

Variant FCC RF Test Report

APPLICANT : Honeywell International Inc.
EQUIPMENT : 99EX Mobile computer
BRAND NAME : Honeywell
MODEL NAME : 99EX
FCC ID : HD599EXL0
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : Digital Spread Spectrum (DSS)

This is a variant report which is only valid combine with the original test report. The product was received on Dec. 06, 2010 and completely tested on Jan. 04, 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:



Anderson Chiu / Deputy 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
FR0D0904-04A	Rev. 01	This is a variant report for adding two types of keypad of the equipment. All the test cases were performed on Sample 1 in original report which can be referred to Sporton Report No. FR0D0904-02A as appendix C. Based on original report, only the worse case of the Radiated Emission and Conducted Emission tests with new types of keypad of equipment were verified.	Apr. 02, 2011

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(d)	A8.5	Frequency Band Edges	$\leq 20\text{dBc}$	Pass	-
3.2	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 17.3 dB at 0.53 MHz
3.3	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 6.76 dB at 2483.5 MHz
3.4	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Honeywell International Inc.

9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.2 Manufacturer

Honeywell International Inc.

9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	99EX Mobile computer
Brand Name	Honeywell
Model Name	99EX
FCC ID	HD599EXL0
Sample 1	EUT with 55 keypad options
Sample 2	EUT with 43 keypad options
Sample 3	EUT with 34 keypad options
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
Antenna Type	PIFA Antenna with gain 2.5 dBi
HW Version	5
SW Version	26.02
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π /4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
EUT Stage	Production Unit

Remark:

1. This test report recorded only product characteristics and test results of Digital Spread Spectrum (DSS).
2. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
3. The test of sample 1 was performed in original report, and this report was performed with sample 2 and 3.

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	03CH07-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.	GPS Station	T&E	GS-50	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A
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.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
7.	Cradle	Honeywell	99EX-HB	N/A	N/A	N/A
8.	Adapter	ENG	3A-902DB12	N/A	N/A	N/A
9.	USB Cable	N/A	N/A	N/A	N/A	N/A

2 Test Configuration of Equipment Under Test

2.1 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).

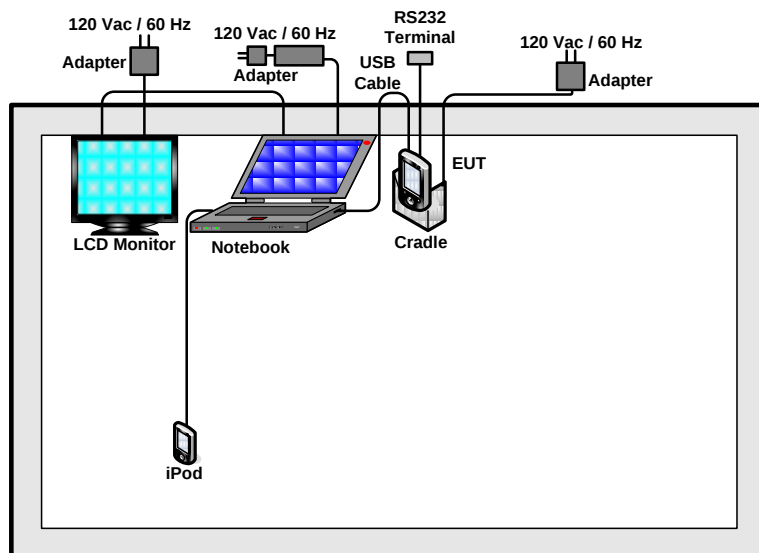
Pre-scanned tests were conducted to determine the final configuration from all possible combinations.

