FCC RF Test Report

APPLICANT	:	Commtiva Technology Ltd.
EQUIPMENT	:	MID
BRAND NAME	:	Commtiva
MODEL NAME	:	N700
FCC ID	:	X7H-N700
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	Digital Spread Spectrum (DSS)

The product was received on Sep. 03, 2010 and completely tested on Sep. 18, 2010. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by:

Anderson Chiu

Anderson Chiu / Deputy Manager

Testing Laboratory
1190

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

TABLE OF CONTENTS

REVISION HISTORY **3**

SUMMARY OF TEST RESULT **4**

1 GENERAL DESCRIPTION **5**

1.1 Applicant 5
1.2 Manufacturer 5
1.3 Feature of Equipment Under Test 5
1.4 Testing Site 6
1.5 Applied Standards 6
1.6 Ancillary Equipment List 6

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST **7**

2.1 RF Output Power 7
2.2 Test Mode 8
2.3 Connection Diagram of Test System 9
2.4 RF Utility 9

3 TEST RESULT **10**

3.1 Number of Channel Measurement 10
3.2 20dB Bandwidth Measurement 12
3.3 Hopping Channel Separation Measurement 19
3.4 Dwell Time Measurement 22
3.5 Peak Output Power Measurement 24
3.6 Band Edges Measurement 27
3.7 Spurious Emission Measurement 31
3.8 AC Conducted Emission Measurement 35
3.9 Radiated Emission Measurement 39
3.10 Antenna Requirements 48

4 LIST OF MEASURING EQUIPMENT **49**

5 UNCERTAINTY OF EVALUATION **50**

APPENDIX A. PHOTOGRAPHS OF EUT

APPENDIX B. SETUP PHOTOGRAPHS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR090307-01AA	Rev. 01	Initial issue of report	Nov. 04, 2010

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	A8.4(2)	Number of Channels	≥ 15Chs	Pass	-
3.2	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.3	15.247(a)(1)	A8.1(b)	Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.4	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	≤ 1W	Pass	-
3.6	15.247(d)	A8.5	Frequency Band Edges	≤ 20dBc	Pass	-
3.7	15.247(d)	A8.5	Spurious Emission	< 20 dBc	Pass	-
3.8	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 9.4 dB at 0.478 MHz
3.9	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.25 dB at 179.85 MHz
3.10	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Commtiva Technology Ltd.
4F., No. 408, Rueiguang Rd., Neihu District, Taipei 114, Taiwan (R.O.C.)

1.2 Manufacturer

Chi Mei Communication Systems, Inc.
No. 4, Mingsheng Street, Tucheng City, Taipei County 23678, Taiwan

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	MID
Brand Name	Commtiva
Model Name	N700
FCC ID	X7H-N700
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Channel Spacing	1 MHz
Maximum Output Power to Antenna	Bluetooth (1Mbps) : 1.89 dBm (0.002 W) Bluetooth EDR (2Mbps) : 2.57 dBm (0.002 W) Bluetooth EDR (3Mbps) : 2.81 dBm (0.002 W)
Antenna Type	Fixed Internal Antenna with gain -5 dBi
HW Version	PR3.6
SW Version	3.16I
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π /4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
EUT Stage	Identical Prototype

Remark:

1. For other wireless features of this EUT, test report will be issued separately.
2. This test report recorded only product characteristics and test results of Digital Spread Spectrum (DSS).
3. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st 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.		FCC/IC Registration No.
	CO05-HY	03CH05-HY	TW1022/4086B-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 Public Notice DA 00-705
- ANSI C63.4-2003
- IC RSS-210 Issue 7

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 (DoC), 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	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Vostro 1510	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

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

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	π /4-DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	1.89 dBm	2.57 dBm	**2.81 dBm**
Ch39	2441MHz	1.63 dBm	2.30 dBm	2.61 dBm
Ch78	2480MHz	1.30 dBm	1.86 dBm	2.18 dBm

Remark:

1. The data rate was set in 3Mbps for all the test items due to the highest RF output power.
2. The EUT is programmed to transmit signals continuously for all testing.

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 were conducted to determine the final configuration from all possible combinations.

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

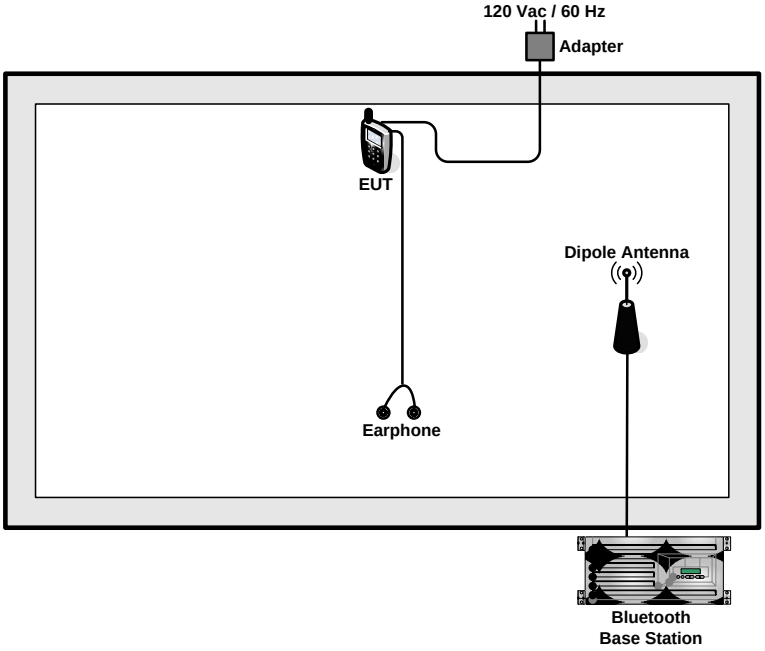
Test Cases			
Test Item	**Data Rate / Modulation**		
	Bluetooth 1Mbps GFSK	**Bluetooth EDR 2Mbps π /4-DQPSK**	**Bluetooth EDR 3Mbps 8-DPSK**
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	N/A	N/A	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz
AC Conducted Emission	Mode 1 :GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + Adapter Mode 2 :WCDMA Band IV Idle + Bluetooth Link + WLAN Link + Earphone + Adapter		

Remark:

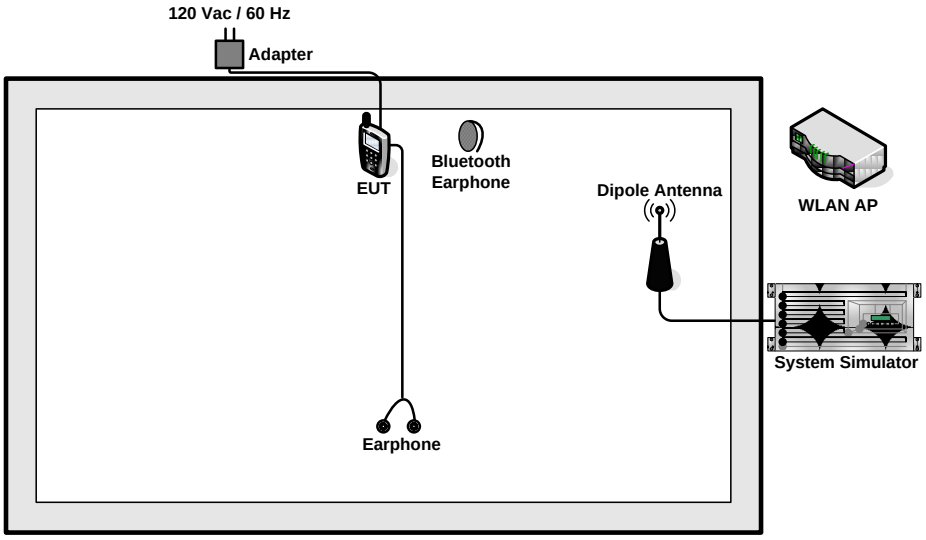
1. For radiated TCs, the data rate was set in 3Mbps due to the highest RF output power; only the data of these modes was reported.
2. For conducted emission, the worst case is mode 2; only the test data of this mode was reported.

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<EUT with Adapter Mode>



2.4 RF Utility

Key in "＊＃＊＃767＃＊＃＊" in order to make the EUT into the engineering modes to contact with Bluetooth base station for transmitting and receiving signals continuously.

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

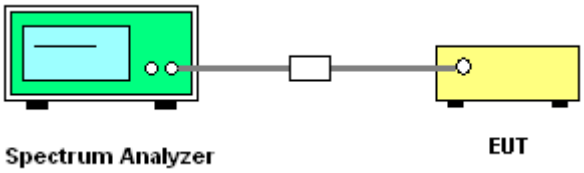
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The modulation types of EUT are irrelevant to number of hopping channels deviation.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
5. The number of hopping frequency used is defined as the device has the numbers of total channel.

