

FCC RF Test Report

APPLICANT : Advantech Co., Ltd.
EQUIPMENT : Tablet PC
BRAND NAME : ADVANTECH
MODEL NAME : S10A
FCC ID : M82-S10A
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : Digital Spread Spectrum (DSS)

The product was received on Apr. 11, 2011 and completely tested on May 07, 2011. 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:



Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR141109	Rev. 01	Initial issue of report	May 31, 2011

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	$\geq 15\text{Chs}$	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	$\geq 2/3$ of 20dB BW	Pass	-
3.4	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
3.6	15.247(d)	A8.5	Frequency Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	A8.5	Spurious Emission	$< 20\text{ dBc}$	Pass	-
3.8	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 10.7 dB at 0.19 MHz
3.9	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.12 dB at 451.90 MHz
3.10	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Advantech Co., Ltd.

No.1, alley 20, Lane 26, Rueiguang Road NeiHu District, Taipei 114, R.O.C.

1.2 Manufacturer

Advantech Co., Ltd.

No.1, alley 20, Lane 26, Rueiguang Road NeiHu District, Taipei 114, R.O.C.

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Tablet PC
Brand Name	ADVANTECH
Model Name	S10A
FCC ID	M82-S10A
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) : 1.69 dBm (0.01 W) Bluetooth EDR (2Mbps) : 2.74 dBm (0.02 W) Bluetooth EDR (3Mbps) : 2.55 dBm (0.02 W)
Antenna Type	Chip Antenna with gain 2.43 dBi
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
EUT Stage	Production Unit

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 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.		FCC/IC Registration No.
	CO05-HY	03CH06-HY	722060/4086B-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 8

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.	Earphone	Ergotech	ET-E200	FCC DoC	Unshielded, 1.8 m	N/A
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.	LCD Monitor	Lenovo	6135-AB1	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
6.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A
7.	Modem	ACCEX	DM1414	IFAXDM1414	Shielded, 1.5 m	N/A
8.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	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	0.91 dBm	1.97 dBm	1.72 dBm
Ch39	2441MHz	1.69 dBm	2.74 dBm	2.55 dBm
Ch78	2480MHz	1.03 dBm	1.88 dBm	1.78 dBm

Remark:

1. The data rate was set in 2Mbps 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).

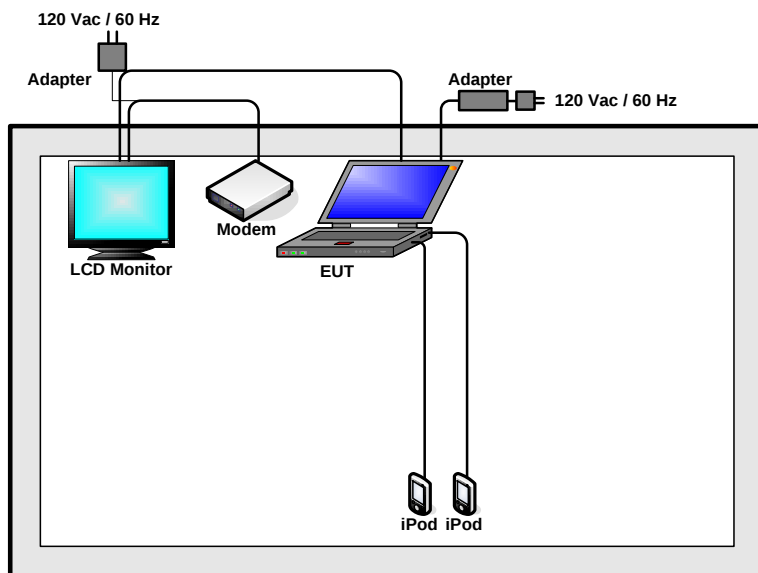
Pre-scanned tests were conducted to determine the final configuration from all possible combinations.

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

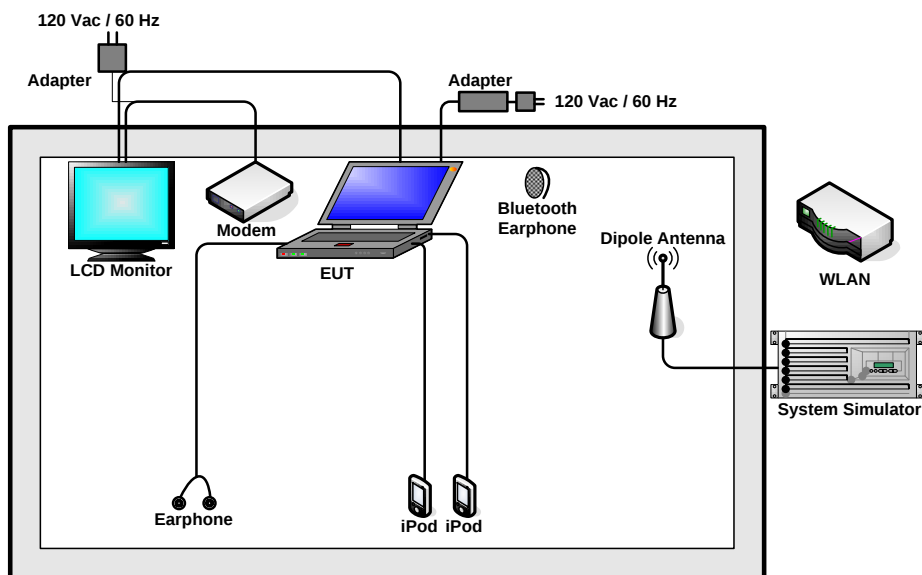
Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	N/A	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	N/A
AC Conducted Emission	Mode 1 :GSM850 Idle + Bluetooth Link + WLAN Link +TC (Charging from Adapter)		
Remark:			
1. TC stands for Test Configuration, and consists of iPod, monitor, earphone, and modem.			
2. For radiated TCs, the data rate was set in 2Mbps due to the highest RF output power; only the data of these modes was reported..			

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>





2.4 RF Utility

For Bluetooth function, the RF utility, “art\id=30a1” was installed in EUT which was programmed 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.

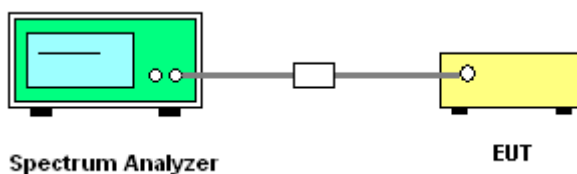
3.1.2 Measuring Instruments

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 $\geq$ 1% of the span; VBW $\geq$ 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 4~6	Temperature :	24~26°C
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%
Number of Hopping Channels (Channel)		Limits (Channel)	Pass/Fail
79		> 15	Pass



3.2 20dB Bandwidth Measurement

3.2.1 Limit of 20dB Bandwidth

N/A

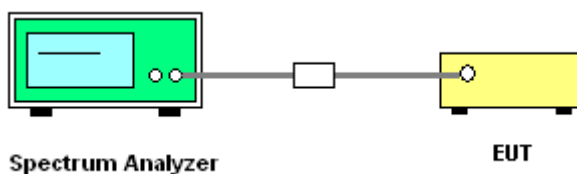
3.2.2 Measuring Instruments

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 $\geq$ 1% of the 20 dB bandwidth; VBW $\geq$ 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

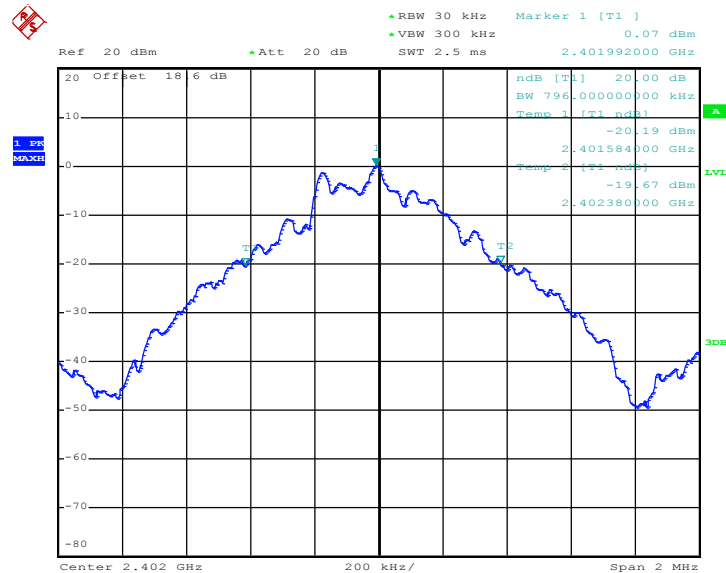


3.2.5 Test Result of 20dB Bandwidth

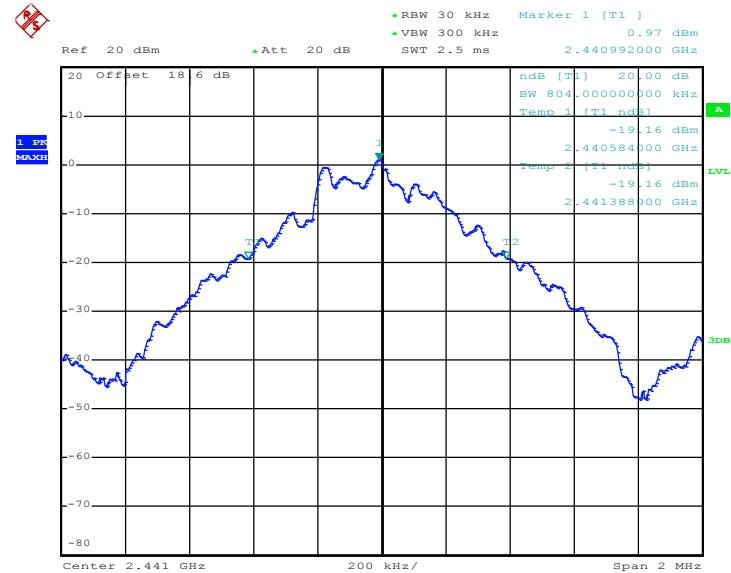
Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.796
39	2441	0.804
78	2480	0.804