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

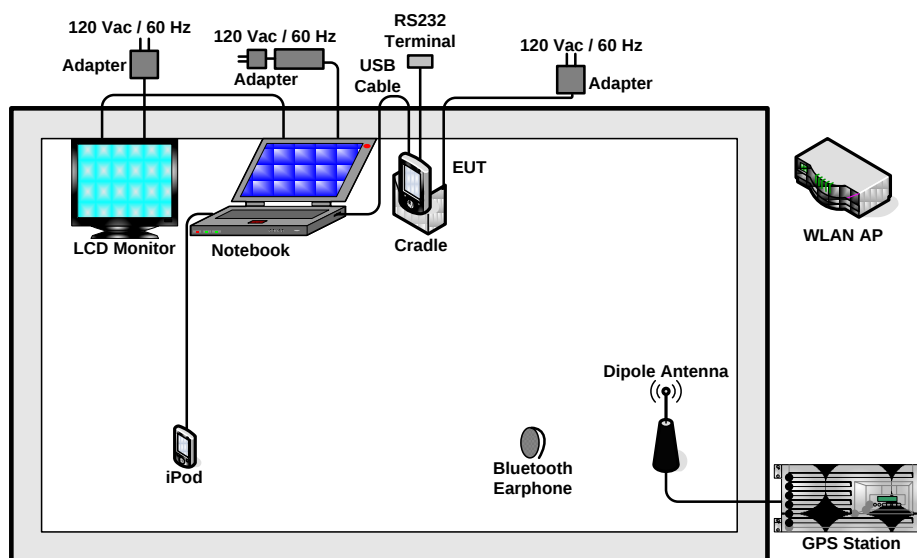
Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth EDR 3Mbps 8-DPSK
Radiated TCs	Mode 1: CH78_2480 MHz + TC for Sample 2 Mode 2: CH78_2480 MHz + TC for Sample 3
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN (2.4G) Link + GPS Rx + Scanner + Cradle + Adapter + RS232 Terminal + USB Cable (Link with Notebook) for Sample 2 Mode 2 :Bluetooth Link + WLAN (2.4G) Link + GPS Rx + Scanner + Cradle + Adapter + RS232 Terminal + USB Cable (Link with Notebook) for Sample 3
Remark: 1. TC stands for Test Configuration, and consists of USB cable, RS232 terminal, cradle, and adapter. 2. For conducted emission, the worst case is mode 1; only the test data of this mode was reported.	

2.2 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>



2.3 RF Utility

For Bluetooth function, the RF utility, "BT Tester" was installed in EUT which can send transmitting signal for all testing.

3 Test Result

3.1 Band Edges Measurement

3.1.1 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.

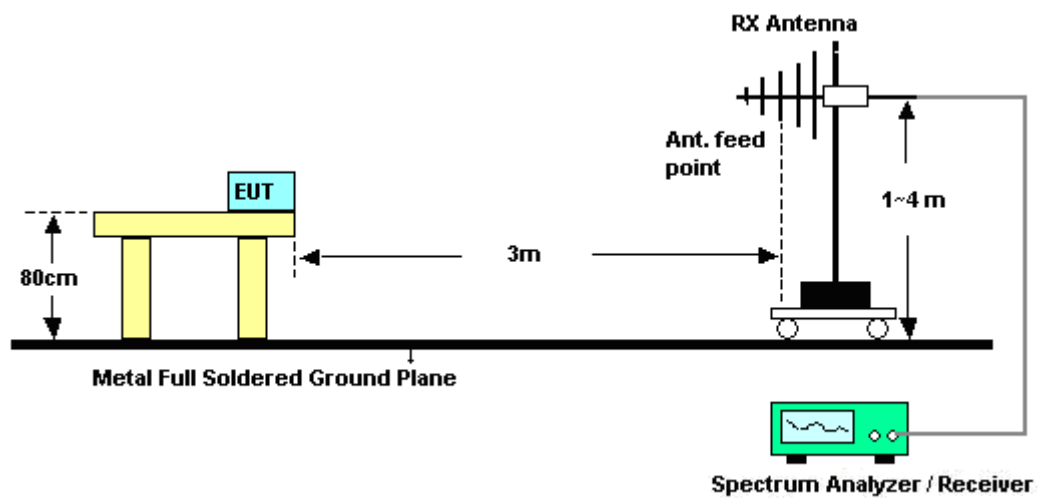
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 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.

3.1.4 Test Setup



3.1.5 Test Result of Radiated Band Edges

Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
		Test Engineer :	Ivan Chiang

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	65.56	-8.44	74	61	32.28	6.18	33.9	100	304	Peak
2483.5	47.24	-6.76	54	42.68	32.28	6.18	33.9	100	304	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Average Result (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
Single Carrier Mode	97.1	49.86	47.24	54	-6.76	Pass
Hopping Mode	97.1	51.37	45.73	54	-8.27	Pass