3.1.4 Test Setup

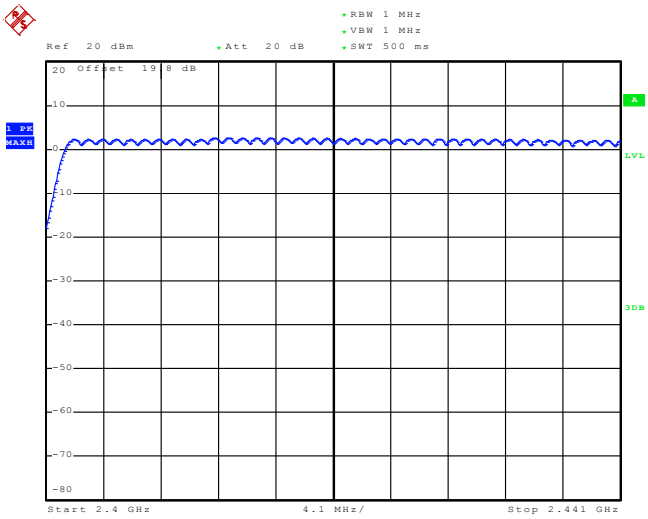


3.1.5 Test Result of Number of Hopping Frequency

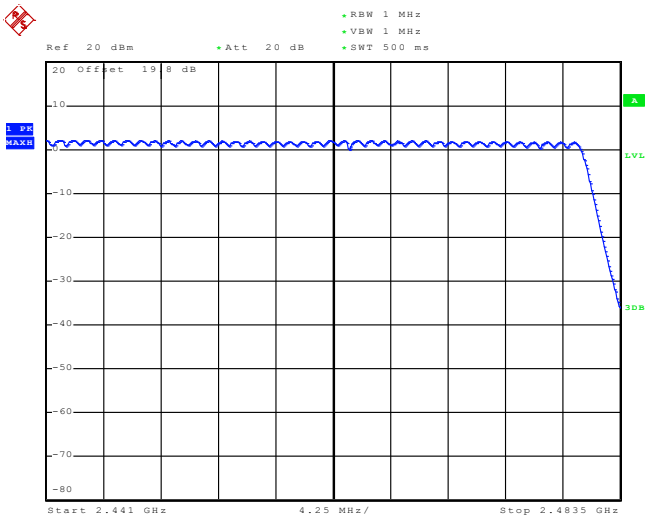
Test Mode :	Mode 7~9	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

Number of Hopping Channels (Channel)	Limits (Channel)	Pass/Fail
79	> 15	Pass

Number of Hopping Channel Plot on Channel 00 - 78



Date: 14.SEP.2010 14:25:04



Date: 14.SEP.2010 14:28:59

3.2 20dB Bandwidth Measurement

3.2.1 Limit of 20dB Bandwidth

N/A

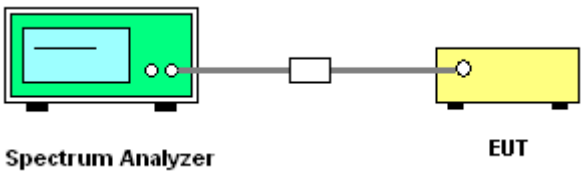
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

3.2.4 Test Setup

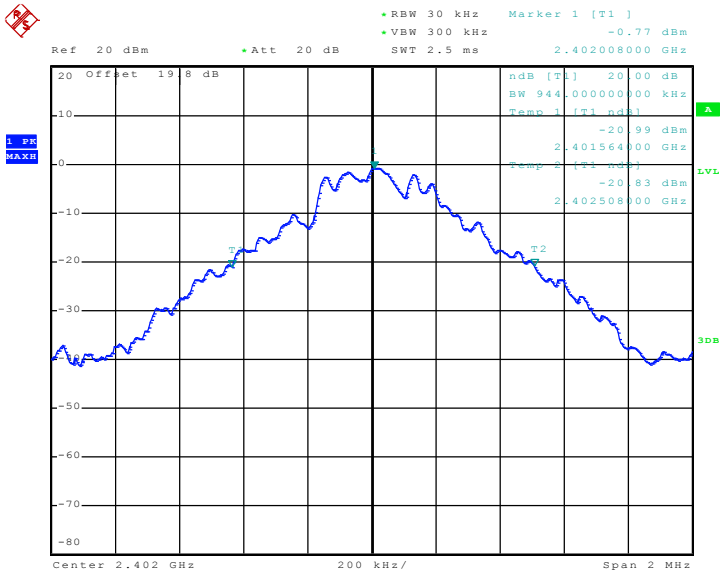


3.2.5 Test Result of 20dB Bandwidth

Test Mode :	Mode 1, 2, 3	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

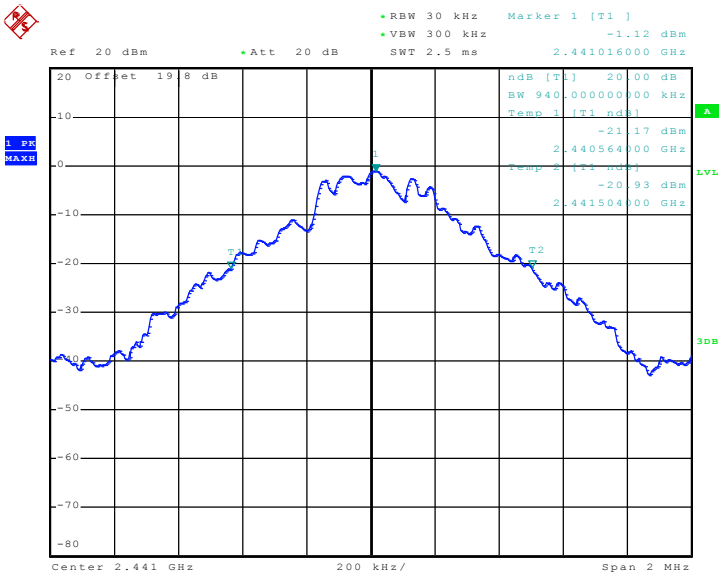
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.944
39	2441	0.940
78	2480	0.940

20 dB Bandwidth Plot on Channel 00



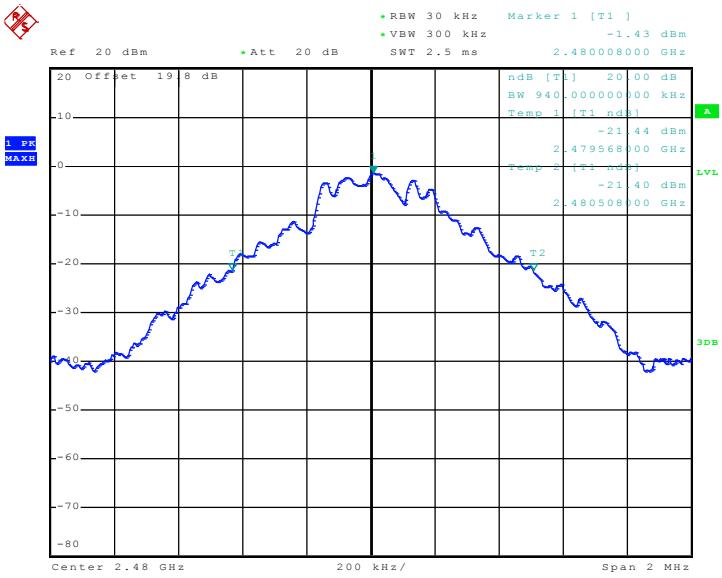
Date: 14.SEP.2010 11:47:14

20 dB Bandwidth Plot on Channel 39



Date: 14.SEP.2010 11:47:45

20 dB Bandwidth Plot on Channel 78

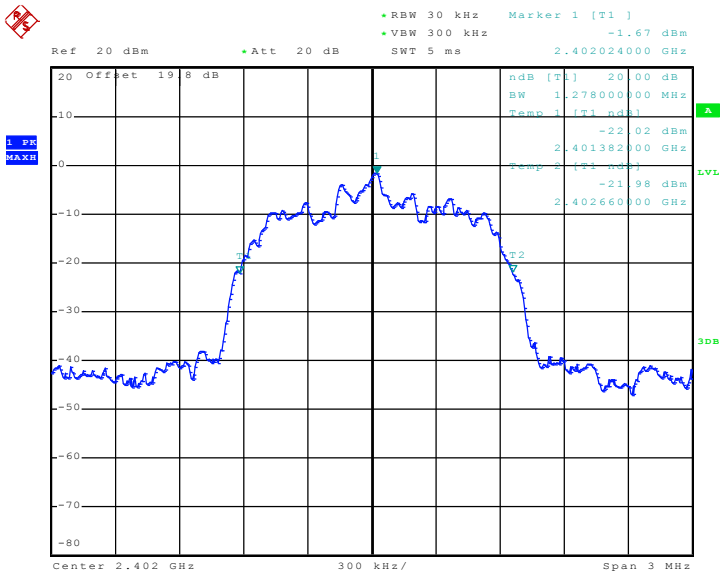


Date: 14.SEP.2010 11:48:24

Test Mode :	Mode 4, 5, 6	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

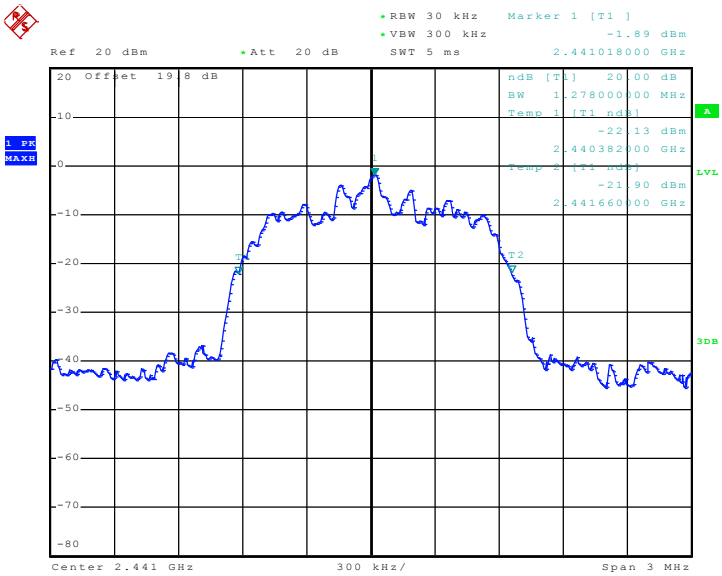
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.278
39	2441	1.278
78	2480	1.278

