Receivers Excluded from Industry Canada Requirements", only radiocommunication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to Industry Canada requirements.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Preliminary tests were performed in different data rates and recorded the RF output power in the following table:

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	$\pi/4$ -DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	8.24 dBm	9.17 dBm	9.49 dBm
Ch39	2441MHz	9.19 dBm	10.05 dBm	10.40 dBm
Ch78	2480MHz	7.76 dBm	8.68 dBm	8.96 dBm

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
 2. The data rate was set in 3Mbps for all the test items due to the highest RF output power.
- 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, and different data rates were conducted to determine the final configuration (Z plane as worst plane) from all possible combinations, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

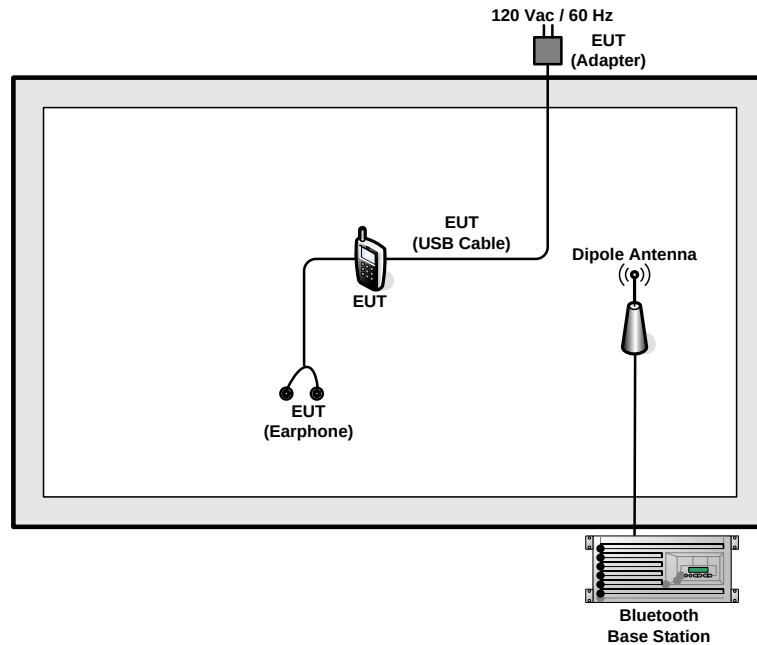
2.2 Test Mode

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

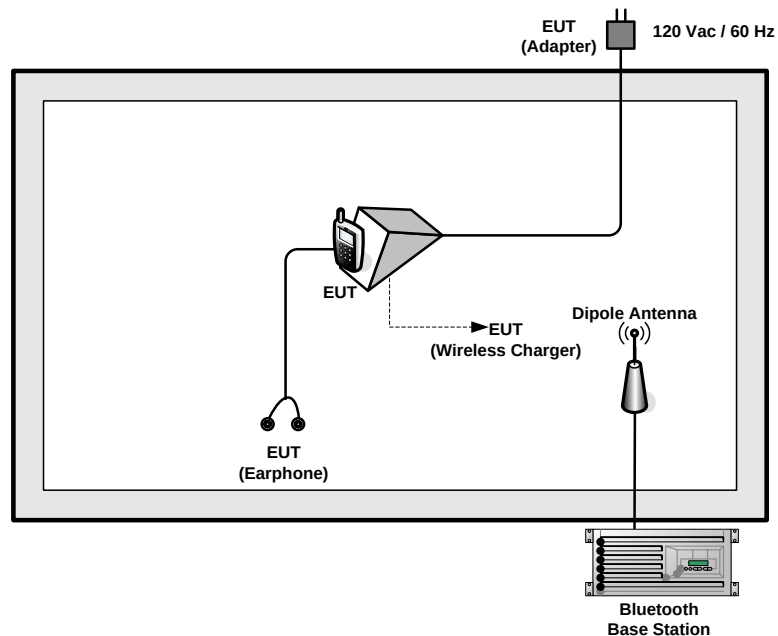
Summary table of Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted Test Cases	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz
Radiated Test Cases	Bluetooth EDR 3Mbps 8-DPSK		
	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz Mode 4: CH78_2480 MHz with WPC Charging		
AC Conducted Emission	Mode 1: LTE Band 7 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC On + Earphone 1 + Battery + USB Cable (Data Link with Notebook) Mode 2: LTE Band 7 Idle + WLAN (5GHz) Link + Bluetooth Link + NFC On + Earphone 1 + Battery + USB Cable (Data Link with Notebook) Mode 3: GSM1900 Idle + WLAN (2.4GHz) Idle + Bluetooth Idle + WPC Charging + MP3 + Earphone 2 + Wireless Charger (Charging from Adapter)		
Remark:			
1. For radiated test cases, the worst mode data rate 3Mbps was reported only.			
2. The worst case of conducted emission is mode 1; only the test data of it was reported.			
3. All the radiated test cases were performance with Sample 1.			