Note : Average result = Maximum field strength – Delta result

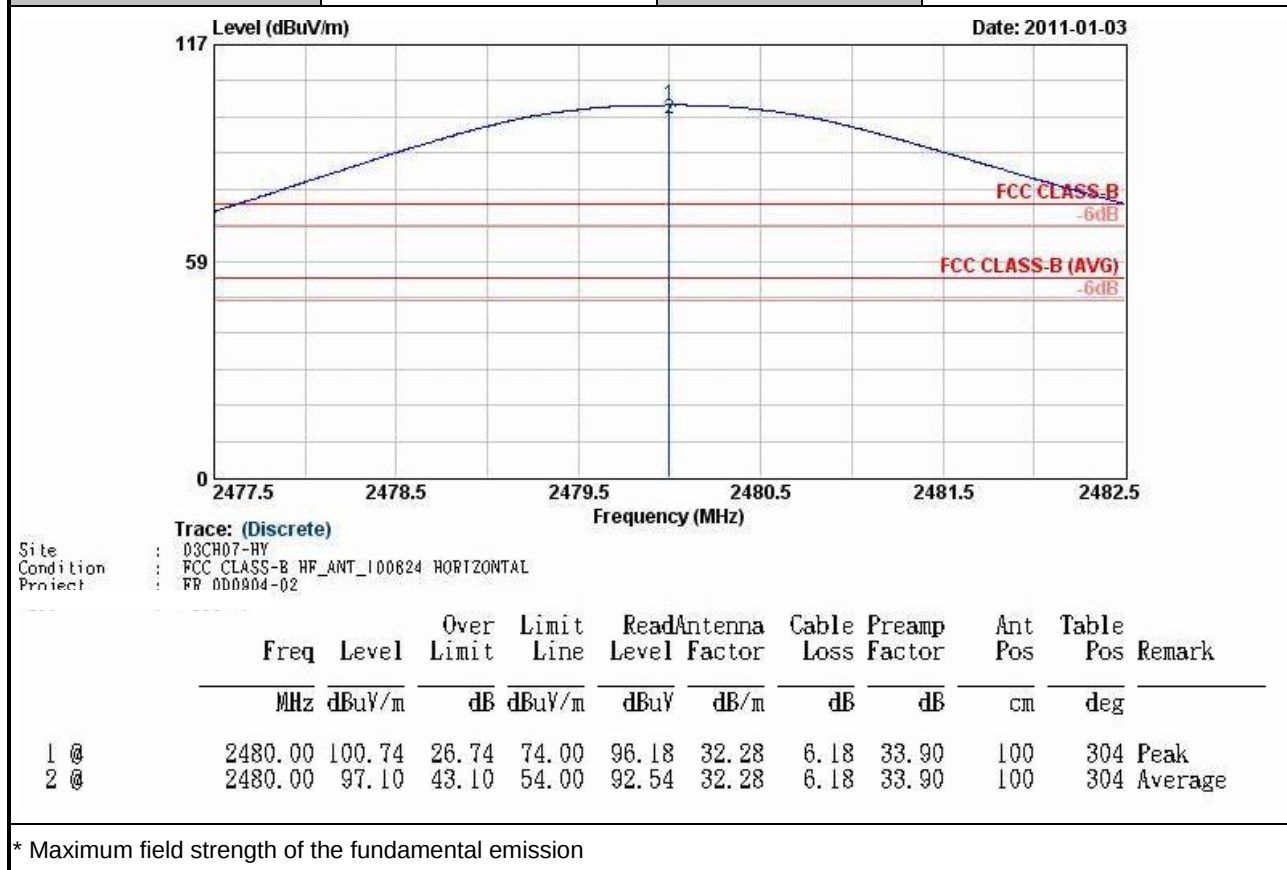
ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	59.67	-14.33	74	55.11	32.28	6.18	33.9	101	358	Peak
2483.5	43.49	-10.51	54	38.93	32.28	6.18	33.9	101	358	Average