20 dB Bandwidth Plot on Channel 00



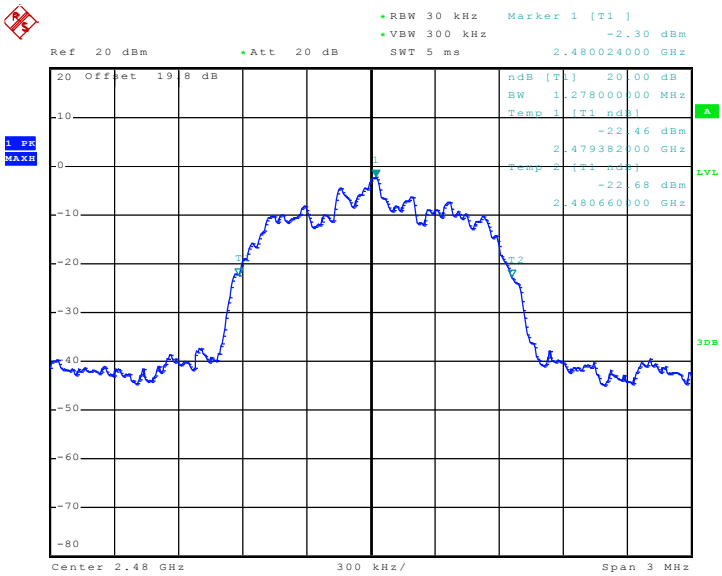
Date: 14.SEP.2010 11:51:00

20 dB Bandwidth Plot on Channel 39



Date: 14.SEP.2010 11:50:27

20 dB Bandwidth Plot on Channel 78

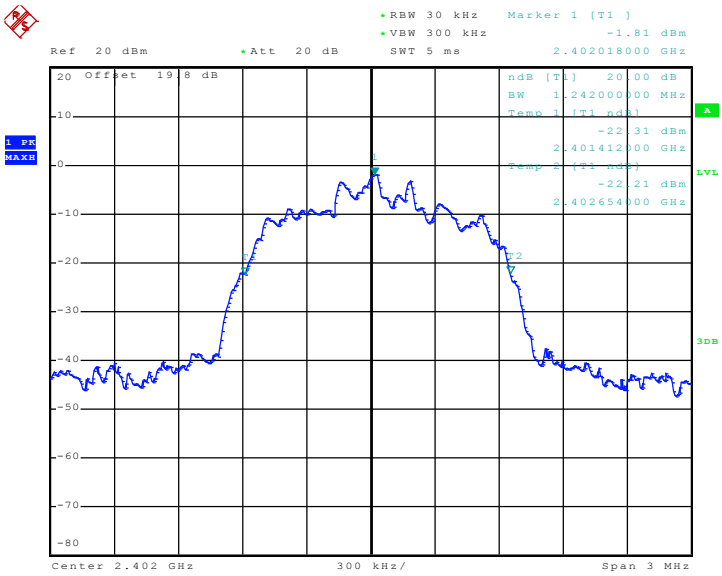


Date: 14.SEP.2010 11:49:35

Test Mode :	Mode 7, 8, 9	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

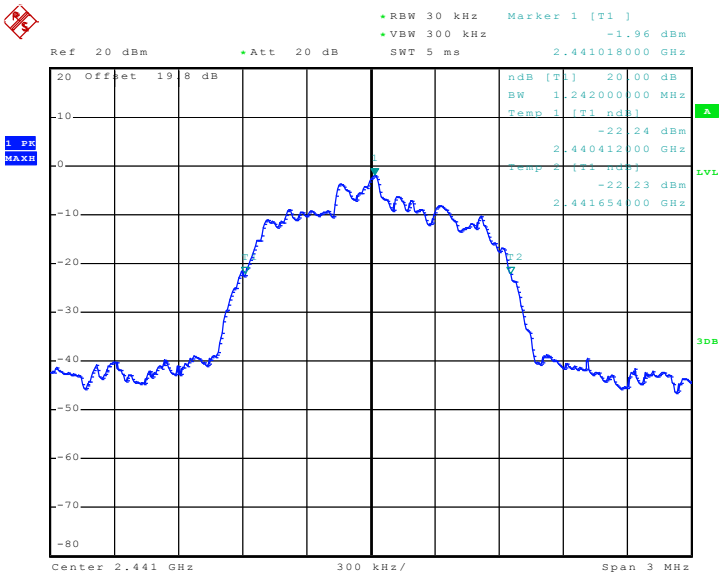
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.242
39	2441	1.242
78	2480	1.242

20 dB Bandwidth Plot on Channel 00



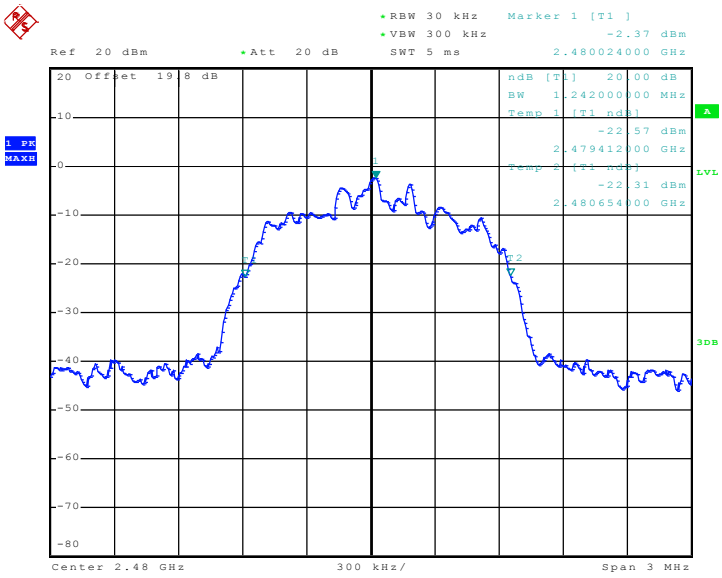
Date: 14.SEP.2010 11:51:37

20 dB Bandwidth Plot on Channel 39



Date: 14.SEP.2010 11:52:14

20 dB Bandwidth Plot on Channel 78



Date: 14.SEP.2010 11:52:57

3.3 Hopping Channel Separation Measurement

3.3.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

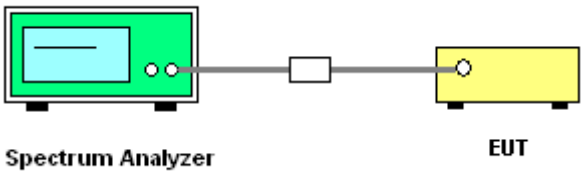
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. Please refer FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels; RBW ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

3.3.4 Test Setup

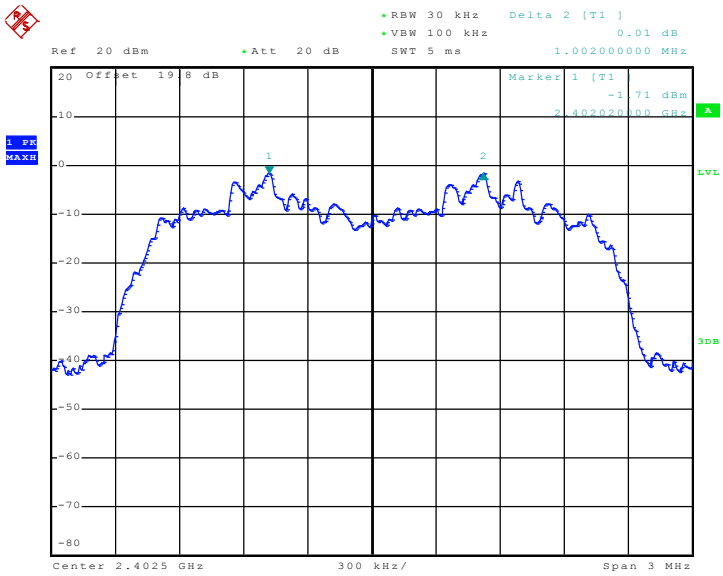


3.3.5 Test Result of Hopping Channel Separation

Test Mode :	Mode 7, 8, 9	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

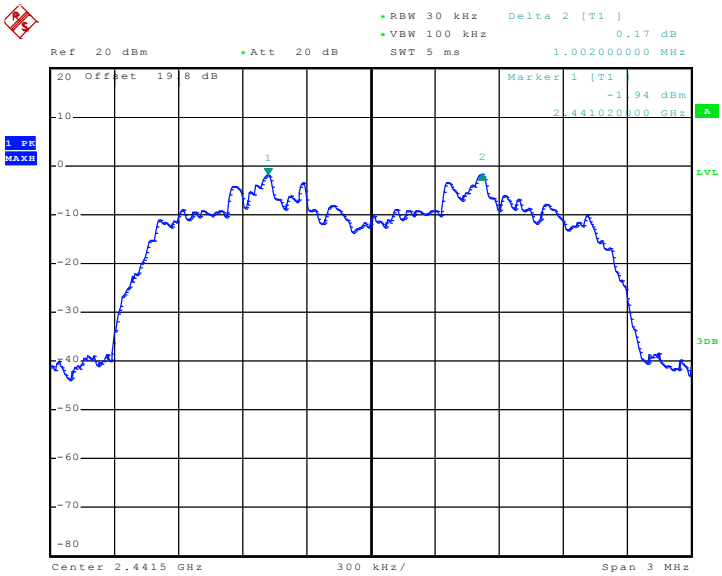
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.828	Pass
39	2441	1.002	0.828	Pass
78	2480	1.002	0.828	Pass

Channel Separation Plot on Channel 00 - 01



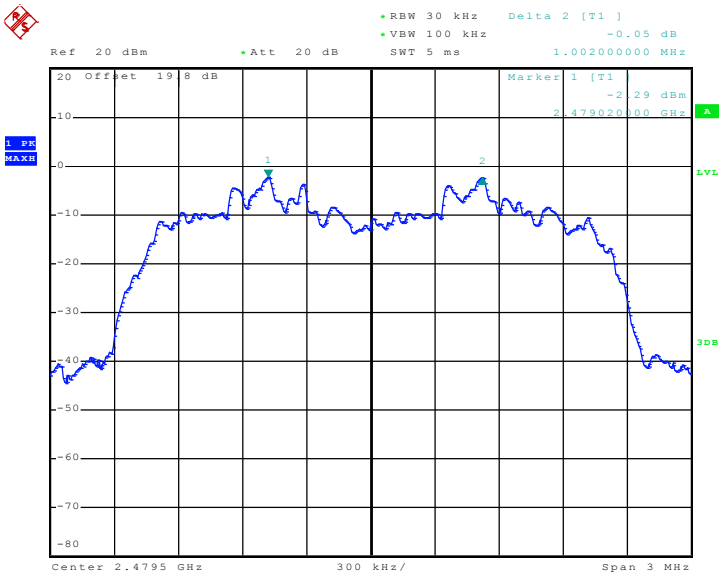
Date: 14.SEP.2010 11:54:48

Channel Separation Plot on Channel 39 - 40



Date: 14.SEP.2010 11:55:25

Channel Separation Plot on Channel 77 - 78



Date: 14.SEP.2010 11:56:03

3.4 Dwell Time Measurement

3.4.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

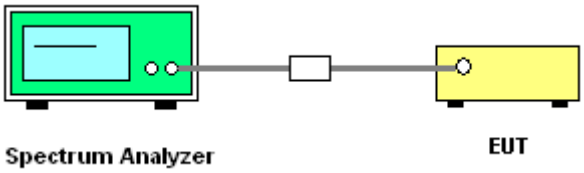
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to calculate the dwell time.