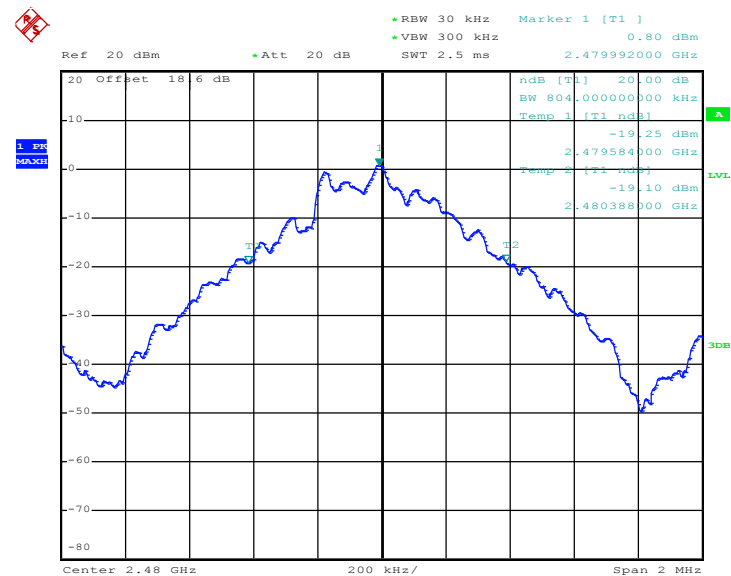
20 dB Bandwidth Plot on Channel 00



Date: 26.APR.2011 16:31:55

20 dB Bandwidth Plot on Channel 39


Date: 26.APR.2011 16:23:51

20 dB Bandwidth Plot on Channel 78


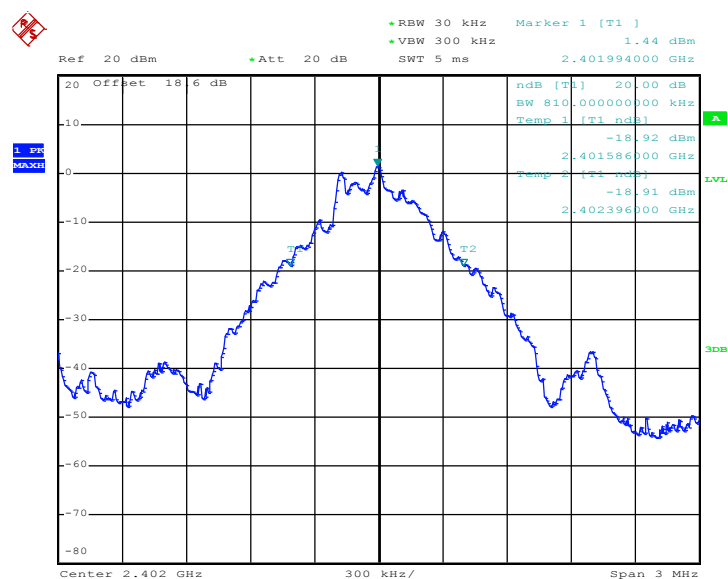
Date: 26.APR.2011 16:41:15



Test Mode :	Mode 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

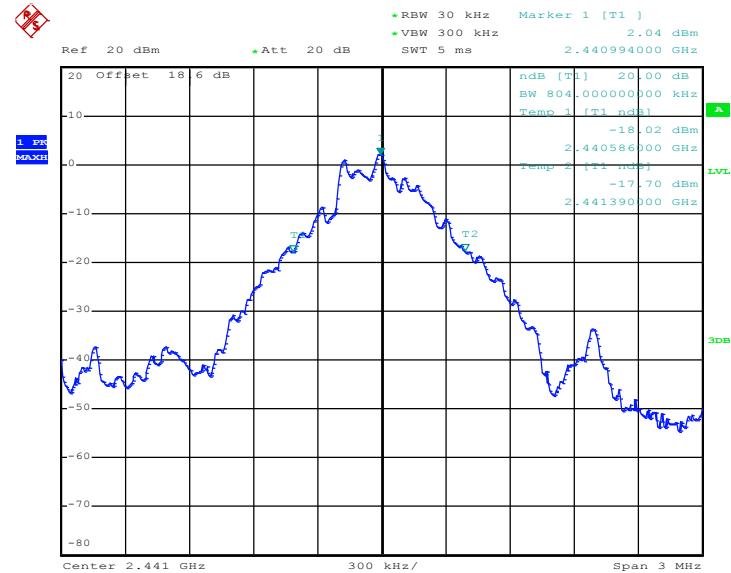
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.810
39	2441	0.804
78	2480	0.846

20 dB Bandwidth Plot on Channel 00



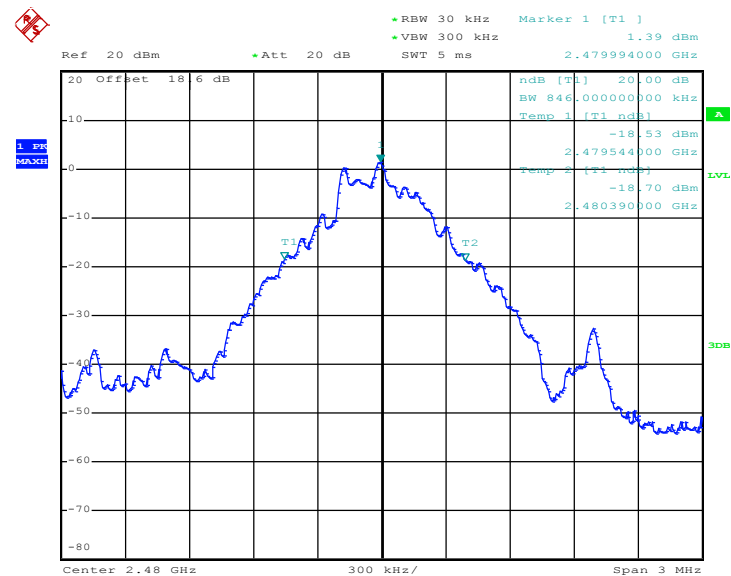
Date: 26.APR.2011 15:56:41

20 dB Bandwidth Plot on Channel 39



Date: 26.APR.2011 15:42:12

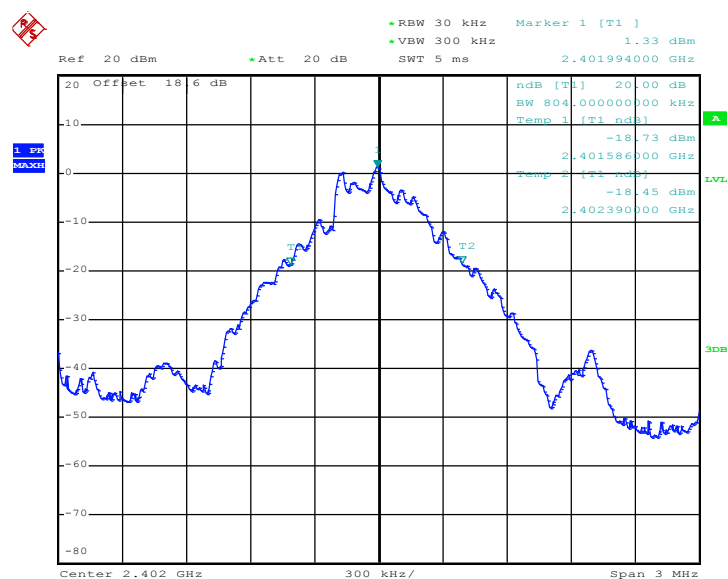
20 dB Bandwidth Plot on Channel 78



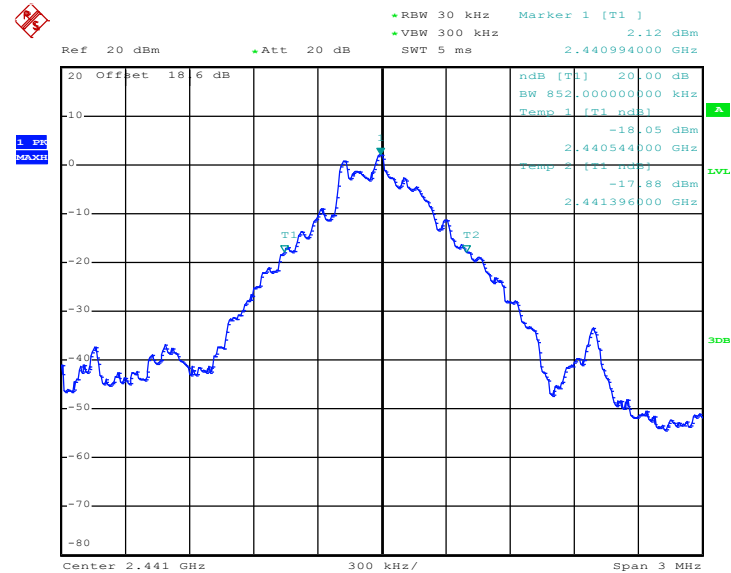
Date: 26.APR.2011 15:47:34

Test Mode :	Mode 7, 8, 9	Temperature :	24~26°C
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