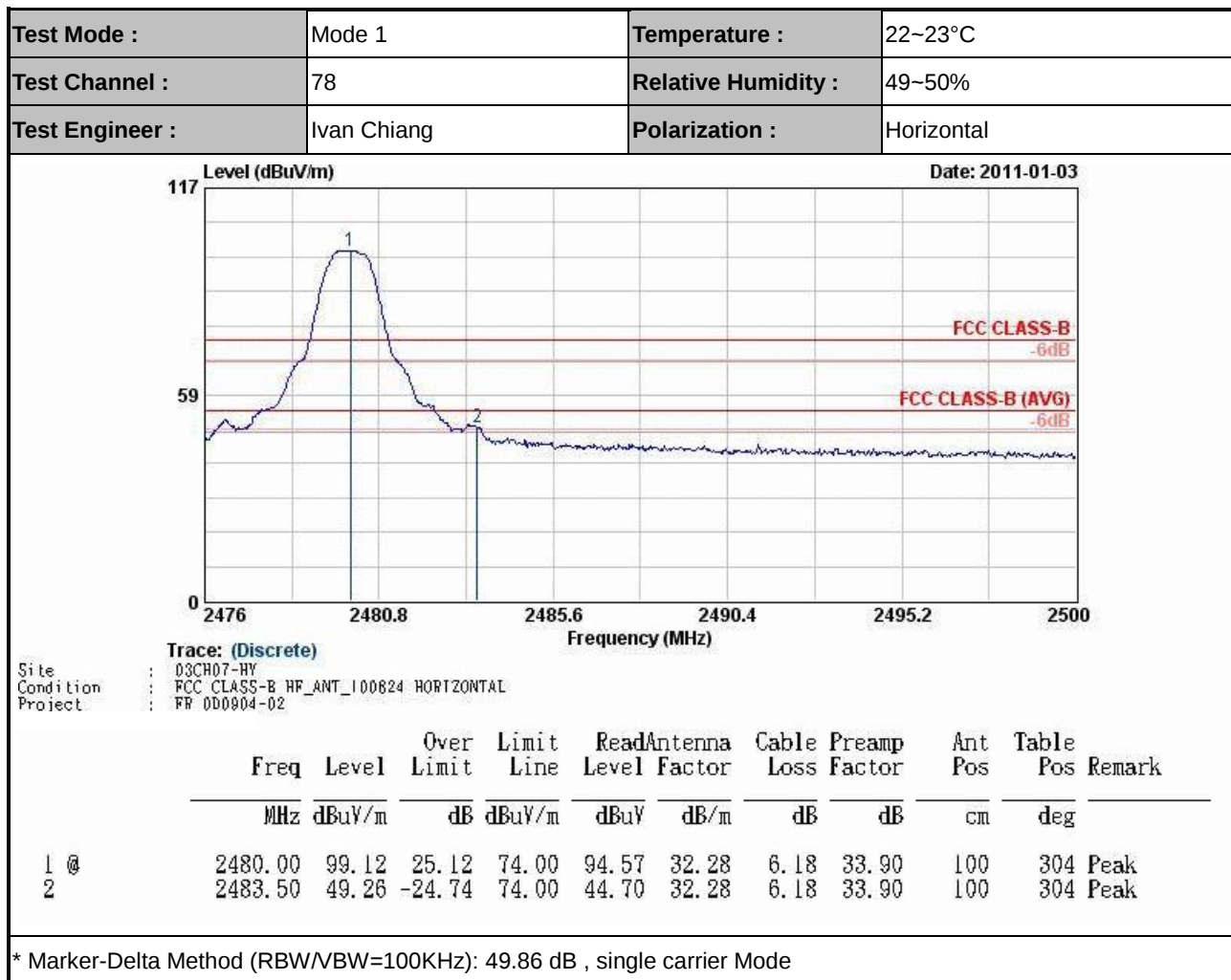
Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Average Result (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
Single Carrier Mode	91.15	47.66	43.49	54	-10.51	Pass
Hopping Mode	91.15	50.56	40.59	54	-13.41	Pass

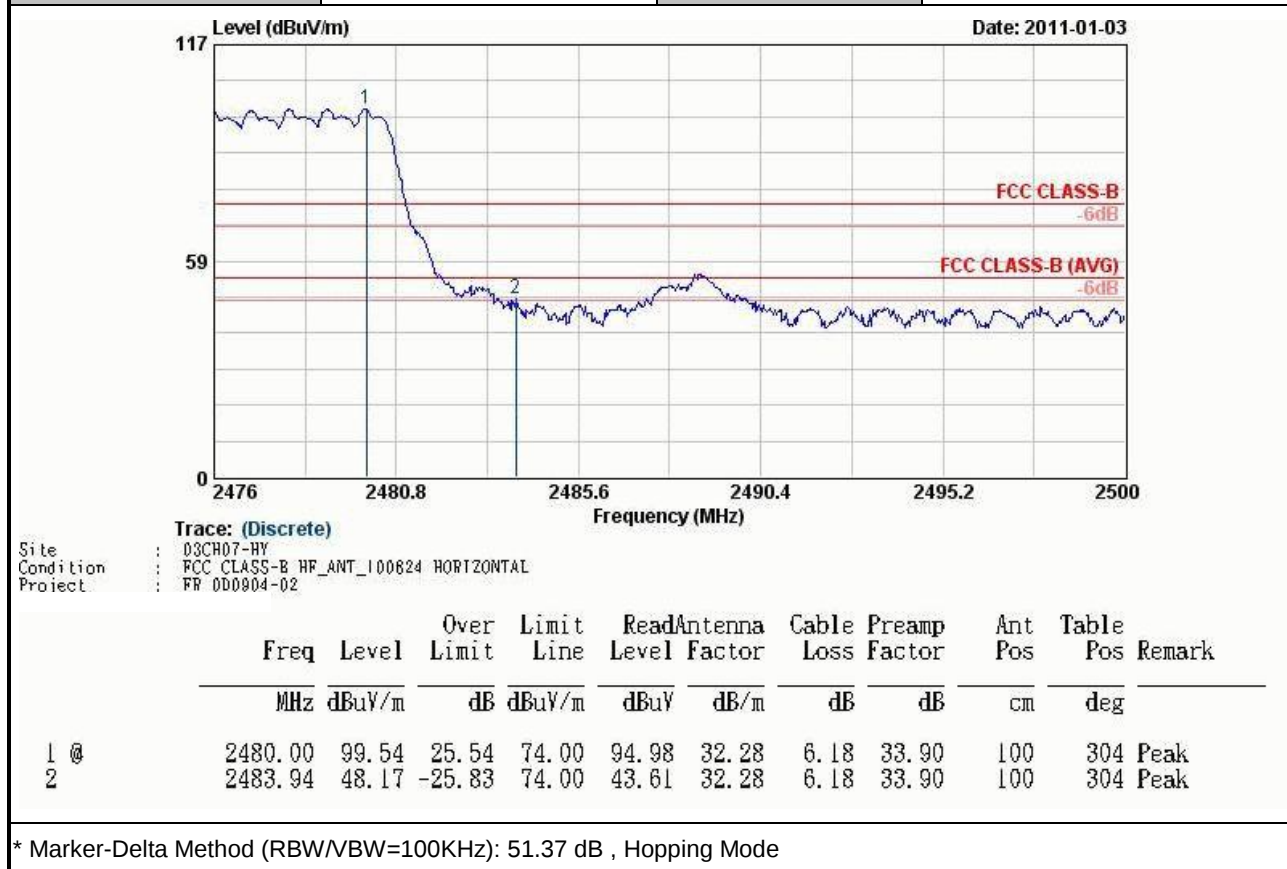
Note : Average result = Maximum field strength – Delta result

Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal





Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal



Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical

Level (dBuV/m)

117

59

0

2477.5

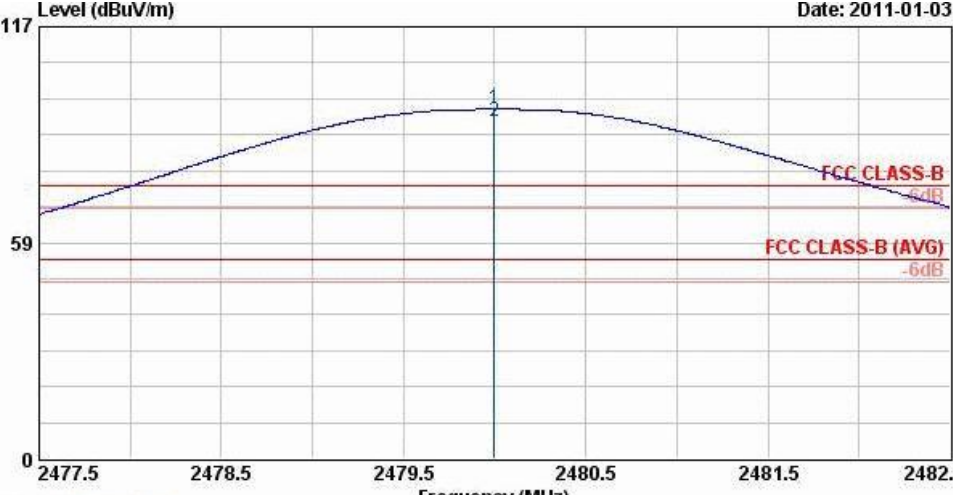
2478.5

2479.5

2480.5

2481.5

2482.5



Date: 2011-01-03

Trace: (Discrete)