3.4.4 Test Setup



3.4.5 Test Result of Dwell Time

Test Mode :	Mode 8	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
3DH5	3.00	2986.00	0.28	0.4	Pass

Remark:

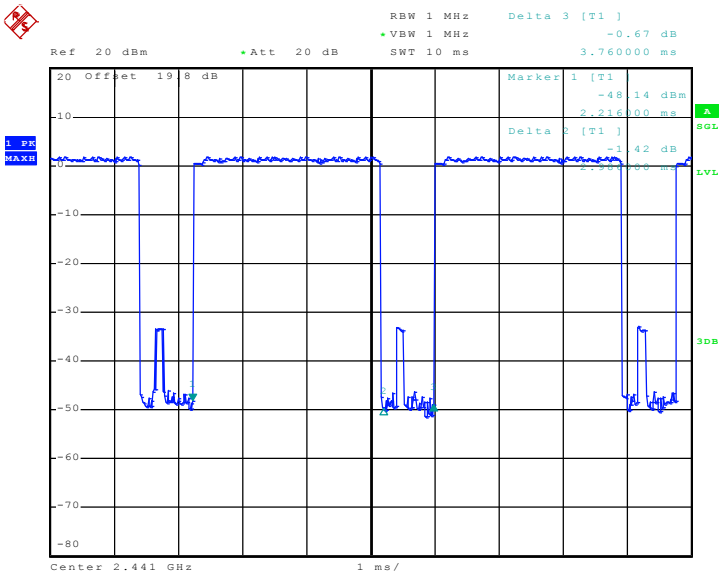
1. Dwell Time=79(channels) x 0.4(s) x average hopping channel x package transfer time

2. 79 channels come from the Hopping Channel number.

3. Average Hopping Channel = hops/sweep time

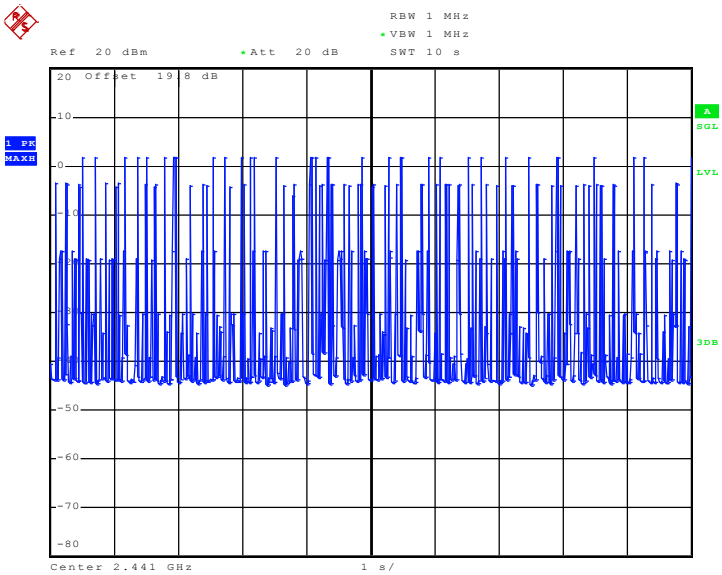
4. t: Package Transfer Time(us)

3DH5 Dwell Time (One Pulse) Plot on Channel 39



Date: 14.SEP.2010 14:09:51

3DH5 Dwell Time (Count Pulses) Plot on Channel 39



Date: 14.SEP.2010 14:18:26

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1W (30 dBm).

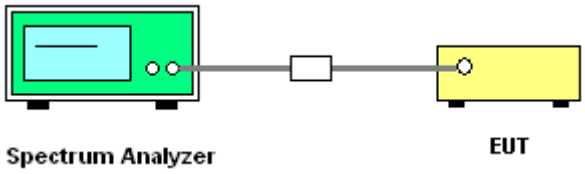
3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.

3.5.4 Test Setup

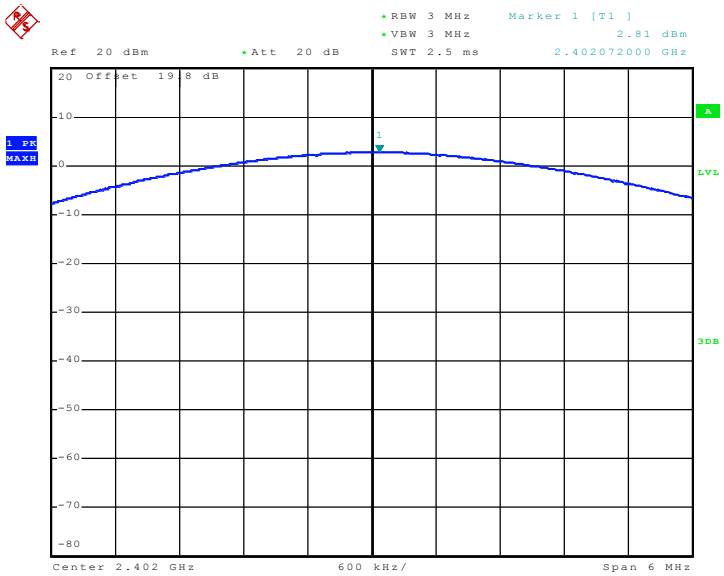


3.5.5 Test Result of Peak Output Power

Test Mode :	Mode 7, 8, 9	**Temperature :**	26~28℃
Test Engineer :	Andy Yeh	**Relative Humidity :**	42~45%

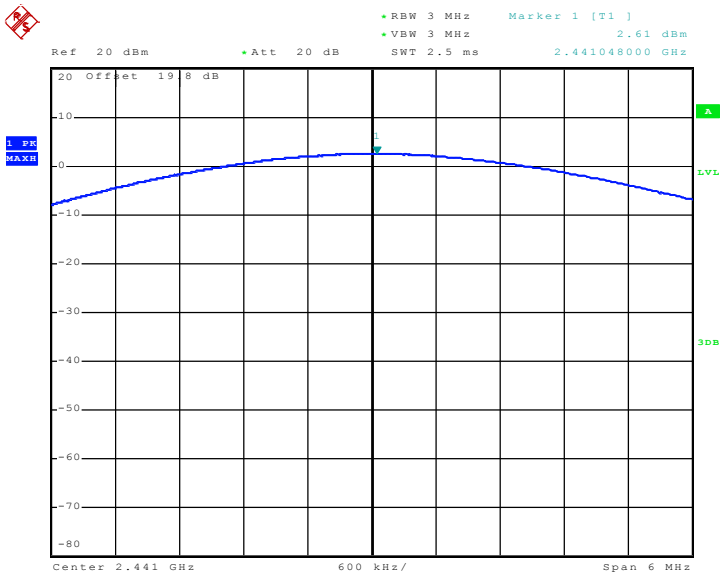
Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK 3 Mbps	Max. Limits (dBm)	Pass/Fail
00	2402	2.81	30	Pass
39	2441	2.61	30	Pass
78	2480	2.18	30	Pass

Peak Output Power Plot on Channel 00



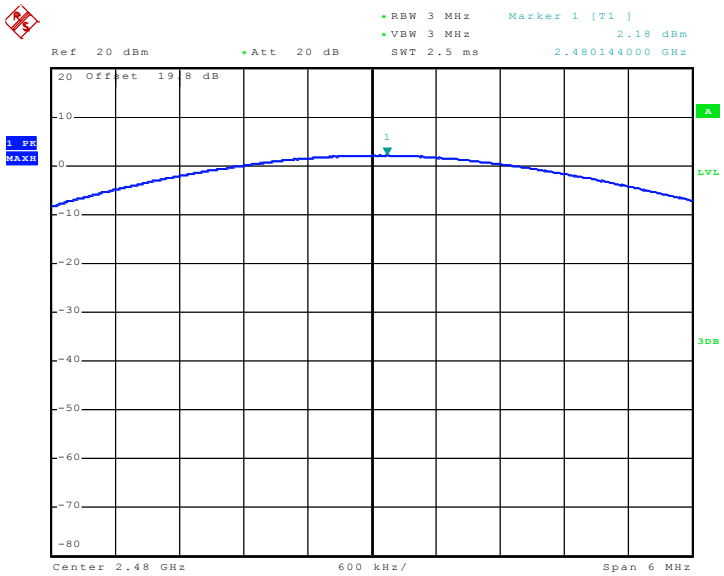
Date: 14.SEP.2010 11:00:58

Peak Output Power Plot on Channel 39



Date: 14.SEP.2010 11:01:30

Peak Output Power Plot on Channel 78



Date: 14.SEP.2010 11:01:58

3.6 Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

3.6.2 Measuring Instruments

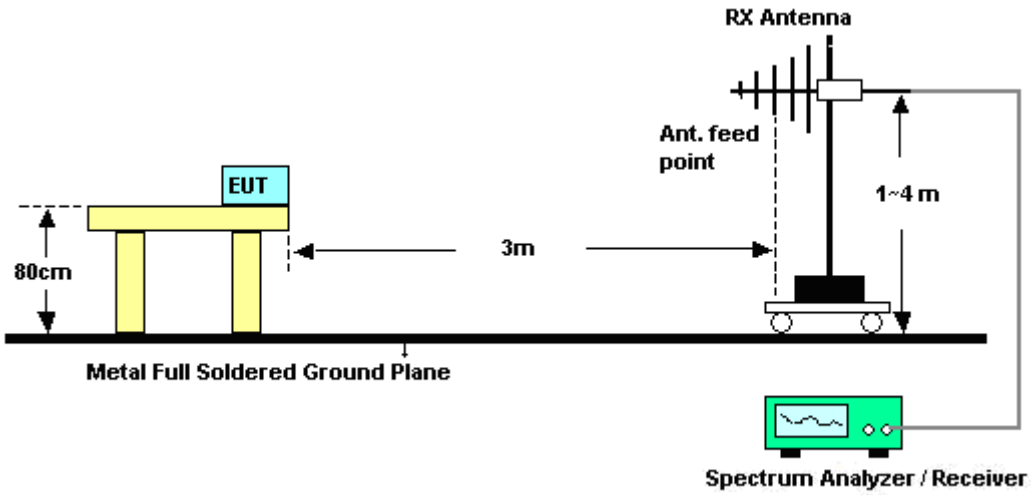
See list of measuring instruments of this test report.