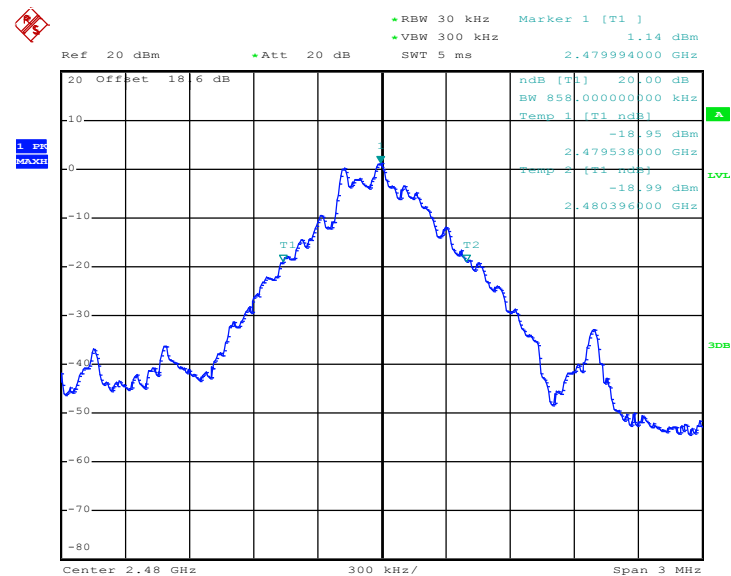
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.804
39	2441	0.852
78	2480	0.858

20 dB Bandwidth Plot on Channel 00


Date: 26.APR.2011 15:15:57

20 dB Bandwidth Plot on Channel 39


Date: 26.APR.2011 15:02:26

20 dB Bandwidth Plot on Channel 78


Date: 26.APR.2011 15:01:30

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.

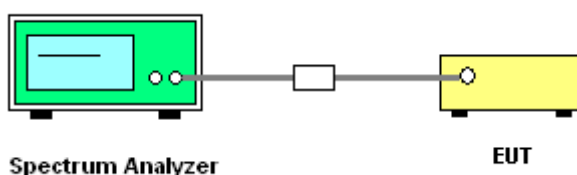
3.3.2 Measuring Instruments

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; $RBW \geq 1\%$ of the span;
 $VBW \geq RBW$; 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

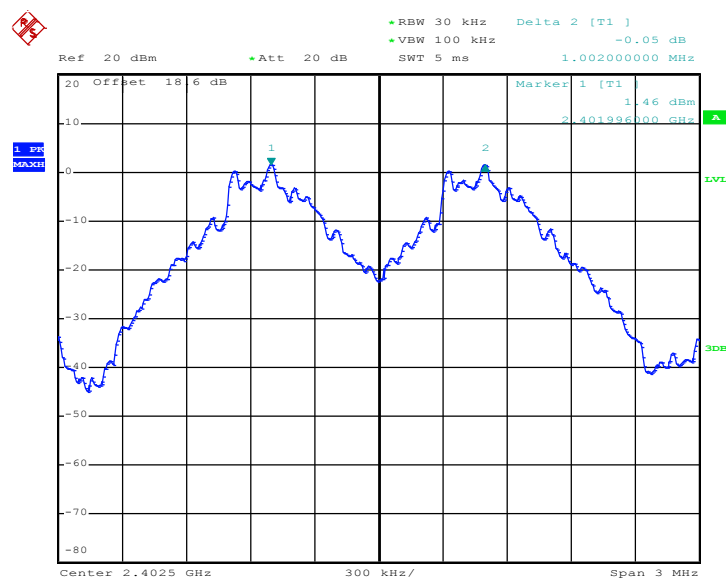


3.3.5 Test Result of Hopping Channel Separation

Test Mode :	Mode 4, 5, 6	Temperature :	24~26℃
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

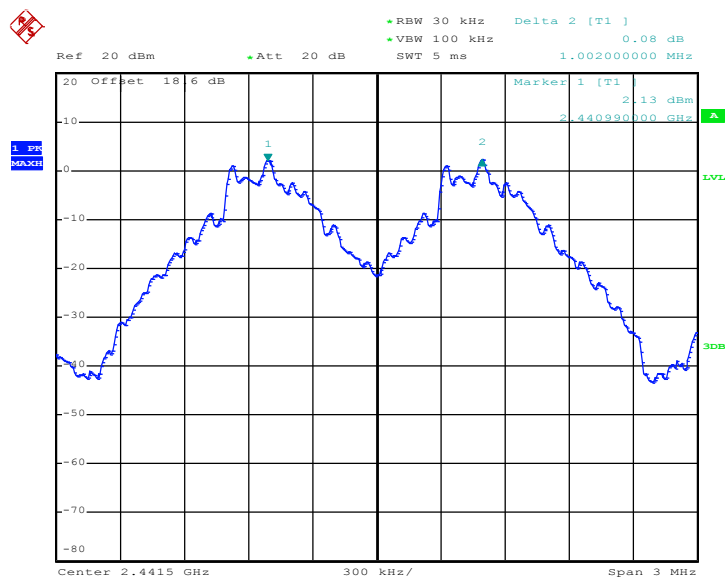
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.540	Pass
39	2441	1.002	0.536	Pass
78	2480	1.002	0.564	Pass

Channel Separation Plot on Channel 00 - 01



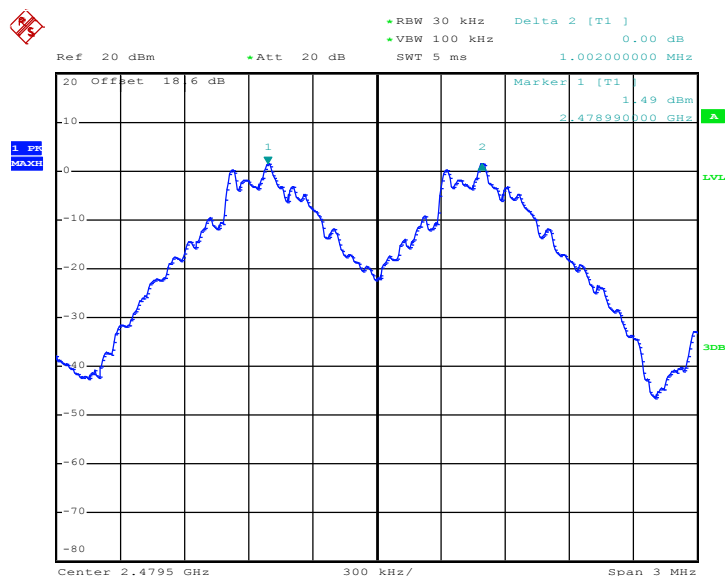
Date: 26.APR.2011 15:59:35

Channel Separation Plot on Channel 39 - 40



Date: 26.APR.2011 15:43:48

Channel Separation Plot on Channel 77 - 78



Date: 26.APR.2011 15:46:36

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.