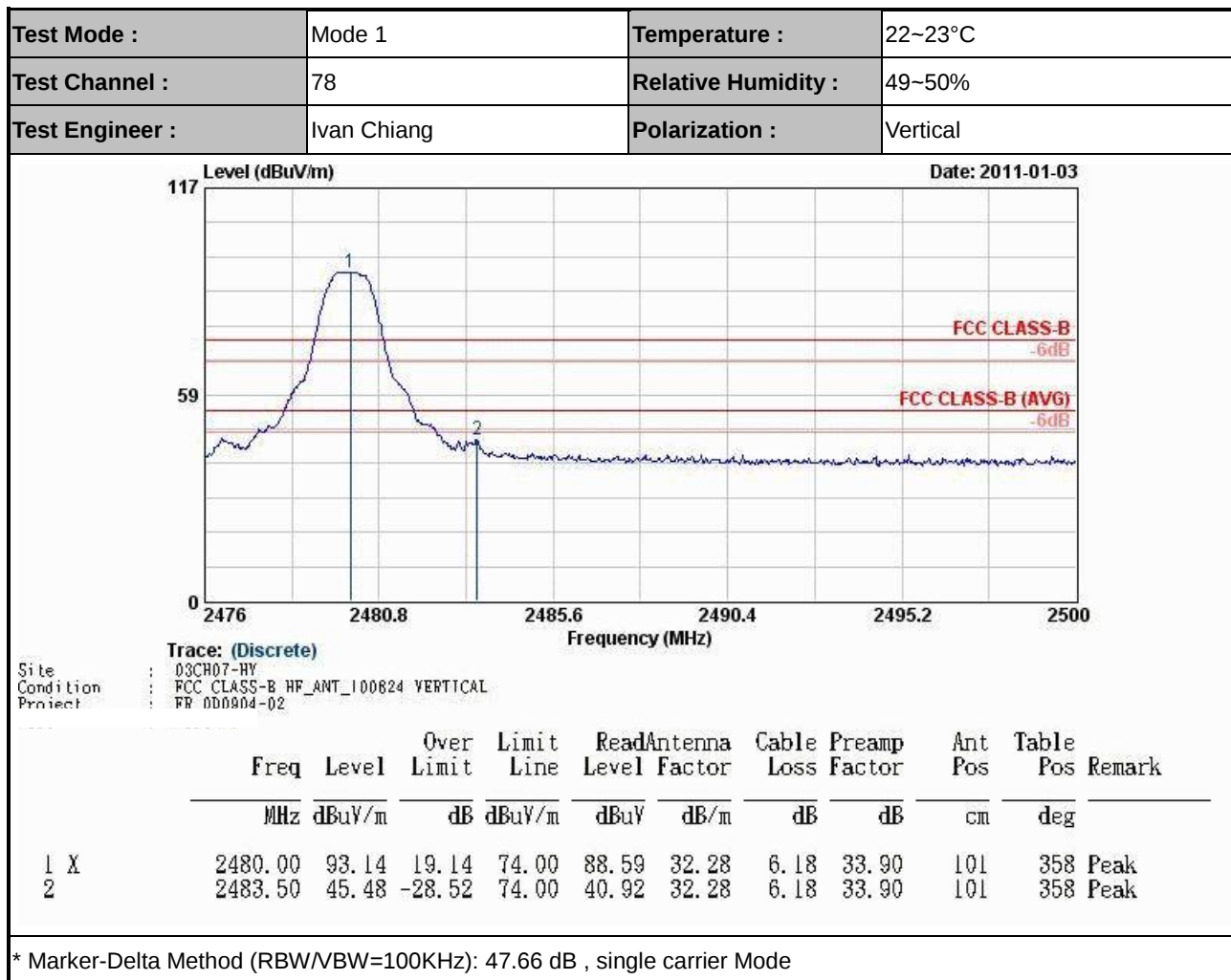
Site : 03CH07-HY

Condition : FCC CLASS-B HF_ANT_100824 VERTICAL

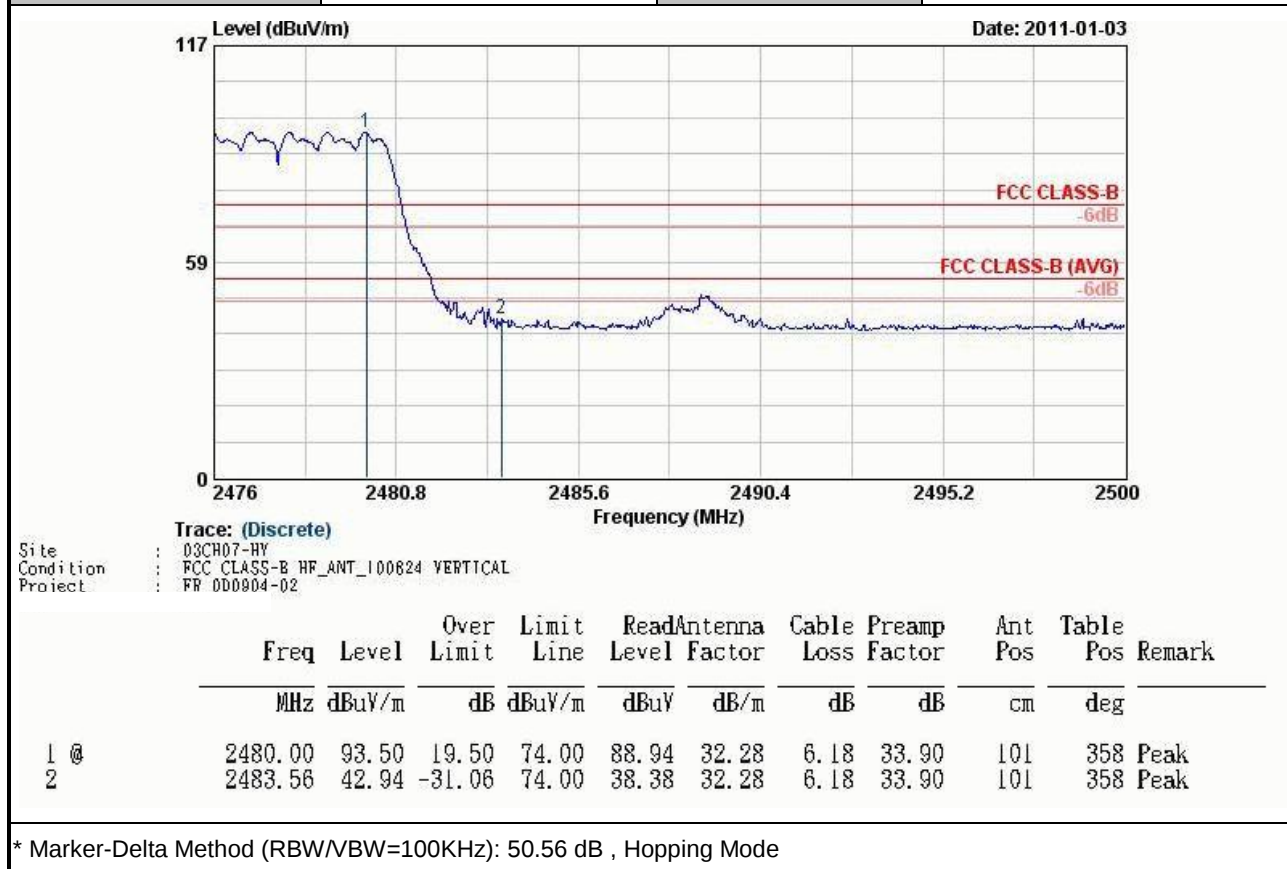
Project : FR 0D0904-02

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Remark
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 @	2480.00	94.77	20.77	74.00	90.21	32.28	6.18	33.90	101	358	Peak
2 @	2480.00	91.15	37.15	54.00	86.59	32.28	6.18	33.90	101	358	Average

* Maximum field strength of the fundamental emission



Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical



Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
		Test Engineer :	Ivan Chiang