3.6.3 Test Procedures

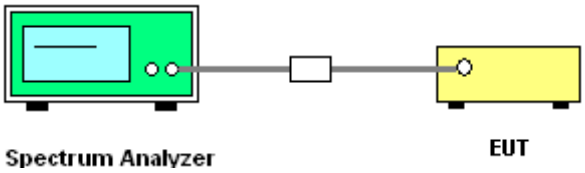
1. The testing follows the guidelines in ANSI C63.4-2003 and FCC Public Notice DA 00-705 Measurement Guidelines.
2. RF antenna conducted test: Set RBW = 300kHz, Video bandwidth (VBW) ≥ RBW. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 300k Hz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.
3. Radiated emission test: Applies to band edge emissions that fall in the restricted bands listed in FCC Section 15.205. The maximum permitted average field strength is listed in FCC Section 15.209. A pre-amp is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 1MHz, Sweep: Auto for Peak; set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto for Average. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See FCC Section 15.35(b) and (c).
4. In case the emission is fail due to the used RBW / VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

3.6.4 Test Setup

<Radiated Band Edges>



<Conducted Band Edges>



3.6.5 Test Result of Radiated Band Edges

Test Mode :	Mode 1	**Temperature :**	25.2~26.2°C
Test Channel :	00	**Relative Humidity :**	47~53%
		Test Engineer :	Jason Wang

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
2318.36	45.84	-28.16	74	43.89	31.63	4.41	34.09	160	10	Peak
2318.36	33.08	-20.92	54	31.13	31.63	4.41	34.09	160	10	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
2370.23	45.67	-28.33	74	43.6	31.68	4.47	34.08	100	334	Peak
2370.23	34.8	-19.2	54	32.73	31.68	4.47	34.08	100	334	Average

Test Mode :	Mode 3	**Temperature :**	25.2~26.2°C
Test Channel :	78	**Relative Humidity :**	47~53%
		Test Engineer :	Jason Wang

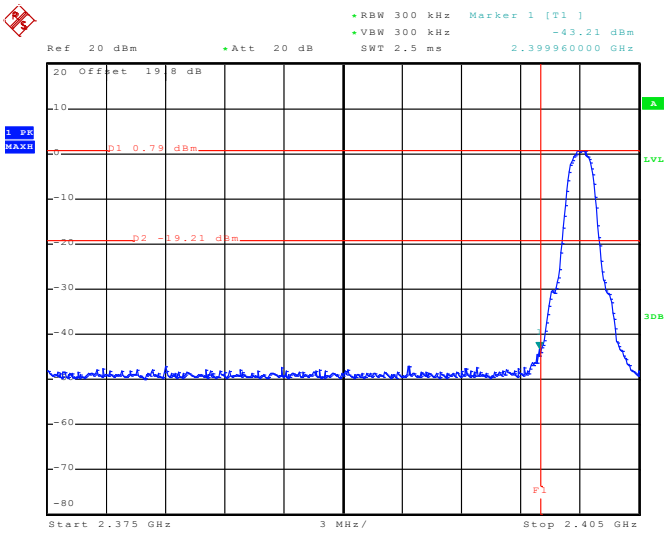
ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	53.87	-20.13	74	51.58	31.78	4.59	34.08	155	13	Peak
2483.5	43.96	-10.04	54	41.67	31.78	4.59	34.08	155	13	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
2483.5	58.22	-15.78	74	55.93	31.78	4.59	34.08	100	314	Peak
2483.5	46.66	-7.34	54	44.37	31.78	4.59	34.08	100	314	Average

3.6.6 Test Result of Conducted Band Edges

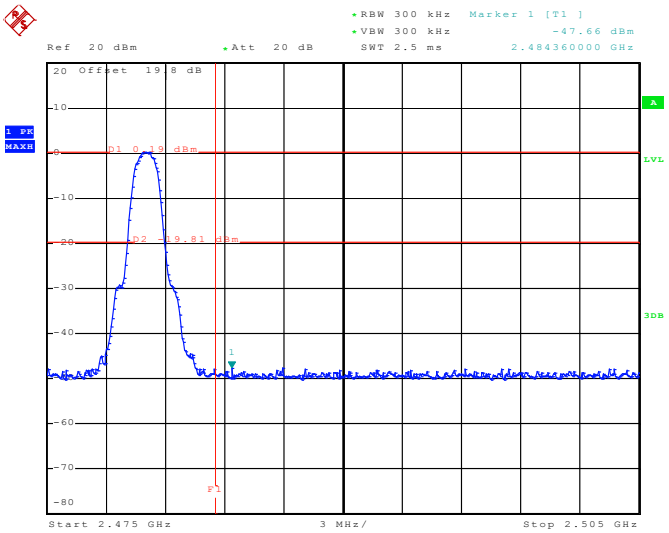
Test Mode :	Mode 7 and 9	**Temperature :**	26~28℃
Test Channel :	00 and 78	**Relative Humidity :**	42~45%
		Test Engineer :	Andy Yeh

Low Band Edge Plot on Channel 00



Date: 14.SEP.2010 13:56:51

High Band Edge Plot on Channel 78



Date: 14.SEP.2010 13:59:51

3.7 Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

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

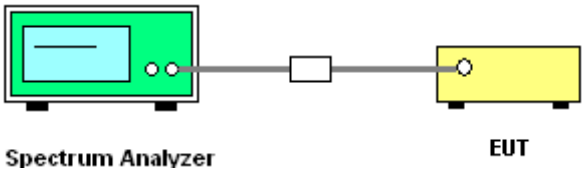
3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

3.7.3 Test Procedure

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set RBW = 100 kHz, Video bandwidth (VBW) ≥ RBW, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

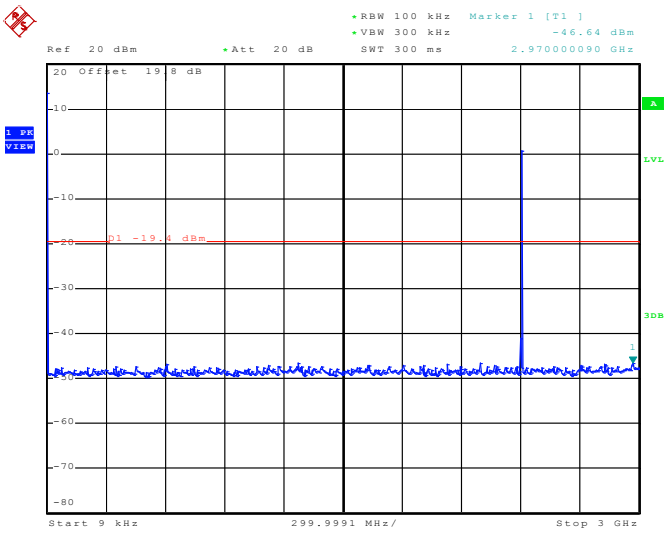
3.7.4 Test Setup



3.7.5 Test Result

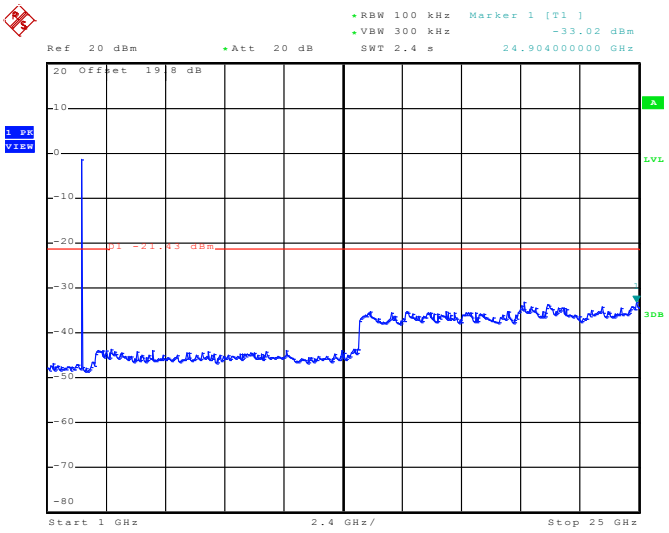
Test Mode :	Mode 7	**Temperature :**	26~28℃
Test Channel :	00	**Relative Humidity :**	42~45%
		Test Engineer :	Andy Yeh