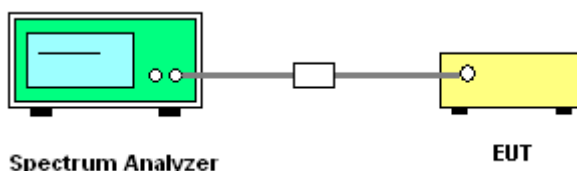
3.4.2 Measuring Instruments

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 $\geq$ 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



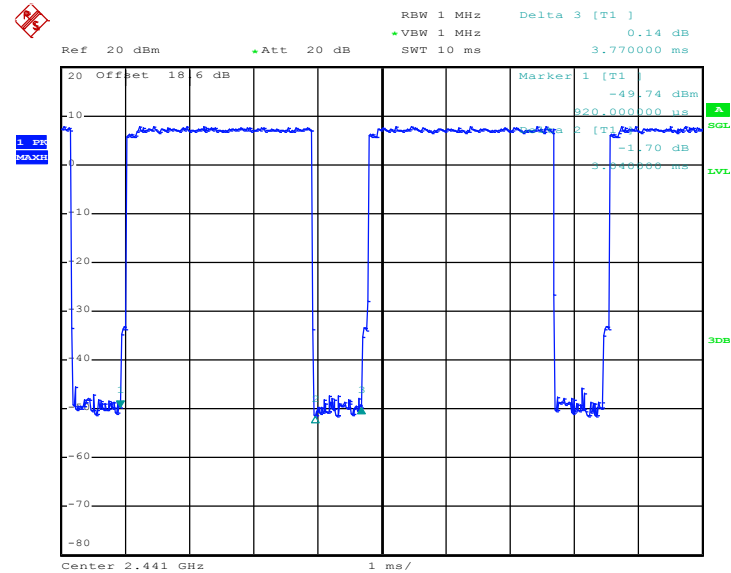
3.4.5 Test Result of Dwell Time

Test Mode :	Mode 5	Temperature :	24~26°C
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

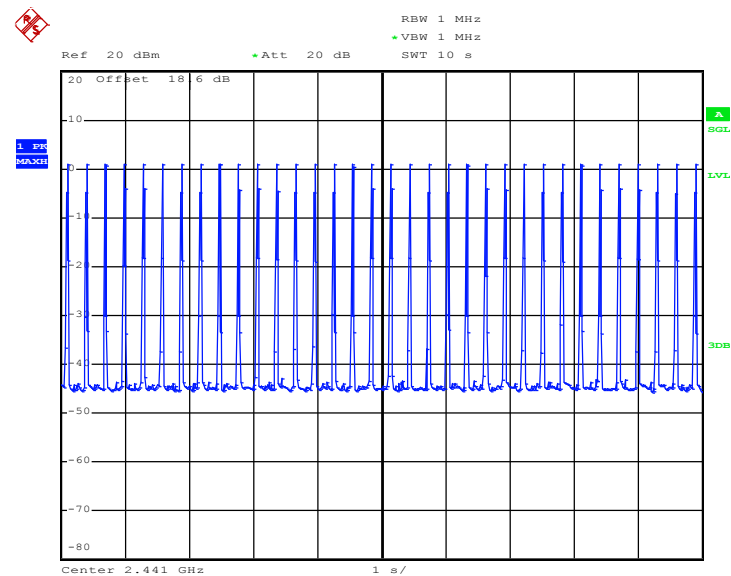
Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
2DH5	3.4	3040.00	0.33	0.4	Pass

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)

2DH5 Dwell Time (One Pulse) Plot on Channel 39


Date: 27.APR.2011 15:21:45

2DH5 Dwell Time (Count Pulses) Plot on Channel 39


Date: 26.APR.2011 16:46:27

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 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, provided the systems operate with an output power no greater than 125 mW (20.97dBm).

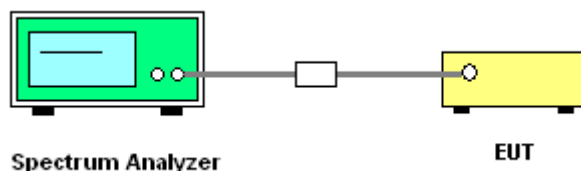
3.5.2 Measuring Instruments

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 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston Tu	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		$\pi/4$ -DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	1.97	20.97	Pass
39	2441	2.74	20.97	Pass
78	2480	1.88	20.97	Pass

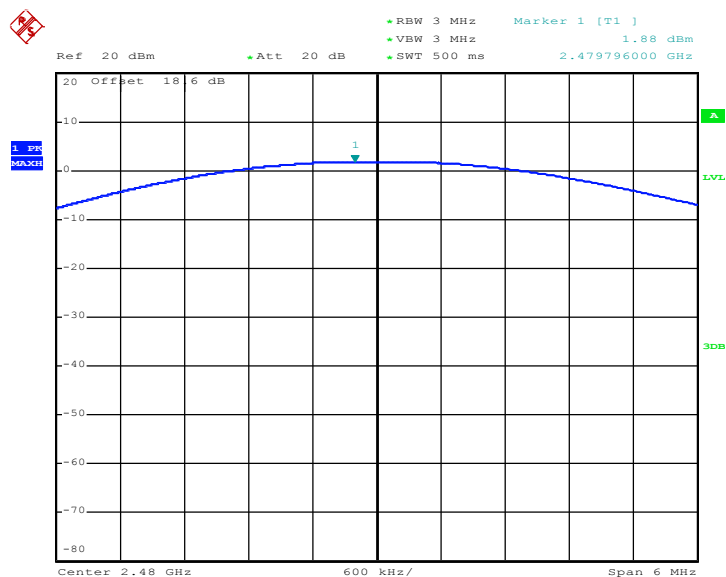


Peak Output Power Plot on Channel 39





Peak Output Power Plot on Channel 78



Date: 26.APR.2011 14:15:06

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

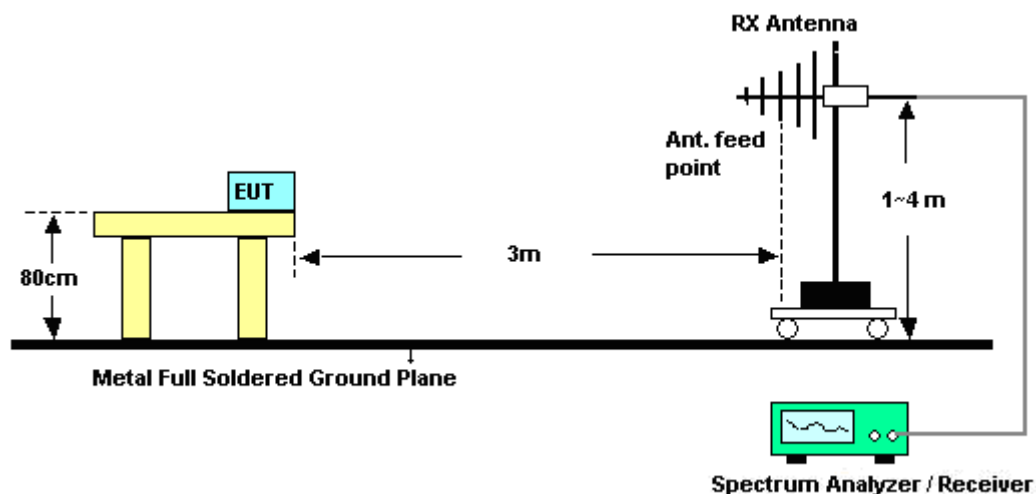
See list of measuring instruments of this test report.

3.6.3 Test Procedures

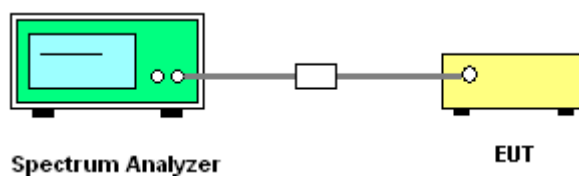
1. The testing follows the guidelines in ANSI C63.4-2003 and FCC Public Notice DA 00-705 Measurement Guidelines.
2. RF antenna conducted test: Set RBW = 300kHz, Video bandwidth (VBW) $\geq$ RBW. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band 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 :	26~27°C
Test Channel :	00	Relative Humidity :	49~50%
		Test Engineer :	Kay Wu

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
2385.81	42.77	-31.23	74	43.72	28.08	5.37	34.4	104	295	Peak
2385.81	30.15	-23.85	54	31.1	28.08	5.37	34.4	104	295	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
2385.62	41.62	-32.38	74	42.61	28.08	5.34	34.41	138	63	Peak
2385.62	31.15	-22.85	54	32.14	28.08	5.34	34.41	138	63	Average

Test Mode :	Mode 3	Temperature :	26~27°C
Test Channel :	78	Relative Humidity :	49~50%
		Test Engineer :	Kay Wu

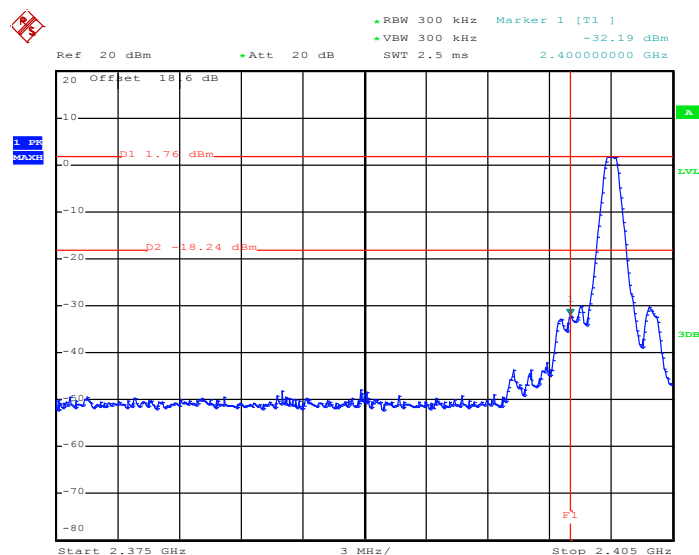
ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	58.54	-15.46	74	59.12	28.27	5.52	34.37	102	294	Peak
2483.5	45.19	-8.81	54	45.77	28.27	5.52	34.37	102	294	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	58.73	-15.27	74	59.31	28.27	5.52	34.37	195	63	Peak
2483.5	44.79	-9.21	54	45.37	28.27	5.52	34.37	195	63	Average