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	64.89	-9.11	74	60.33	32.28	6.18	33.9	100	306	Peak
2483.5	46.62	-7.38	54	42.06	32.28	6.18	33.9	100	306	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Average Result (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
Single Carrier Mode	96.51	49.89	46.62	54	-7.38	Pass
Hopping Mode	96.51	50.56	45.95	54	-8.05	Pass

Note : Average result = Maximum field strength – Delta result

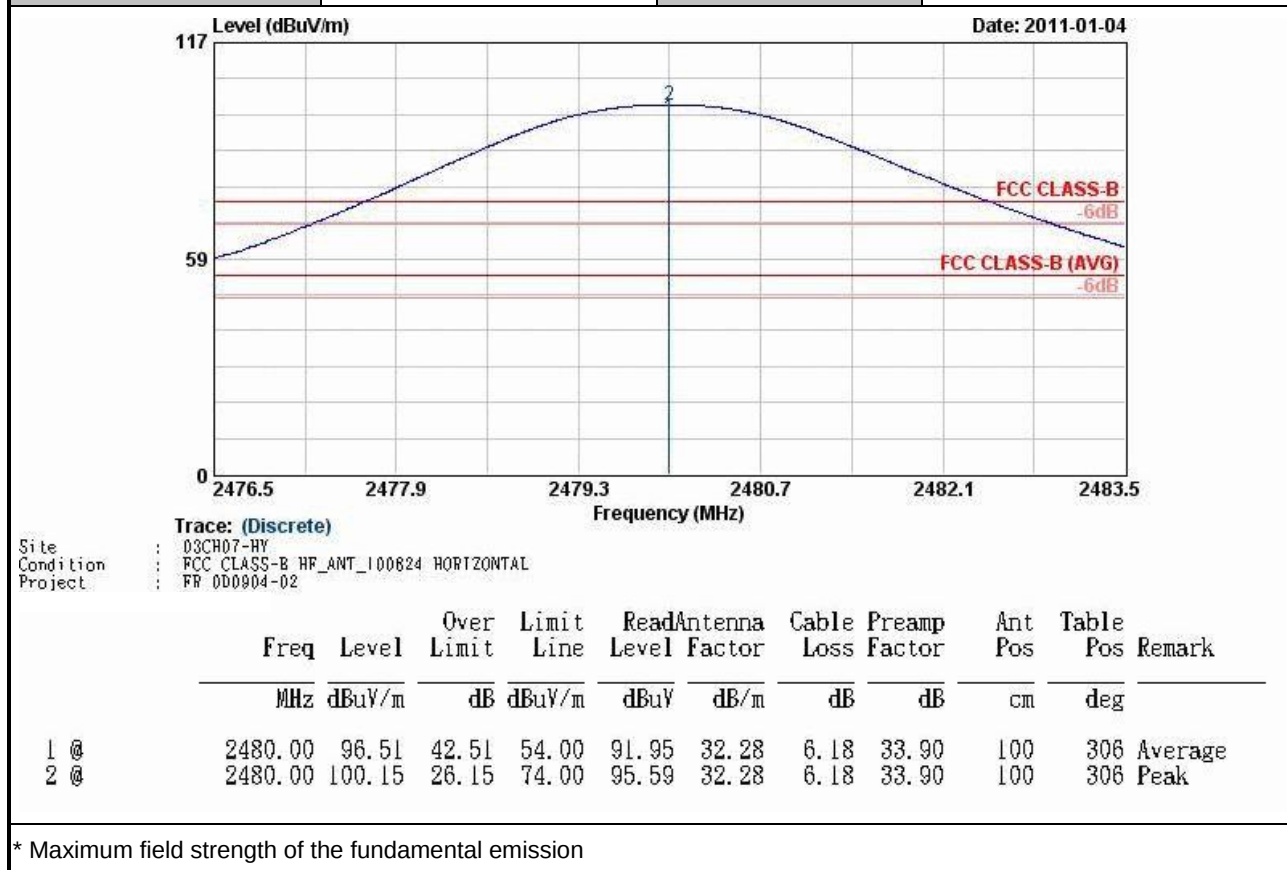
ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	58.76	-15.24	74	54.2	32.28	6.18	33.9	100	357	Peak
2483.5	42.08	-11.92	54	37.52	32.28	6.18	33.9	100	357	Average