Conducted Spurious Emission Plot between 9 kHz ~ 3 GHz



Date: 14.SEP.2010 15:05:01

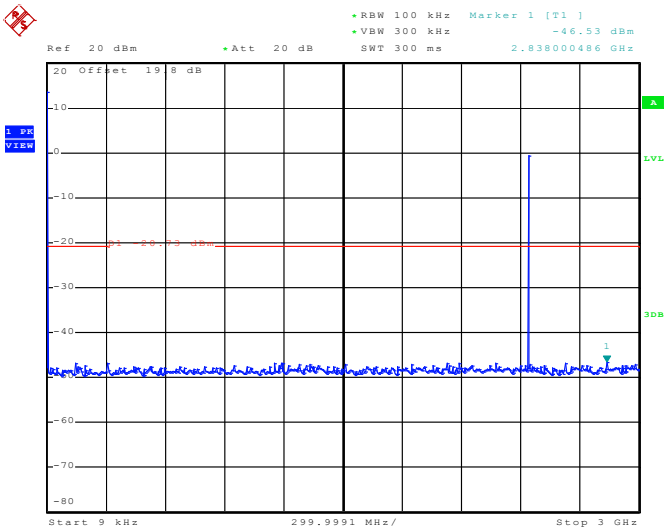
Conducted Spurious Emission Plot between 1 GHz ~ 25 GHz



Date: 14.SEP.2010 15:06:34

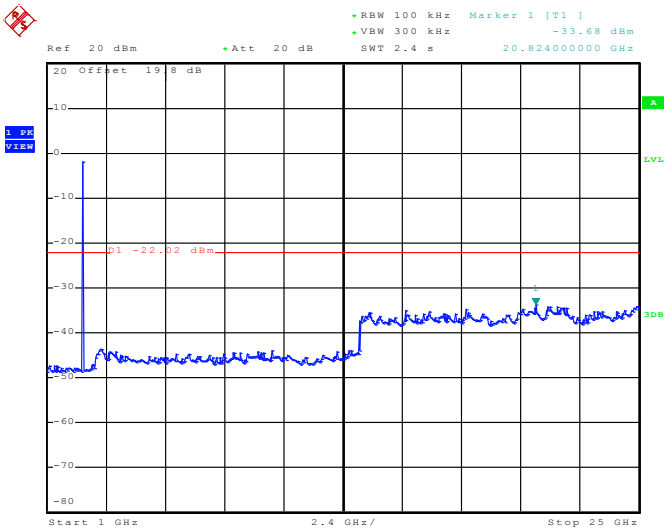
Test Mode :	Mode 8	**Temperature :**	26~28℃
Test Channel :	39	**Relative Humidity :**	42~45%
		Test Engineer :	Andy Yeh

Conducted Spurious Emission Plot between 9 kHz ~ 3 GHz



Date: 14.SEP.2010 15:07:10

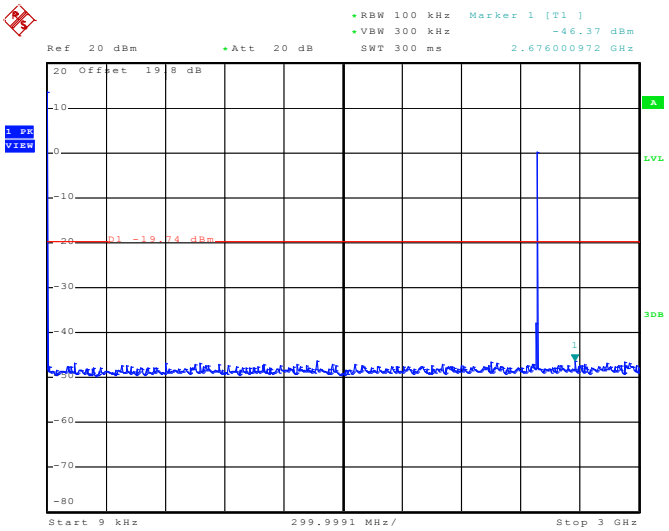
Conducted Spurious Emission Plot between 1 GHz ~ 25 GHz



Date: 14.SEP.2010 15:07:53

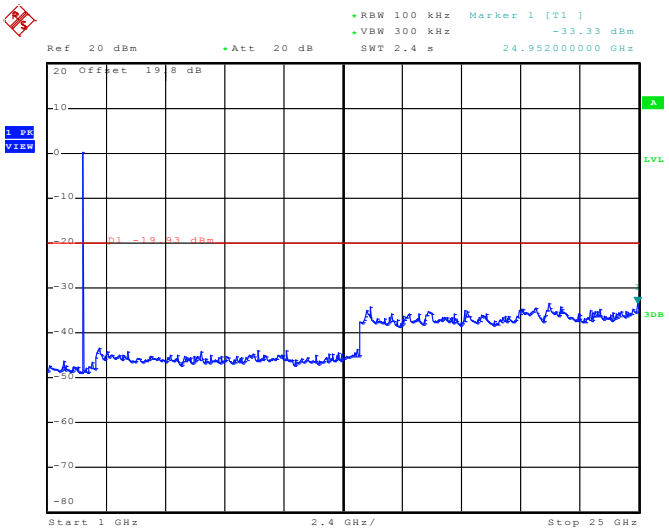
Test Mode :	Mode 9	**Temperature :**	26~28℃
Test Channel :	78	**Relative Humidity :**	42~45%
		Test Engineer :	Andy Yeh

Conducted Spurious Emission Plot between 9 kHz ~ 3 GHz



Date: 14.SEP.2010 15:08:33

Conducted Spurious Emission Plot between 1 GHz ~ 25 GHz



Date: 14.SEP.2010 15:09:11

3.8 AC Conducted Emission Measurement

3.8.1 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.

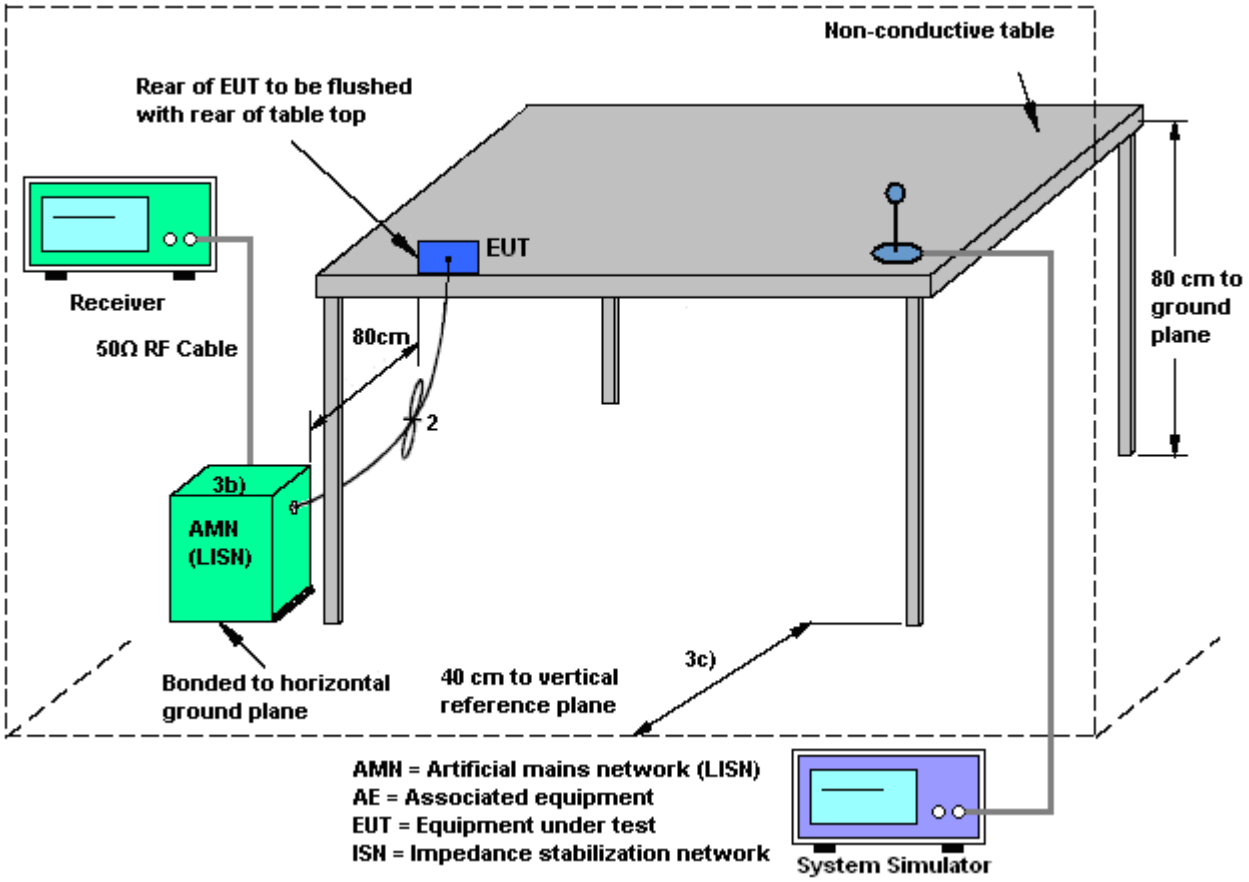
3.8.2 Measuring Instruments

See list of measuring instruments of this test report.