3.6.6 Test Result of Conducted Band Edges

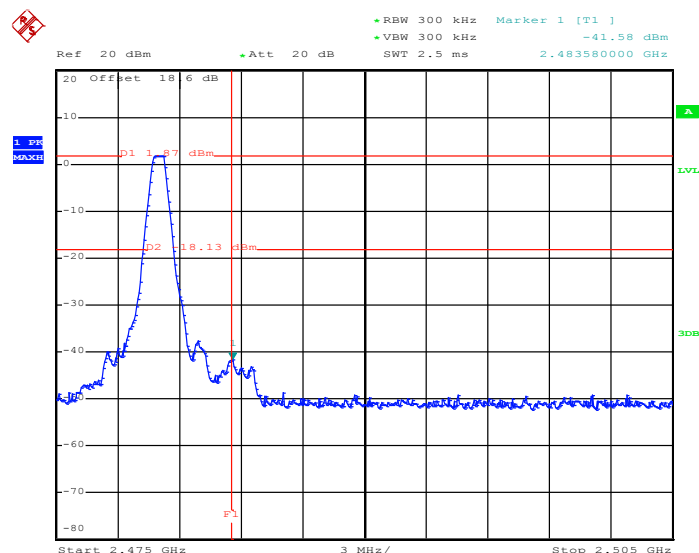
Test Mode :	Mode 4 and 6	Temperature :	24~26℃
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Pinkston Tu

Low Band Edge Plot on Channel 00



Date: 26.APR.2011 15:55:20

High Band Edge Plot on Channel 78



Date: 26.APR.2011 15:47:57

3.7 Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

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

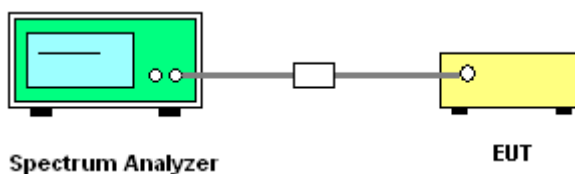
3.7.2 Measuring Instruments

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) $\geq$ 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.

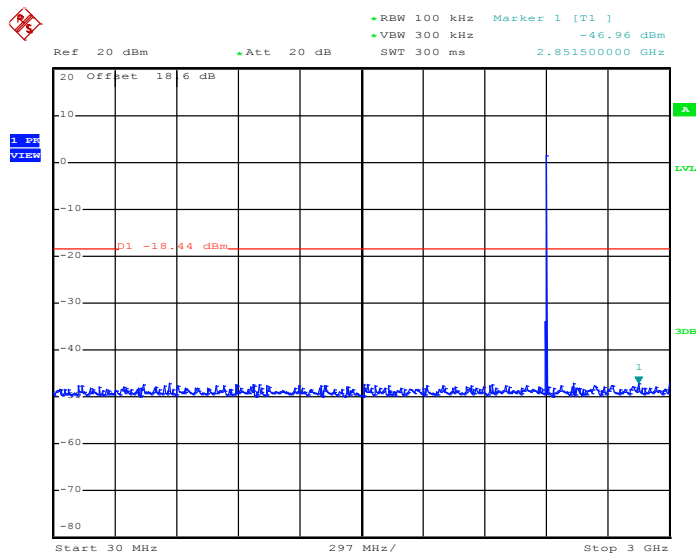
3.7.4 Test Setup



3.7.5 Test Result

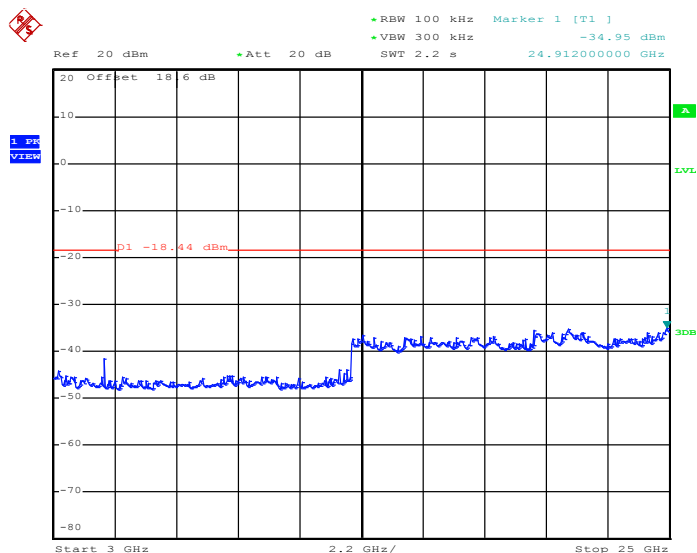
Test Mode :	Mode 4	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Pinkston Tu

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



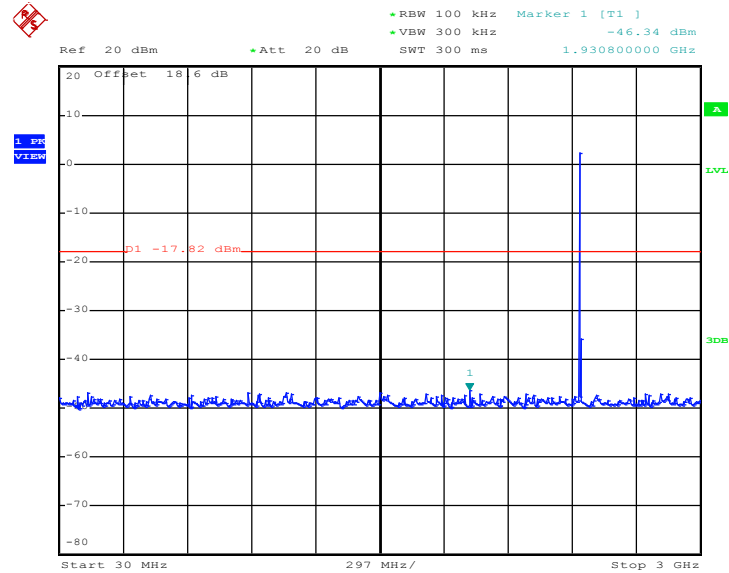
Date: 26.APR.2011 15:53:50

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz

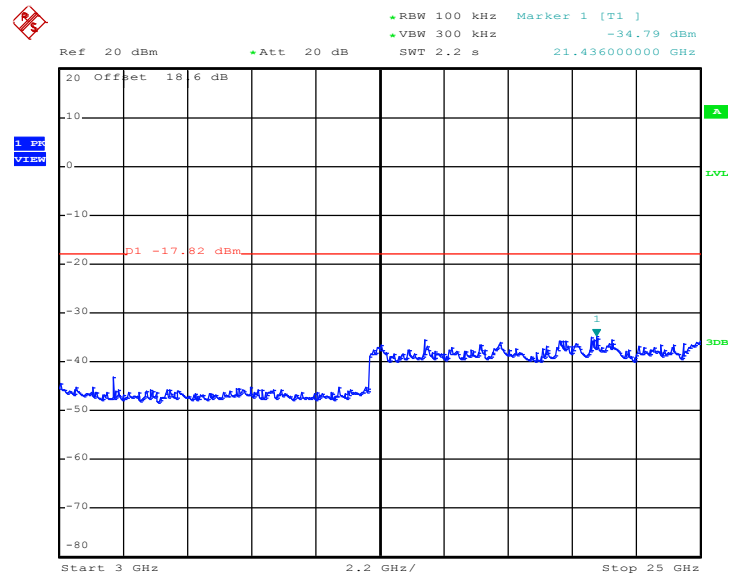


Date: 26.APR.2011 15:54:12

Test Mode :	Mode 5	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Pinkston Tu