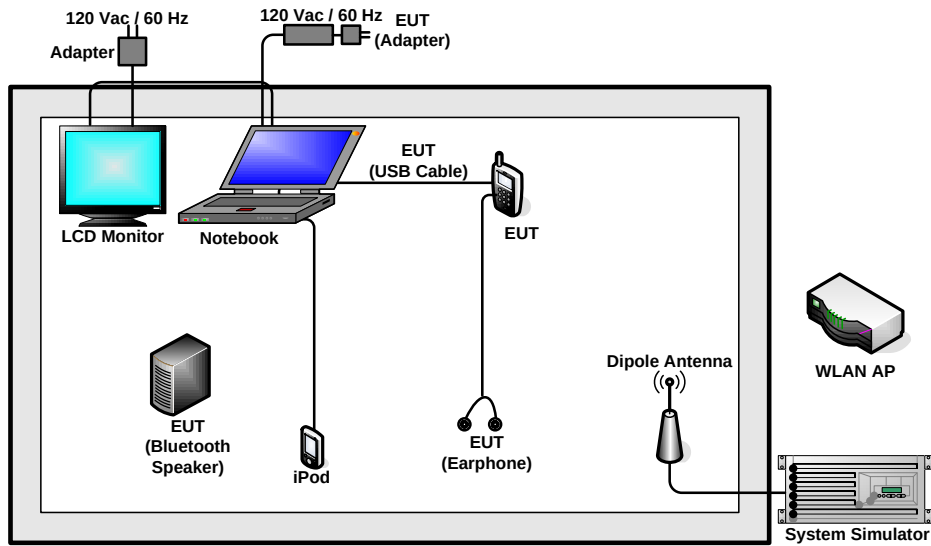
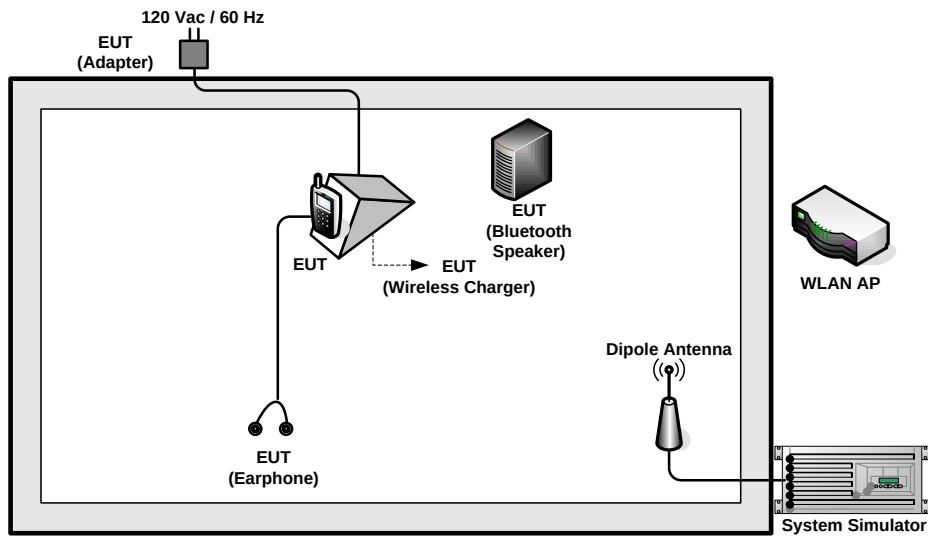
2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<Bluetooth Tx Mode with WPC Charging>



<AC Conducted Emission Mode>

<EUT with WPC 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	R&S	CMW 500	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
4.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
5.	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
6.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
7.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
8.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A
9.	NFC Card	Metro Taipei	Easy Card	N/A	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 contact with Bluetooth base station for continuous 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.

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\
 &= 4.2 + 10 = 14.2 \text{ (dB)}
 \end{aligned}$$

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 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

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



3.1.3 Test Procedures

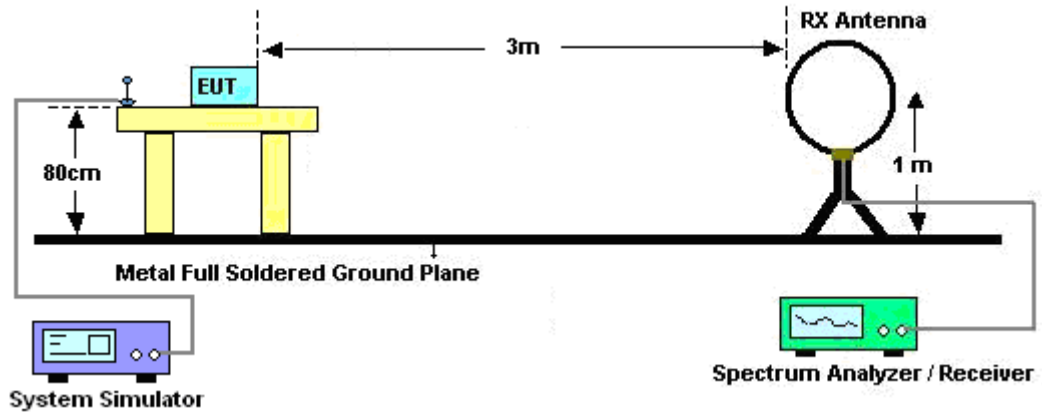
1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. 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.
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, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
$$\text{On time} = N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$$

Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

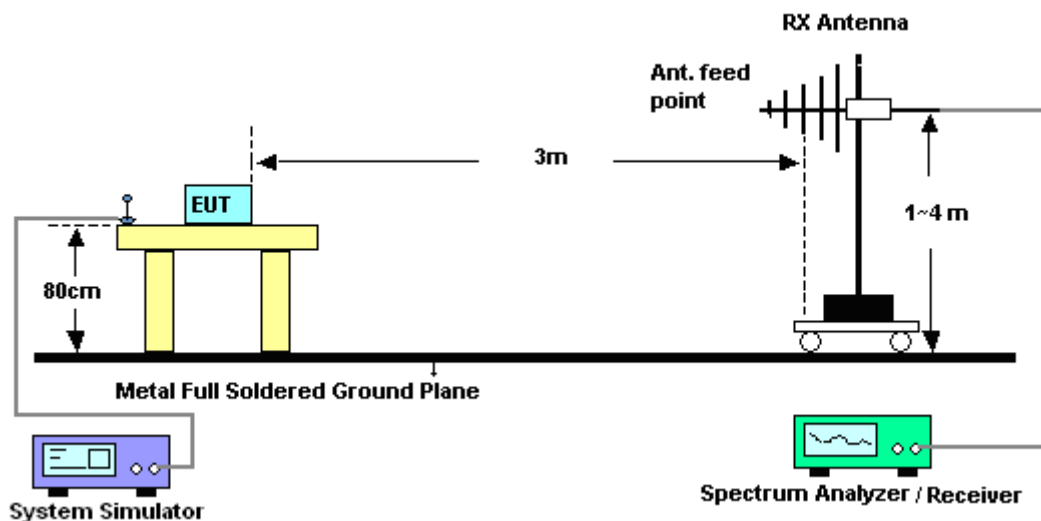
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.1.4 Test Setup

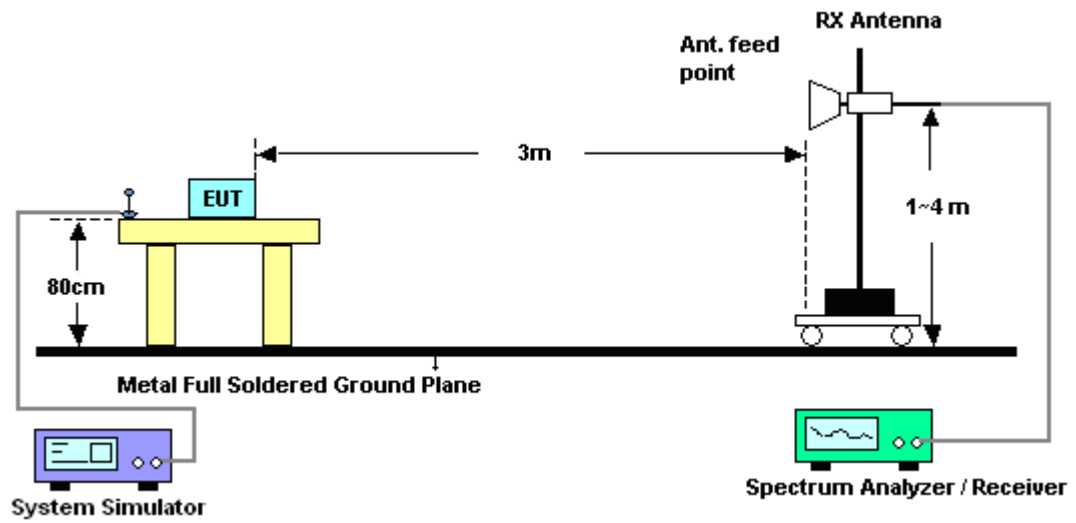
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz

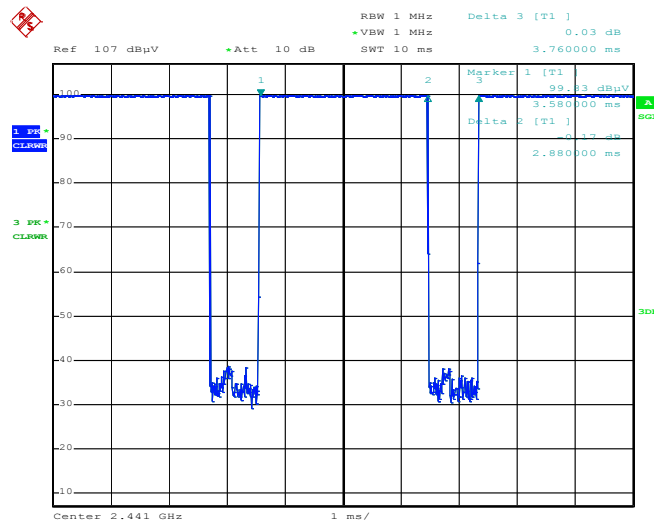


For radiated emissions above 1GHz



3.1.5 Duty cycle correction factor for average measurement

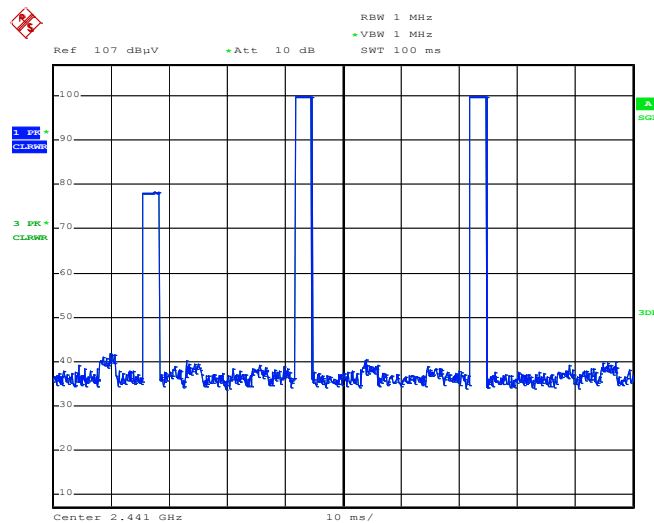
DH5 on time (One Pulse) Plot on Channel 39



4

Date: 9.JUL.2014 12:42:14

DH5 on time (Count Pulses) Plot on Channel 39



4

Date: 9.JUL.2014 12:46:57

Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.

**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$

3.1.6 Test Result of Radiated Spurious at Band Edges

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	00	Relative Humidity :	50~51%
		Test Engineer :	Jet Lu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2367.24	36.99	-37.01	74	39.26	26.84	4.57	33.68	107	132	Peak
2367.24	12.2	-41.8	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2327.64	37.75	-36.25	74	40.17	26.75	4.53	33.7	122	112	Peak
2327.64	12.96	-41.04	54	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	50~51%
		Test Engineer :	Jet Lu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	58.06	-15.94	74	59.83	27.16	4.64	33.57	102	128	Peak
2483.5	33.27	-20.73	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	59.6	-14.4	74	61.37	27.16	4.64	33.57	130	70	Peak
2483.5	34.81	-19.19	54	-	-	-	-	-	-	Average

Note: Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79dB)



<Bluetooth Tx Mode with WPC Charging Mode>

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	50~51%
		Test Engineer :	Jet Lu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	59.43	-14.57	74	61.2	27.16	4.64	33.57	100	124	Peak
2483.5	34.64	-19.36	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	54.13	-19.87	74	55.9	27.16	4.64	33.57	103	145	Peak
2483.5	29.34	-24.66	54	-	-	-	-	-	-	Average

Note: Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79dB)

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

<Below 30MHz>

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	Bluetooth Tx CH78 with WPC Charging Mode	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Horizontal

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.01242	36.6	-89.12	125.72	16.03	20.28	0.29	-	-	Average
0.07527	32.67	-77.4	110.07	12.31	20.07	0.29	-	-	Average
0.09074	22.78	-85.67	108.45	2.44	20.05	0.29	-	-	QP
0.12544	20.26	-85.38	105.64	-0.05	20.02	0.29	-	-	Average
0.1422	55.01	-49.54	104.55	34.7	20.02	0.29	-	-	Average
0.42676	44.65	-50.35	95	24.45	19.91	0.29	-	-	Average
1.188	38.69	-27.41	66.1	18.45	19.93	0.31	100	39	QP
9.36	36.12	-33.88	70	15.98	19.76	0.38	-	-	QP
21.319	37.86	-32.14	70	17.31	20.12	0.43	-	-	QP
26.105	36.35	-33.65	70	15.53	20.35	0.47	-	-	QP



Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	Bluetooth Tx CH78 with WPC Charging Mode	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Vertical

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.01798	31.67	-90.84	122.51	11.1	20.28	0.29	-	-	Average
0.06285	28.32	-83.32	111.64	7.96	20.07	0.29	-	-	Average
0.09666	22.37	-85.53	107.9	2.03	20.05	0.29	-	-	QP
0.14176	23.01	-81.56	104.57	2.7	20.02	0.29	-	-	Average
0.1486	47.97	-56.19	104.16	27.68	20	0.29	-	-	Average
0.4543	44.26	-50.2	94.46	24.07	19.9	0.29	-	-	Average
1.241	40.08	-25.65	65.73	19.84	19.93	0.31	100	124	QP
15.656	36.58	-33.42	70	16.51	19.66	0.41	-	-	QP
18.574	36.86	-33.14	70	16.52	19.91	0.43	-	-	QP
29.755	35.96	-34.04	70	15.21	20.22	0.53	-	-	QP

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

Note: Pre-scanned all test modes and only choose the worst case mode recorded in the test report for radiated spurious emission below 1GHz.