3.8.3 Test Procedures

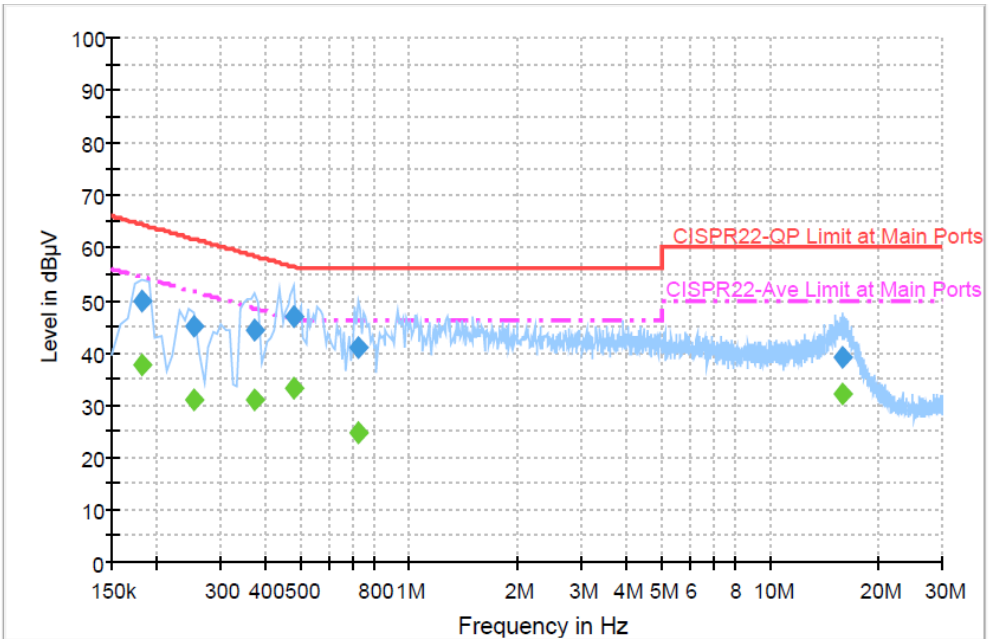
1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All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

3.8.4 Test Setup



3.8.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	**Temperature :**	20~22℃
Test Engineer :	Novic Jiang	**Relative Humidity :**	35~37%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	WCDMA Band IV Idle + Bluetooth Link + WLAN Link + Earphone + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



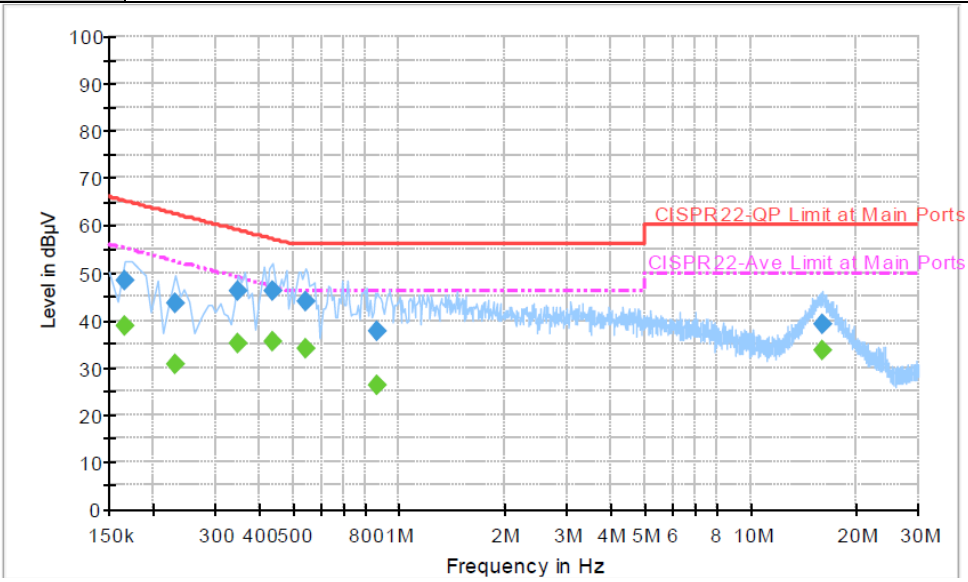
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	49.7	Off	L1	19.4	14.7	64.4
0.254000	44.9	Off	L1	19.3	16.7	61.6
0.374000	44.4	Off	L1	19.4	14.0	58.4
0.478000	47.0	Off	L1	19.4	9.4	56.4
0.726000	40.9	Off	L1	19.4	15.1	56.0
15.886000	39.2	Off	L1	19.7	20.8	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	37.5	Off	L1	19.4	16.9	54.4
0.254000	31.0	Off	L1	19.3	20.6	51.6
0.374000	30.9	Off	L1	19.4	17.5	48.4
0.478000	33.1	Off	L1	19.4	13.3	46.4
0.726000	24.6	Off	L1	19.4	21.4	46.0
15.886000	31.9	Off	L1	19.7	18.1	50.0

Test Mode :	Mode 2	**Temperature :**	20~22℃
Test Engineer :	Novic Jiang	**Relative Humidity :**	35~37%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Function Type :	WCDMA Band IV Idle + Bluetooth Link + WLAN Link + Earphone + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	48.4	Off	N	19.3	16.8	65.2
0.230000	43.5	Off	N	19.4	18.9	62.4
0.350000	46.0	Off	N	19.3	13.0	59.0
0.438000	46.0	Off	N	19.4	11.1	57.1
0.542000	43.8	Off	N	19.3	12.2	56.0
0.870000	37.6	Off	N	19.4	18.4	56.0
15.998000	39.1	Off	N	19.8	20.9	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	38.7	Off	N	19.3	26.5	55.2
0.230000	30.8	Off	N	19.4	21.6	52.4
0.350000	35.0	Off	N	19.3	14.0	49.0
0.438000	35.4	Off	N	19.4	11.7	47.1
0.542000	33.9	Off	N	19.3	12.1	46.0
0.870000	26.1	Off	N	19.4	19.9	46.0
15.998000	33.4	Off	N	19.8	16.6	50.0

3.9 Radiated Emission Measurement

3.9.1 Limit of Radiated 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

3.9.2 Measuring Instruments

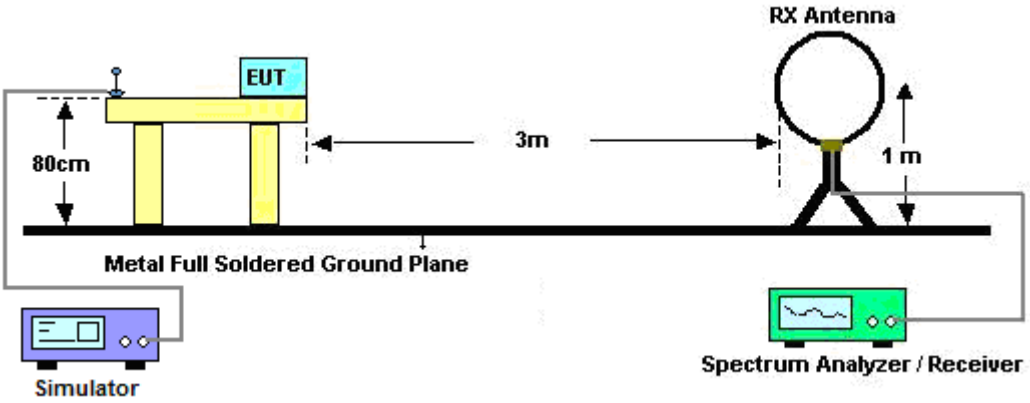
See list of measuring instruments of this test report.

3.9.3 Test Procedures

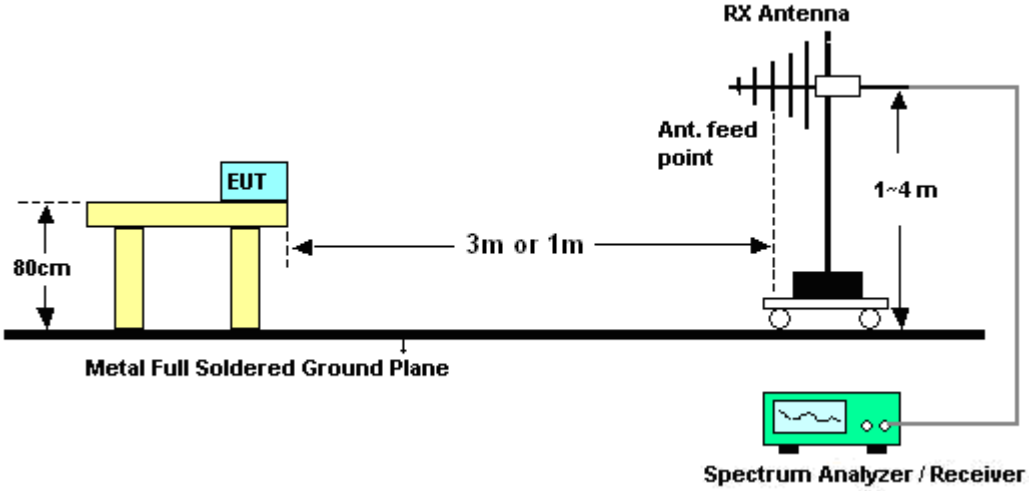
1. The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
2. Use the following spectrum analyzer settings:
   (1) Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
   (2) Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB)
3. Follow the guidelines in ANSI C63.4-2003 with respect to maximizing the emission by rotating the EUT, measuring the emission for three EUT orthogonal planes, and adjusting the measurement antenna height and polarization. A pre-amp and a high pass filter are used for this test in order to get the good signal level.

3.9.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



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

Test Engineer :	Jason Wang	**Temperature :**	25.2~26.2°C
		Relative Humidity :	47~53%

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

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

Test Mode :	Mode 1	**Temperature :**	25.2~26.2°C
Test Channel :	00	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Horizontal
Remark :	2402 MHz is Fundamental Signals 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
99.93	37.98	-5.52	43.5	57.41	11.2	0.95	31.58	-	-	Peak
139.89	38.47	-5.03	43.5	57.46	11.45	1.07	31.51	156	128	Peak
280.02	37.93	-8.07	46	54.59	13.23	1.48	31.37	-	-	Peak
319.6	39.55	-6.45	46	54.9	14.31	1.63	31.29	-	-	Peak
339.9	36.99	-9.01	46	51.91	14.75	1.63	31.3	-	-	Peak
400.1	36.6	-9.4	46	49.48	16.48	1.82	31.18	-	-	Peak
2318.36	33.08	-20.92	54	31.13	31.63	4.41	34.09	160	10	Average
2318.36	45.84	-28.16	74	43.89	31.63	4.41	34.09	160	10	Peak
2402	75.71	-	-	73.59	31.7	4.5	34.08	160	10	Average
2402	90.64	-	-	88.52	31.7	4.5	34.08	160	10	Peak
2484	31.64	-22.36	54	29.35	31.78	4.59	34.08	160	10	Average
2484	43.75	-30.25	74	41.46	31.78	4.59	34.08	160	10	Peak