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz


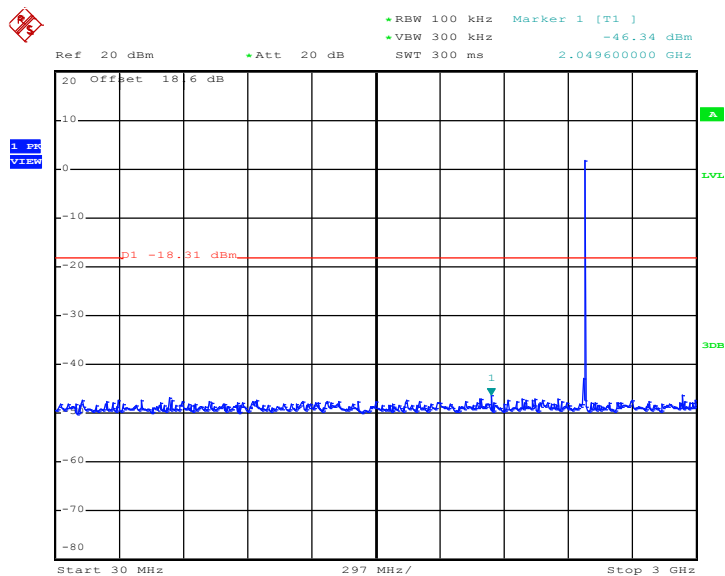
Date: 26.APR.2011 15:38:33

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz


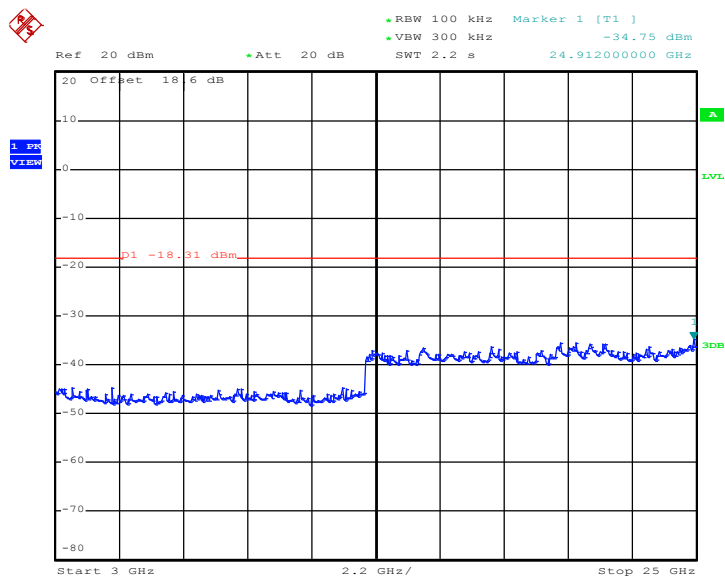
Date: 26.APR.2011 15:38:55



Test Mode :	Mode 6	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Pinkston Tu

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz

Date: 26.APR.2011 15:52:07

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz

Date: 26.APR.2011 15:52:29

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.

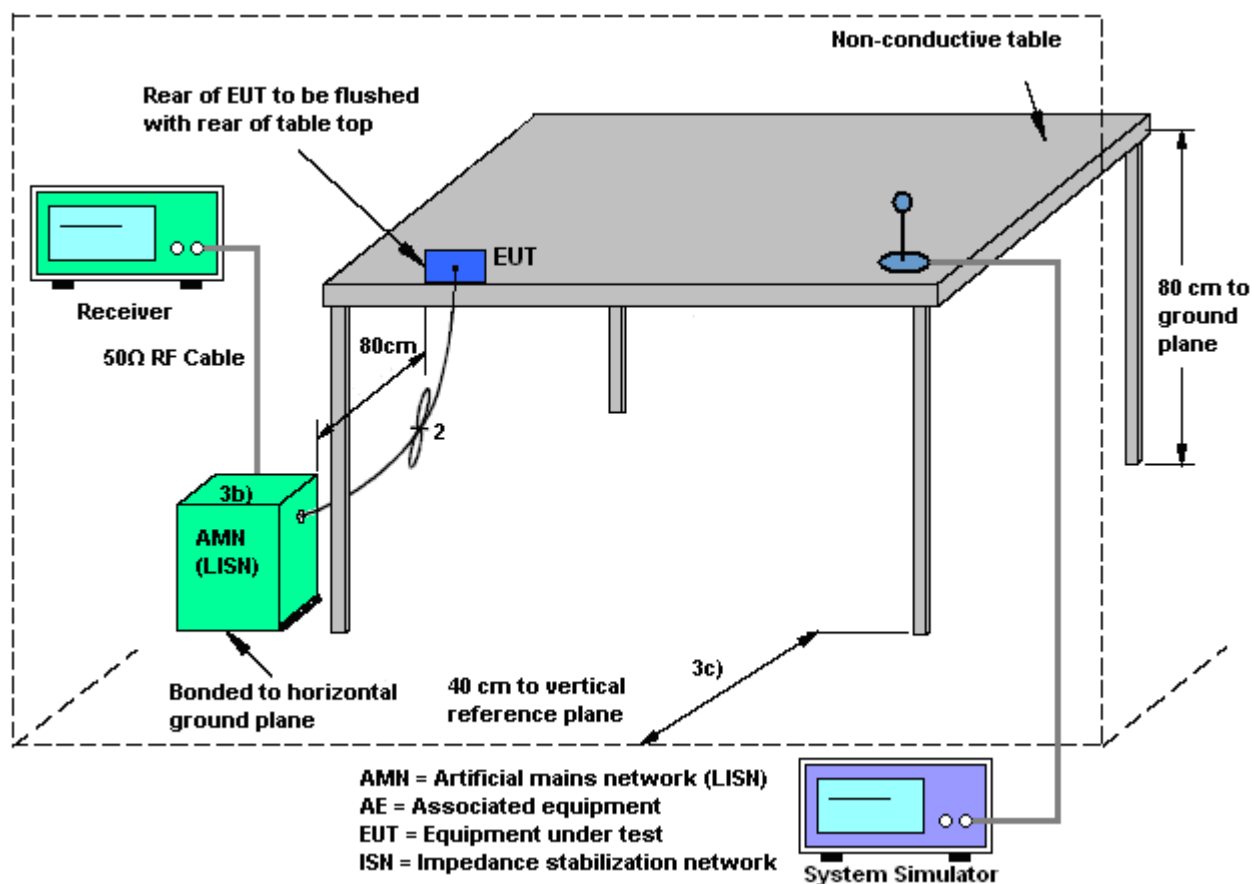
3.8.2 Measuring Instruments

See list of measuring instruments of this test report.

3.8.3 Test Procedures

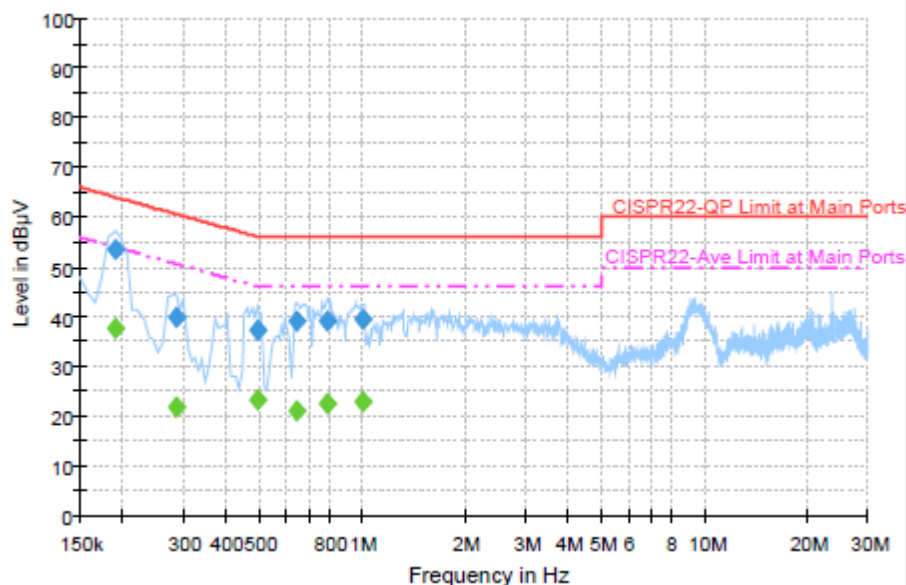
1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All 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 1	Temperature :	20~22°C
Test Engineer :	Novic Chiang	Relative Humidity :	40~42%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link +TC (Charging from Adapter)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