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	00	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Horizontal
Remark :	2404 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2404	98.49	-	-	120.81	26.98	4.62	53.92	107	132	Peak
2404	73.7	-	-	-	-	-	-	-	-	Average
4803	37.22	-36.78	74	58.47	31.2	6.52	58.97	100	0	Peak
4803	12.43	-41.57	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	00	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Vertical
Remark :	2402 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2402	97.85	-	-	120.22	26.93	4.62	53.92	122	112	Peak
2402	73.06	-	-	-	-	-	-	-	-	Average
4803	31.94	-42.06	74	53.19	31.2	6.52	58.97	100	0	Peak
4803	7.15	-46.85	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	39	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Horizontal
Remark :	2442 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2442	97.35	-	-	99.2	27.07	4.68	33.6	104	133	Peak
2442	72.56	-	-	-	-	-	-	-	-	Average
4881	35.59	-38.41	74	56.57	31.31	6.58	58.87	100	0	Peak
4881	10.8	-43.2	54	-	-	-	-	-	-	Average
7323	40.96	-33.04	74	55.02	36.19	8.24	58.49	100	0	Peak
7323	16.17	-37.83	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	39	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Vertical
Remark :	2442 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2442	98.35	-	-	100.2	27.07	4.68	33.6	109	69	Peak
2442	73.56	-	-	-	-	-	-	-	-	Average
4881	32.62	-41.38	74	53.6	31.31	6.58	58.87	100	0	Peak
4881	7.83	-46.17	54	-	-	-	-	-	-	Average
7323	39.76	-34.24	74	53.82	36.19	8.24	58.49	100	0	Peak
7323	14.97	-39.03	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)



Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Horizontal
Remark :	2482 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
43.23	14.1	-25.9	40	34.06	11.08	0.77	31.81	-	-	Peak
207.93	18.65	-24.85	43.5	39.76	9.17	1.5	31.78	-	-	Peak
234.12	22.44	-23.56	46	42.04	10.58	1.59	31.77	-	-	Peak
389.6	33.45	-12.55	46	47.76	15.5	1.99	31.8	152	223	Peak
857.9	26.52	-19.48	46	32.1	23.12	2.94	31.64	-	-	Peak
971.3	28.21	-25.79	54	31.12	24.81	3.14	30.86	-	-	Peak
2482	97.66	-	-	99.34	27.16	4.73	33.57	102	208	Peak
2482	72.87	-	-	-	-	-	-	-	-	Average
4959	36.22	-37.78	74	56.92	31.44	6.61	58.75	100	0	Peak
4959	11.43	-42.57	54	-	-	-	-	-	-	Average
7440	40.81	-33.19	74	54.68	36.48	8.36	58.71	100	0	Peak
7440	16.02	-37.98	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)



Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Vertical
Remark :	2482 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
32.97	28.88	-11.12	40	42.63	17.34	0.72	31.81	125	315	Peak
208.2	18.7	-24.8	43.5	39.8	9.18	1.5	31.78	-	-	Peak
234.12	22.87	-23.13	46	42.47	10.58	1.59	31.77	-	-	Peak
389.6	28.01	-17.99	46	42.32	15.5	1.99	31.8	-	-	Peak
494.6	26.42	-19.58	46	38.14	17.95	2.22	31.89	-	-	Peak
533.1	30.97	-15.03	46	42.3	18.31	2.3	31.94	-	-	Peak
2482	97.8	-	-	99.48	27.16	4.73	33.57	130	150	Peak
2482	73.01	-	-	-	-	-	-	-	-	Average
4959	34.37	-39.63	74	55.07	31.44	6.61	58.75	100	0	Peak
4959	9.58	-44.42	54	-	-	-	-	-	-	Average
7440	40.91	-33.09	74	54.78	36.48	8.36	58.71	100	0	Peak
7440	16.12	-37.88	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)



Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	Bluetooth Tx CH78 with WPC Charging Mode	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Horizontal
Remark :	2482 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
92.1	27.12	-16.38	43.5	48.88	8.96	1.06	31.78	-	-	Peak
142.05	24.69	-18.81	43.5	43.71	11.5	1.26	31.78	-	-	Peak
196.05	32.28	-11.22	43.5	53.74	8.86	1.46	31.78	126	258	Peak
405	16.76	-29.24	46	30.41	16.12	2.03	31.8	-	-	Peak
456.8	17	-29	46	29.36	17.34	2.15	31.85	-	-	Peak
498.1	21.41	-24.59	46	33.09	17.98	2.23	31.89	-	-	Peak
2482	94.89	-	-	96.57	27.16	4.73	33.57	103	145	Peak
2482	70.1	-	-	-	-	-	-	-	-	Average
4959	36.73	-37.27	74	57.43	31.44	6.61	58.75	100	0	Peak
4959	11.94	-42.06	54	-	-	-	-	-	-	Average
7440	40.44	-33.56	74	54.31	36.48	8.36	58.71	100	0	Peak
7440	15.65	-38.35	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	Bluetooth Tx CH78 with WPC Charging Mode	Relative Humidity :	50~51%
Test Engineer :	Jet Lu	Polarization :	Vertical
Remark :	2482 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
42.96	34.06	-5.94	40	53.34	11.76	0.77	31.81	105	189	Peak
90.75	28.74	-14.76	43.5	50.59	8.88	1.05	31.78	-	-	Peak
130.71	26.18	-17.32	43.5	44.75	11.98	1.23	31.78	-	-	Peak
367.9	22.43	-23.57	46	37.46	14.82	1.94	31.79	-	-	Peak
496.7	19.06	-26.94	46	30.77	17.96	2.22	31.89	-	-	Peak
598.2	19.61	-26.39	46	29.54	19.68	2.43	32.04	-	-	Peak
2482	99.76	-	-	101.44	27.16	4.73	33.57	100	124	Peak
2482	74.97	-	-	-	-	-	-	-	-	Average
4959	36.93	-37.07	74	57.63	31.44	6.61	58.75	100	0	Peak
4959	12.14	-41.86	54	-	-	-	-	-	-	Average
7440	40.66	-33.34	74	54.53	36.48	8.36	58.71	100	0	Peak
7440	15.87	-38.13	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.79)

3.2 AC Conducted Emission Measurement

3.2.1 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 (dB μ V)	
	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.

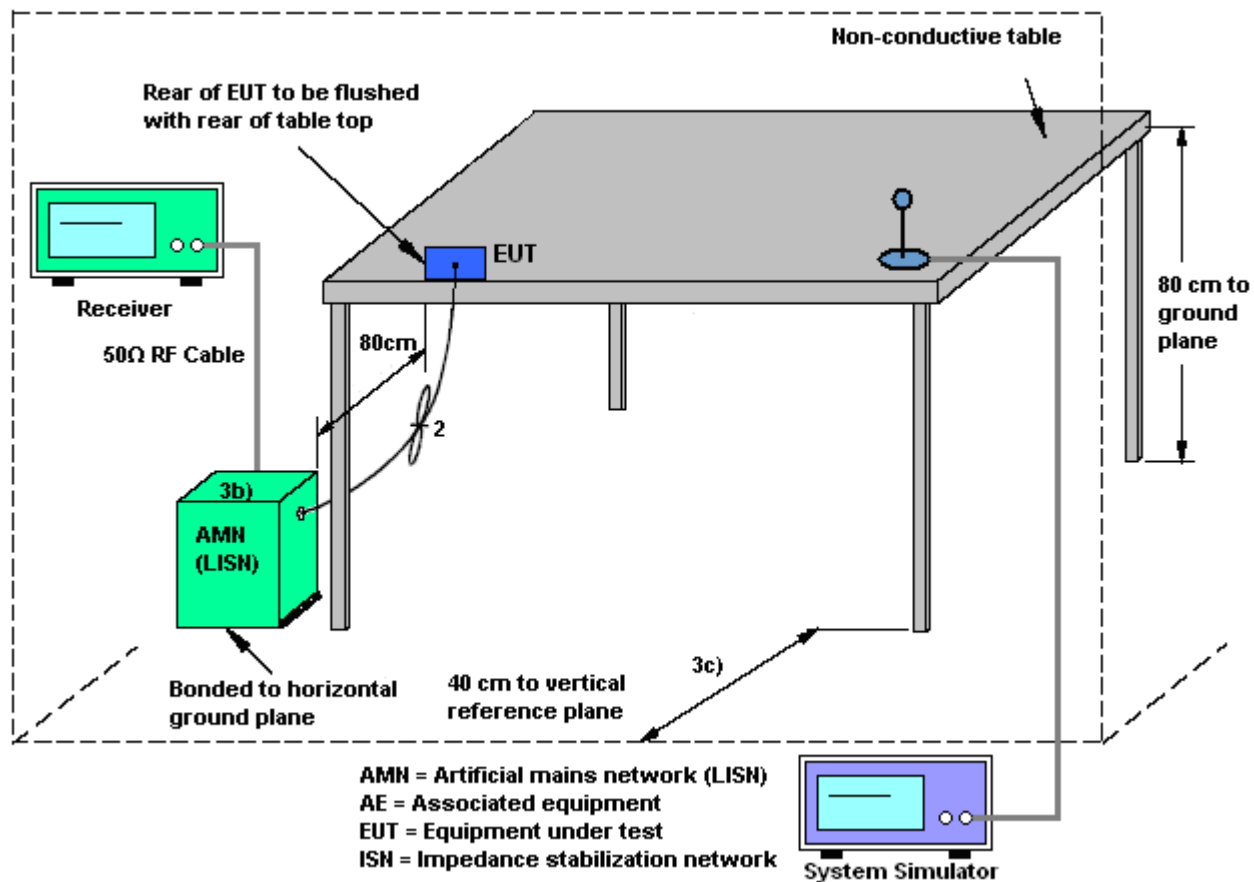
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