Test Mode :	Mode 1	**Temperature :**	25.2~26.2°C
Test Channel :	00	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Vertical
Remark :	2402 MHz is Fundamental Signals 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
119.91	36.51	-6.99	43.5	54.33	12.63	1.07	31.52	-	-	Peak
179.85	38.65	-4.85	43.5	59.9	9.03	1.23	31.51	115	231	Peak
260.04	38.71	-7.29	46	55.09	13.68	1.42	31.48	-	-	Peak
339.9	32.99	-13.01	46	47.91	14.75	1.63	31.3	-	-	Peak
359.5	33.02	-12.98	46	47.36	15.23	1.71	31.28	-	-	Peak
400.1	32.82	-13.18	46	45.7	16.48	1.82	31.18	-	-	Peak
2370.23	34.8	-19.2	54	32.73	31.68	4.47	34.08	100	334	Average
2370.23	45.67	-28.33	74	43.6	31.68	4.47	34.08	100	334	Peak
2402	78.9	-	-	76.78	31.7	4.5	34.08	100	334	Average
2402	96.19	-	-	94.07	31.7	4.5	34.08	100	334	Peak
2492	31.66	-22.34	54	29.32	31.8	4.62	34.08	100	334	Average
2492	43.58	-30.42	74	41.24	31.8	4.62	34.08	100	334	Peak

Test Mode :	Mode 2	**Temperature :**	25.2~26.2°C
Test Channel :	39	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Horizontal
Remark :	2441 MHz is Fundamental Signals 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
140.16	39.38	-4.12	43.5	58.37	11.45	1.07	31.51	-	-	Peak
180.12	39.99	-3.51	43.5	61.24	9.03	1.23	31.51	113	58	Peak
280.02	39.95	-6.05	46	56.61	13.23	1.48	31.37	-	-	Peak
319.6	37.52	-8.48	46	52.87	14.31	1.63	31.29	-	-	Peak
339.9	37.03	-8.97	46	51.95	14.75	1.63	31.3	-	-	Peak
379.8	36.12	-9.88	46	49.8	15.78	1.77	31.23	-	-	Peak
2382	32.1	-21.9	54	30.03	31.68	4.47	34.08	104	18	Average
2382	44.15	-29.85	74	42.08	31.68	4.47	34.08	104	18	Peak
2441	75.67	-	-	73.44	31.75	4.56	34.08	104	18	Average
2441	90.64	-	-	88.41	31.75	4.56	34.08	104	18	Peak
2484	31.67	-22.33	54	29.38	31.78	4.59	34.08	104	18	Average
2484	43.9	-30.1	74	41.61	31.78	4.59	34.08	104	18	Peak

Test Mode :	Mode 2	**Temperature :**	25.2~26.2°C
Test Channel :	39	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Vertical
Remark :	2441 MHz is Fundamental Signals 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
119.91	35.67	-7.83	43.5	53.49	12.63	1.07	31.52	-	-	Peak
180.12	39.46	-4.04	43.5	60.71	9.03	1.23	31.51	151	149	Peak
200.1	38.53	-4.97	43.5	59.09	9.63	1.26	31.45	-	-	Peak
359.5	33.53	-12.47	46	47.87	15.23	1.71	31.28	-	-	Peak
379.8	32.58	-13.42	46	46.26	15.78	1.77	31.23	-	-	Peak
400.1	30.57	-15.43	46	43.45	16.48	1.82	31.18	-	-	Peak
2318	33.43	-20.57	54	31.48	31.63	4.41	34.09	100	315	Average
2318	44.3	-29.7	74	42.35	31.63	4.41	34.09	100	315	Peak
2441	80.1	-	-	77.87	31.75	4.56	34.08	100	315	Average
2441	96.09	-	-	93.86	31.75	4.56	34.08	100	315	Peak
2492	31.71	-22.29	54	29.37	31.8	4.62	34.08	100	315	Average
2492	43.23	-30.77	74	40.89	31.8	4.62	34.08	100	315	Peak

Test Mode :	Mode 3	**Temperature :**	25.2~26.2°C
Test Channel :	78	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Horizontal
Remark :	2480 MHz is Fundamental Signals 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
119.91	39.96	-3.54	43.5	57.78	12.63	1.07	31.52	163	117	Peak
139.89	39.63	-3.87	43.5	58.62	11.45	1.07	31.51	-	-	Peak
180.12	39.58	-3.92	43.5	60.83	9.03	1.23	31.51	-	-	Peak
319.6	37.26	-8.74	46	52.61	14.31	1.63	31.29	-	-	Peak
339.9	34.99	-11.01	46	49.91	14.75	1.63	31.3	-	-	Peak
400.1	37.58	-8.42	46	50.46	16.48	1.82	31.18	-	-	Peak
2322	31.97	-22.03	54	30.02	31.63	4.41	34.09	155	13	Average
2322	44	-30	74	42.05	31.63	4.41	34.09	155	13	Peak
2480	72.83	-	-	70.54	31.78	4.59	34.08	155	13	Average
2480	89.02	-	-	86.73	31.78	4.59	34.08	155	13	Peak
2483.5	43.96	-10.04	54	41.67	31.78	4.59	34.08	155	13	Average
2483.5	53.87	-20.13	74	51.58	31.78	4.59	34.08	155	13	Peak

Test Mode :	Mode 3	**Temperature :**	25.2~26.2°C
Test Channel :	78	**Relative Humidity :**	47~53%
Test Engineer :	Jason Wang	**Polarization :**	Vertical
Remark :	2480 MHz is Fundamental Signals 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
119.91	37.09	-6.41	43.5	54.91	12.63	1.07	31.52	-	-	Peak
179.85	40.25	-3.25	43.5	61.5	9.03	1.23	31.51	134	241	Peak
200.1	38.65	-4.85	43.5	59.21	9.63	1.26	31.45	-	-	Peak
359.5	33.37	-12.63	46	47.71	15.23	1.71	31.28	-	-	Peak
379.8	29.33	-16.67	46	43.01	15.78	1.77	31.23	-	-	Peak
472.9	30.52	-15.48	46	41.98	17.68	1.98	31.12	-	-	Peak
2326	32.98	-21.02	54	31.03	31.63	4.41	34.09	100	314	Average
2326	44.45	-29.55	74	42.5	31.63	4.41	34.09	100	314	Peak
2480	77.31	-	-	75.02	31.78	4.59	34.08	100	314	Average
2480	95.06	-	-	92.77	31.78	4.59	34.08	100	314	Peak
2483.5	46.66	-7.34	54	44.37	31.78	4.59	34.08	100	314	Average
2483.5	58.22	-15.78	74	55.93	31.78	4.59	34.08	100	314	Peak

3.10 Antenna Requirements

3.10.1 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.

3.10.2 Antenna Connected Construction

The antennas type used in this product is Fixed Internal Antenna without connector and it is considered to meet antenna requirement.

3.10.3 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	Due Date	Remark
Spectrum Analyzer	R&S	FSP30	101329	9kHz~30GHz	Apr. 26, 2010	Apr. 25, 2011	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 13, 2010	Sep. 12, 2011	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	N/A	Sep. 14, 2010	Sep. 13, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100057	9KHz-40GHz	Oct. 20, 2009	Oct. 19, 2010	Radiation (03CH05-HY)
Amplifier	COM-POWER	PA-103	161069	1KHz - 1GHz	Mar. 29, 2010	Mar. 28, 2011	Radiation (03CH05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 31, 2009	Oct. 30, 2010	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 251	15GHz- 40GHz	Oct. 14, 2009	Oct. 13, 2010	Radiation (03CH05-HY)
Pre Amplifier	Agilent	8449B	3008A019 17	1GHz- 26.5GHz	Nov. 11, 2009	Nov. 10, 2010	Radiation (03CH05-HY)
Turn Table	HD	Deis HD 2000	420/611	0 - 360 degree	N/A	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	MA 240	240/666	1 m - 4 m	N/A	N/A	Radiation (03CH05-HY)
Horn Antenna	ESCO	3117	00066584	1GHz ~ 18GHz	Aug. 05, 2010	Aug. 04, 2011	Radiation (03CH05-HY)
Horn Antenna	Training Research	AH-0801	95119	8GHz~18GHz	Nov. 02, 2009	Nov. 01, 2010	Radiation (03CH05-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH05-HY)
Bluetooth Base Station	R&S	CBT32	100519	N/A	May 12, 2009	May 11, 2011	Radiation (03CH05-HY)

5 Uncertainty of Evaluation

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.10	Normal (k=2)	0.05
Cable Loss	0.10	Normal (k=2)	0.05
AMN Insertion Loss	2.50	Rectangular	0.63
Receiver Specification	1.50	Rectangular	0.43
Site Imperfection	1.39	Rectangular	0.80
Mismatch	+0.34 / -0.35	U-Shape	0.24
Combined Standard Uncertainty Uc(y)	**1.13**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**		

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.41	Normal (k=2)	0.21
Antenna Factor Calibration	0.83	Normal (k=2)	0.42
Cable Loss Calibration	0.25	Normal (k=2)	0.13
Pre-Amplifier Gain Calibration	0.27	Normal (k=2)	0.14
RCV/SPA Specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site Imperfection	1.43	Rectangular	0.83
Mismatch	+0.39 / -0.41	U-Shape	0.28
Combined Standard Uncertainty Uc(y)	**1.27**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.54**		

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Contribution	Uncertainty of X_i		$u(X_i)$	C_i	$C_i * u(X_i)$
	dB	Probability Distribution			
Receiver Reading	±0.10	Normal (k=2)	0.10	1	0.10
Antenna Factor Calibration	±1.70	Normal (k=2)	0.85	1	0.85
Cable Loss Calibration	±0.50	Normal (k=2)	0.25	1	0.25
Receiver Correction	±2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	±1.50	Rectangular	0.87	1	0.87
Site Imperfection	±2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR Γ1 = 0.197 Antenna VSWR Γ2 = 0.194 Uncertainty = 20Log(1-Γ1*Γ2)	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty Uc(y)	**2.36**				
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.72**				

Appendix A. Photographs of EUT

Please refer to Sporton report number EP090307-01A as below.