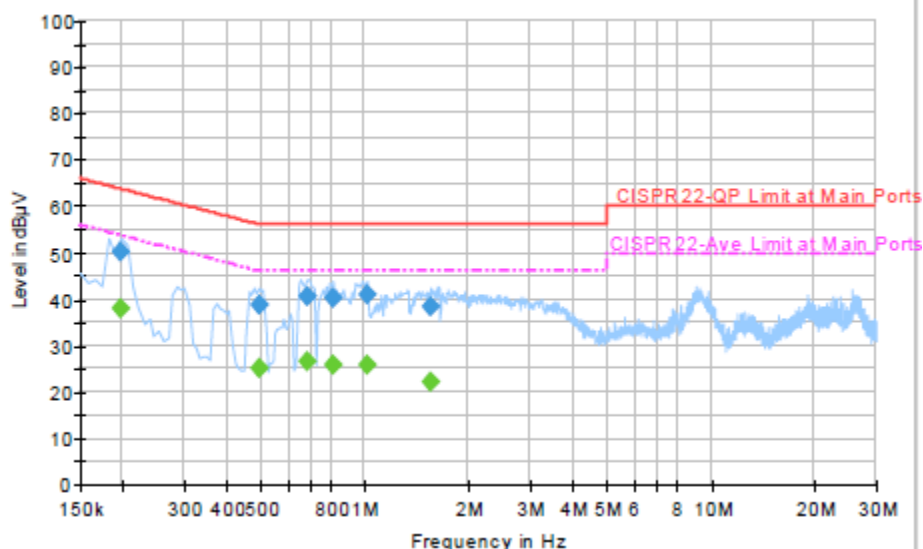
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.190000	53.3	Off	L1	19.4	10.7	64.0
0.286000	39.7	Off	L1	19.4	20.9	60.6
0.494000	37.1	Off	L1	19.4	19.0	56.1
0.646000	39.1	Off	L1	19.4	16.9	56.0
0.790000	39.0	Off	L1	19.4	17.0	56.0
1.006000	39.5	Off	L1	19.4	16.5	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.190000	37.5	Off	L1	19.4	16.5	54.0
0.286000	21.9	Off	L1	19.4	28.7	50.6
0.494000	23.2	Off	L1	19.4	22.9	46.1
0.646000	21.2	Off	L1	19.4	24.8	46.0
0.790000	22.7	Off	L1	19.4	23.3	46.0
1.006000	23.0	Off	L1	19.4	23.0	46.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Novic Chiang	Relative Humidity :	40~42%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link +TC (Charging from 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)
0.198000	50.1	Off	N	19.4	13.6	63.7
0.494000	38.8	Off	N	19.4	17.3	56.1
0.686000	40.7	Off	N	19.5	15.3	56.0
0.814000	40.1	Off	N	19.4	15.9	56.0
1.014000	40.8	Off	N	19.5	15.2	56.0
1.558000	38.4	Off	N	19.5	17.6	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.198000	38.0	Off	N	19.4	15.7	53.7
0.494000	25.2	Off	N	19.4	20.9	46.1
0.686000	26.5	Off	N	19.5	19.5	46.0
0.814000	25.9	Off	N	19.4	20.1	46.0
1.014000	26.0	Off	N	19.5	20.0	46.0
1.558000	22.1	Off	N	19.5	23.9	46.0

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

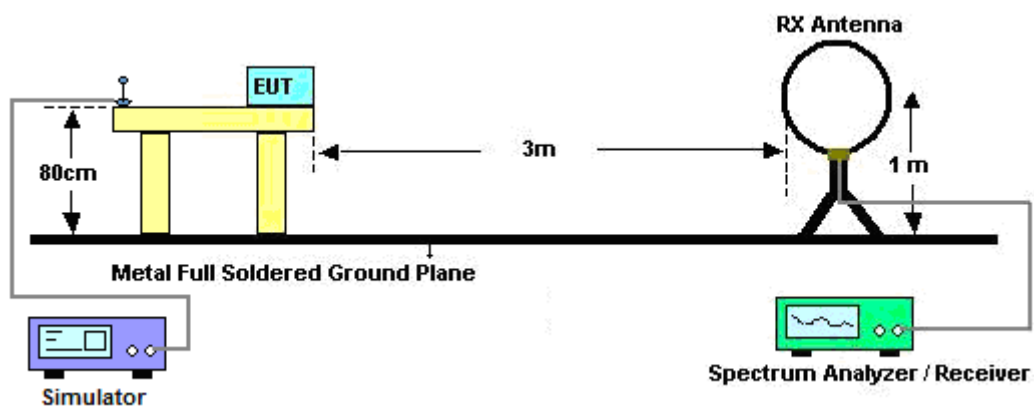
See list of measuring instruments of this test report.

3.9.3 Test Procedures

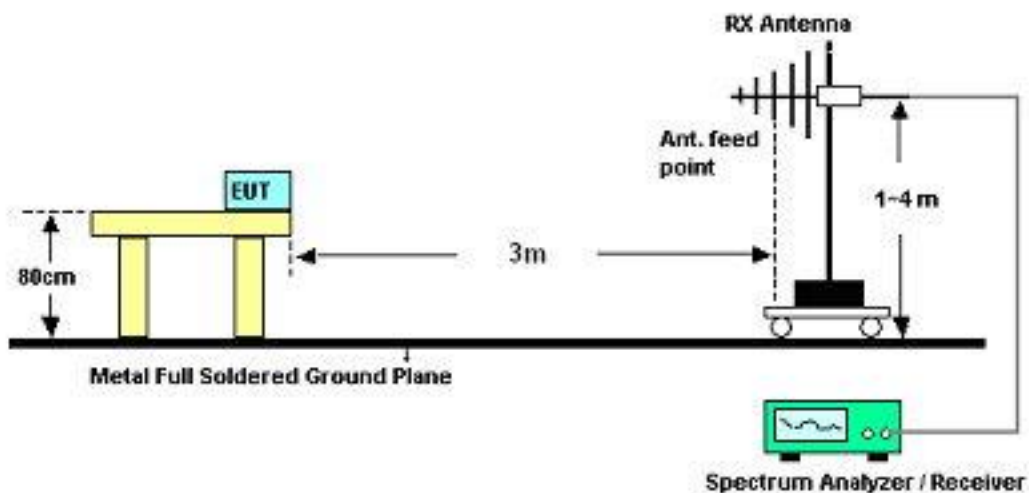
- The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
- Use the following spectrum analyzer settings:
 - Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
 - 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 = $20 \log (\text{specific distance [3m]} / \text{test distance [1m]})$ (dB)
- 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.
- Measured average value for the peak value is greater than 54 dBuV/m

3.9.4 Test Setup

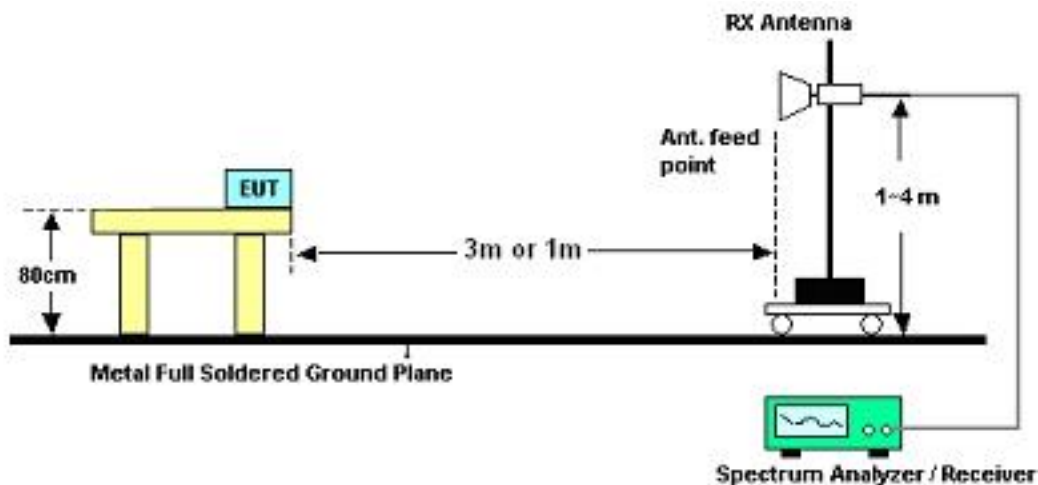
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

Test Engineer :	Kay Wu	Temperature :	26~27°C	
		Relative Humidity :	49~50%	

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 = $40 \log (\text{specific distance} / \text{test distance})$ (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 :	26~27°C
Test Channel :	00	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
133.14	40.23	-3.27	43.5	58.87	11.66	1.4	31.7	-	-	Peak
199.83	36.69	-6.81	43.5	57.33	9.35	1.66	31.65	-	-	Peak
265.44	40.39	-5.61	46	57.25	12.92	1.92	31.7	-	-	Peak
451.9	42.88	-3.12	46	55.39	16.83	2.51	31.85	100	126	Peak
626.9	41.72	-4.28	46	51.55	19.23	2.99	32.05	-	-	Peak
901.3	42.79	-3.21	46	48.98	21.63	3.76	31.58	-	-	Peak
1860	50.7	-19.05	69.75	53.69	26.94	4.7	34.63	-	-	Peak
2126	48.32	-21.43	69.75	50.01	27.69	5.08	34.46	-	-	Peak
2385.81	42.77	-31.23	74	43.72	28.08	5.37	34.4	104	295	Peak
2385.81	30.15	-23.85	54	31.1	28.08	5.37	34.4	104	295	Average
2402	76.26	-	-	77.09	28.16	5.4	34.39	104	295	Average
2402	89.75	-	-	90.58	28.16	5.4	34.39	104	295	Peak
2494	49.08	-24.92	74	49.63	28.3	5.52	34.37	104	295	Peak
2494	30.08	-23.92	54	30.63	28.3	5.52	34.37	104	295	Average