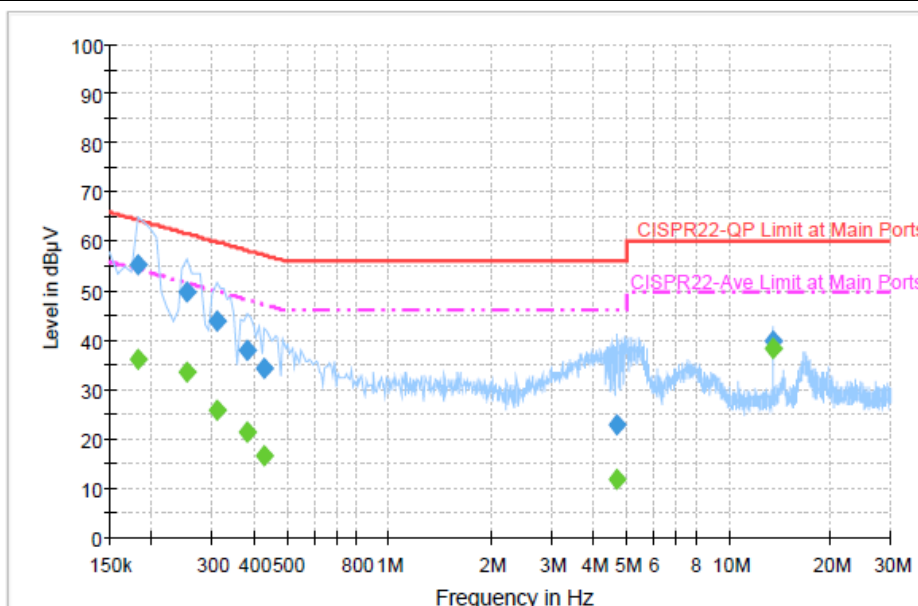
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
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 with Maximum Hold Mode.

3.2.4 Test Setup



3.2.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Kai-Chun CHu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	LTE Band 7 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC On + Earphone 1 + Battery + USB Cable (Data Link with Notebook)		



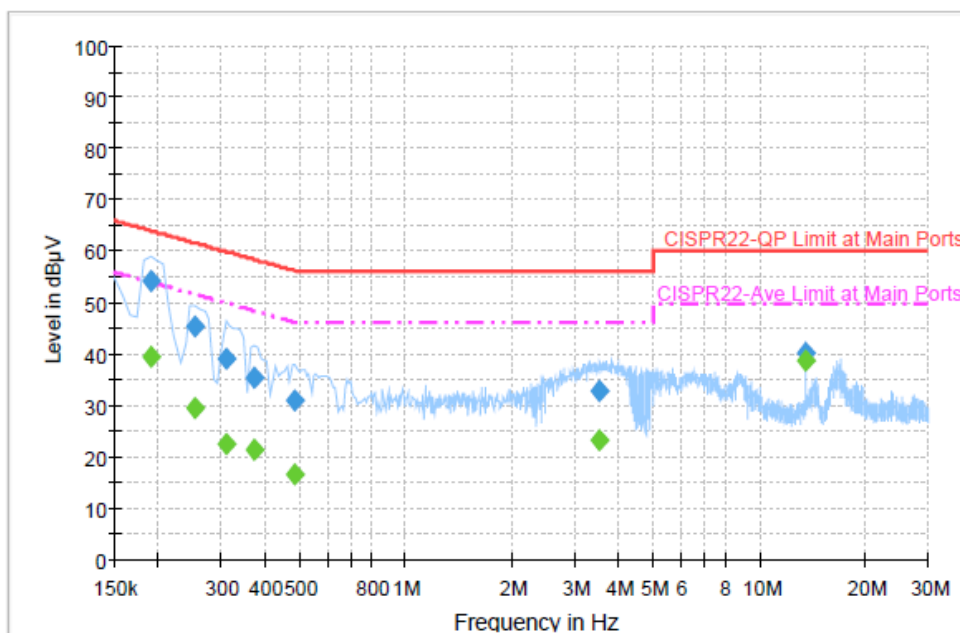
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.182000	55.4	Off	L1	19.4	9.0	64.4
0.254000	49.9	Off	L1	19.4	11.7	61.6
0.310000	43.9	Off	L1	19.4	16.1	60.0
0.382000	38.1	Off	L1	19.4	20.1	58.2
0.430000	34.4	Off	L1	19.4	22.9	57.3
4.694000	22.8	Off	L1	19.6	33.2	56.0
13.558000	40.0	Off	L1	19.8	20.0	60.0

Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.182000	36.3	Off	L1	19.4	18.1	54.4
0.254000	33.6	Off	L1	19.4	18.0	51.6
0.310000	25.9	Off	L1	19.4	24.1	50.0
0.382000	21.5	Off	L1	19.4	26.7	48.2
0.430000	16.8	Off	L1	19.4	30.5	47.3
4.694000	11.9	Off	L1	19.6	34.1	46.0
13.558000	38.3	Off	L1	19.8	11.7	50.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Kai-Chun CHu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	LTE Band 7 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC On + Earphone 1 + Battery + USB Cable (Data Link with Notebook)		


Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.190000	54.3	Off	N	19.3	9.7	64.0
0.254000	45.2	Off	N	19.4	16.4	61.6
0.310000	39.0	Off	N	19.4	21.0	60.0
0.374000	35.4	Off	N	19.4	23.0	58.4
0.486000	31.0	Off	N	19.4	25.2	56.2
3.526000	32.7	Off	N	19.6	23.3	56.0
13.558000	40.2	Off	N	19.8	19.8	60.0

Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.190000	39.6	Off	N	19.3	14.4	54.0
0.254000	29.6	Off	N	19.4	22.0	51.6
0.310000	22.3	Off	N	19.4	27.7	50.0
0.374000	21.3	Off	N	19.4	27.1	48.4
0.486000	16.6	Off	N	19.4	29.6	46.2
3.526000	23.1	Off	N	19.6	22.9	46.0
13.558000	38.7	Off	N	19.8	11.3	50.0



3.3 Antenna Requirements

3.3.1 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.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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	Agilent	E4416A	GB41292344	300MHz~40GHz z	Jan. 28, 2014	Jul. 16, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz z	Jan. 28, 2014	Jul. 16, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Jul. 09, 2014~ Jul. 25, 2014	Jun. 08, 2015	Radiation (03CH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2725	30MHz~1GHz	Oct. 10, 2013	Jul. 09, 2014~ Jul. 25, 2014	Oct. 09, 2014	Radiation (03CH05-HY)
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Apr. 16, 2014	Jul. 09, 2014~ Jul. 25, 2014	Apr. 15, 2015	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 03, 2013	Jul. 09, 2014~ Jul. 25, 2014	Oct. 02, 2014	Radiation (03CH05-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	100kHz~18GHz	Jul. 07, 2014	Jul. 09, 2014~ Jul. 25, 2014	Jul. 06, 2015	Radiation (03CH05-HY)
Preamplifier	EMCI	EMC011830	980148	DC~18GHz	Jun. 23, 2014	Jul. 09, 2014~ Jul. 25, 2014	Jun. 22, 2015	Radiation (03CH05-HY)
Preamplifier	COM-POWER	PA-103	161075	9kHz~30MHz	Apr. 15, 2014	Jul. 09, 2014~ Jul. 25, 2014	Apr. 14, 2015	Radiation (03CH05-HY)
Preamplifier	Miteq	TTA0204	1872107	18GHz~40GHz	May 23, 2014	Jul. 09, 2014~ Jul. 25, 2014	May 22, 2015	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Jul. 09, 2014~ Jul. 25, 2014	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Jul. 09, 2014~ Jul. 25, 2014	N/A	Radiation (03CH05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9 kHz~7 GHz	Sep. 06, 2013	Jul. 22, 2014	Sep. 05, 2014	Radiation (03CH07-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV30	101749	10Hz ~ 30GHz	Feb. 10, 2014	Jul. 22, 2014	Feb. 09, 2015	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100330	9 kHz~30 MHz	Nov. 15, 2012	Jul. 22, 2014	Nov. 14, 2014	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10 MHz ~ 1000MHz	Mar. 17, 2014	Jul. 22, 2014	Mar. 16, 2015	Radiation (03CH07-HY)
Turn Table	ChainTek	ChainTek 3000	N/A	0 ~ 360 degree	N/A	Jul. 22, 2014	N/A	Radiation (03CH07-HY)
Antenna Mast	ChainTek	ChainTek 3000	N/A	N/A	N/A	Jul. 22, 2014	N/A	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Jul. 11, 2014	Nov. 14, 2014	Conduction (CO05-HY)
LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Jul. 11, 2014	Dec. 11, 2014	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Jul. 11, 2014	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jul. 11, 2014	N/A	Conduction (CO05-HY)



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% ($U = 2Uc(y)$)	5.10
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