Test Mode :	Mode 1	Temperature :	26~27°C
Test Channel :	00	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
30	36.64	-3.36	40	49.73	17.91	0.72	31.72	100	49	Peak
177.69	34.98	-8.52	43.5	55.61	9.5	1.56	31.69	-	-	Peak
265.44	27.84	-18.16	46	44.7	12.92	1.92	31.7	-	-	Peak
626.9	38.19	-7.81	46	48.02	19.23	2.99	32.05	-	-	Peak
724.9	36.91	-9.09	46	45.94	19.72	3.31	32.06	-	-	Peak
901.3	36.61	-9.39	46	42.8	21.63	3.76	31.58	-	-	Peak
1860	56.41	-14.08	70.49	59.4	26.94	4.7	34.63	-	-	Peak
2132	49.83	-20.66	70.49	51.49	27.72	5.08	34.46	-	-	Peak
2385.62	41.62	-32.38	74	42.61	28.08	5.34	34.41	138	63	Peak
2385.62	31.15	-22.85	54	32.14	28.08	5.34	34.41	138	63	Average
2402	75.7	-	-	76.53	28.16	5.4	34.39	138	63	Average
2402	90.49	-	-	91.32	28.16	5.4	34.39	138	63	Peak
2494	52.5	-21.5	74	53.05	28.3	5.52	34.37	138	63	Peak
2494	28.88	-25.12	54	29.43	28.3	5.52	34.37	138	63	Average

Test Mode :	Mode 2	Temperature :	26~27°C
Test Channel :	39	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
118.83	29.56	-13.94	43.5	47.78	12.16	1.33	31.71	-	-	Peak
265.98	40.21	-5.79	46	57.07	12.92	1.92	31.7	-	-	Peak
287.58	31.88	-14.12	46	48.26	13.27	2.01	31.66	-	-	Peak
451.9	42.32	-3.68	46	54.83	16.83	2.51	31.85	100	139	Peak
628.3	41.89	-4.11	46	51.71	19.23	2.99	32.04	-	-	Peak
724.9	40.57	-5.43	46	49.6	19.72	3.31	32.06	-	-	Peak
1862	52.21	-21.45	73.66	55.2	26.94	4.7	34.63	-	-	Peak
2132	48.74	-24.92	73.66	50.4	27.72	5.08	34.46	-	-	Peak
2310	41.18	-32.82	74	42.28	28	5.31	34.41	105	292	Peak
2310	28.3	-25.7	54	29.4	28	5.31	34.41	105	292	Average
2441	77.84	-	-	78.54	28.22	5.46	34.38	105	292	Average
2441	93.66	-	-	94.36	28.22	5.46	34.38	105	292	Peak
2494	48.77	-25.23	74	49.32	28.3	5.52	34.37	105	292	Peak
2494	30.37	-23.63	54	30.92	28.3	5.52	34.37	105	292	Average



Test Mode :	Mode 2	Temperature :	26~27°C
Test Channel :	39	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
30	36.11	-3.89	40	49.2	17.91	0.72	31.72	100	129	Peak
116.13	34.11	-9.39	43.5	52.57	11.94	1.31	31.71	-	-	Peak
249.78	36.93	-9.07	46	54.06	12.67	1.85	31.65	-	-	Peak
628.3	38.02	-7.98	46	47.84	19.23	2.99	32.04	-	-	Peak
724.9	36.58	-9.42	46	45.61	19.72	3.31	32.06	-	-	Peak
901.3	40.76	-5.24	46	46.95	21.63	3.76	31.58	-	-	Peak
1862	56.75	-15.32	72.07	59.74	26.94	4.7	34.63	-	-	Peak
2132	49.92	-22.15	72.07	51.58	27.72	5.08	34.46	-	-	Peak
2390	42.34	-31.66	74	43.2	28.13	5.4	34.39	165	61	Peak
2390	28.5	-25.5	54	29.36	28.13	5.4	34.39	165	61	Average
2441	76.96	-	-	77.66	28.22	5.46	34.38	165	61	Average
2441	92.07	-	-	92.77	28.22	5.46	34.38	165	61	Peak
2492	52.8	-21.2	74	53.35	28.3	5.52	34.37	165	61	Peak
2492	28.63	-25.37	54	29.18	28.3	5.52	34.37	165	61	Average

Test Mode :	Mode 3	Temperature :	26~27°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
118.83	28.4	-15.1	43.5	46.62	12.16	1.33	31.71	-	-	Peak
266.79	30.63	-15.37	46	47.47	12.93	1.92	31.69	-	-	Peak
299.73	29.8	-16.2	46	45.95	13.46	2.06	31.67	-	-	Peak
451.9	42.25	-3.75	46	54.76	16.83	2.51	31.85	100	128	Peak
628.3	41.64	-4.36	46	51.46	19.23	2.99	32.04	-	-	Peak
724.9	41.3	-4.7	46	50.33	19.72	3.31	32.06	-	-	Peak
1862	56.84	-15.75	72.59	59.83	26.94	4.7	34.63	-	-	Peak
2124	48.59	-24	72.59	50.28	27.69	5.08	34.46	-	-	Peak
2356	42.48	-31.52	74	43.47	28.08	5.34	34.41	102	294	Peak
2356	28.25	-25.75	54	29.24	28.08	5.34	34.41	102	294	Average
2480	76.74	-	-	77.32	28.27	5.52	34.37	102	294	Average
2480	92.59	-	-	93.17	28.27	5.52	34.37	102	294	Peak
2483.5	58.54	-15.46	74	59.12	28.27	5.52	34.37	102	294	Peak
2483.5	45.19	-8.81	54	45.77	28.27	5.52	34.37	102	294	Average

Test Mode :	Mode 3	Temperature :	26~27°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Kay Wu	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
30	36.2	-3.8	40	49.29	17.91	0.72	31.72	100	182	Peak
57.54	25.21	-14.79	40	49.02	6.95	0.92	31.68	-	-	Peak
265.44	28.15	-17.85	46	45.01	12.92	1.92	31.7	-	-	Peak
628.3	38.16	-7.84	46	47.98	19.23	2.99	32.04	-	-	Peak
724.9	37.09	-8.91	46	46.12	19.72	3.31	32.06	-	-	Peak
796.3	35.34	-10.66	46	43.24	20.72	3.36	31.98	-	-	Peak
1860	55.29	-16.07	71.36	58.28	26.94	4.7	34.63	-	-	Peak
2132	50.61	-20.75	71.36	52.27	27.72	5.08	34.46	-	-	Peak
2388	41.48	-32.52	74	42.34	28.13	5.4	34.39	195	63	Peak
2388	28.83	-25.17	54	29.69	28.13	5.4	34.39	195	63	Average
2480	76.14	-	-	76.72	28.27	5.52	34.37	195	63	Average
2480	91.36	-	-	91.94	28.27	5.52	34.37	195	63	Peak
2483.5	58.73	-15.27	74	59.31	28.27	5.52	34.37	195	63	Peak
2483.5	44.79	-9.21	54	45.37	28.27	5.52	34.37	195	63	Average



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 Chip 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
System Simulator	R&S	CMU200	117995	N/A	Jun. 08, 2009	Jun. 07, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9KHz~40GHz	Jun. 11, 2010	Jun. 10, 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)
Power Meter	Agilent	E4416A	GB41292344	N/A	Feb. 18, 2011	Feb. 17, 2012	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	N/A	Feb. 18, 2011	Feb. 17, 2012	Conducted (TH02-HY)
Thermal Chamber	Ten Billion	TTH-D35P	TBN-930701	N/A	Jul. 30, 2010	Jul. 29, 2011	Conducted (TH02-HY)
EMI Test Receive	R&S	ESCS 30	100356	9KHz – 2.75GHz	Aug. 16, 2010	Aug. 15, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz – 30MHz	Dec. 03, 2010	Dec. 02, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz – 30MHz	Dec. 01, 2010	Nov. 30, 2011	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	N/A	Conduction (CO05-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2885	30MHz -2GHz	Oct. 31, 2010	Oct. 31, 2011	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz~18GHz	Aug. 02, 2010	Aug. 01, 2011	Radiation (03CH06-HY)
Double Ridge Horn Antenna	Training Research	AH-0801	95119	8GHz~18GHz	Oct. 20, 2010	Oct. 19, 2011	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH06-HY)
Pre Amplifier	Agilent	8449B	3008A01917	1GHz- 26.5GHz	Apr. 14, 2011	Apr. 13, 2012	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9KHz~1GHz	Apr. 14, 2011	Apr. 13, 2012	Radiation (03CH06-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH06-HY)
System Simulator	R&S	CMU200	117591	N/A	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH06-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 $U_c(y)$	1.13		
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	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 $U_c(y)$	1.27		
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	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 $\Gamma_1 = 0.197$ Antenna VSWR $\Gamma_2 = 0.194$ Uncertainty = $20\text{Log}(1-\Gamma_1*\Gamma_2)$	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty $U_c(y)$	2.36				
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.72				



Appendix A. Photographs of EUT

Please refer to Sporton report number EP141109 as below.