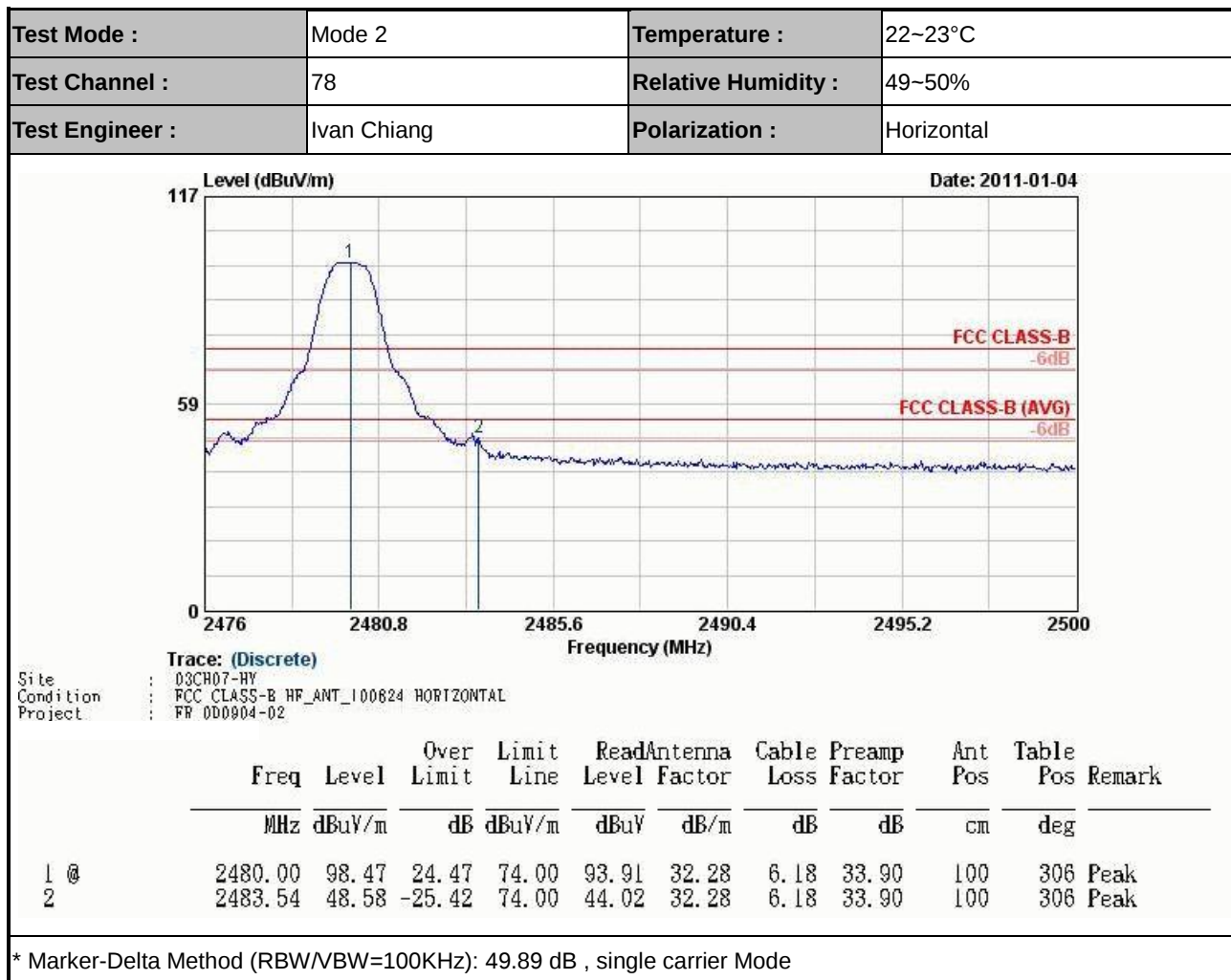
Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Average Result (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
Single Carrier Mode	90.22	48.14	42.08	54	-11.92	Pass
Hopping Mode	90.22	49.19	41.03	54	-12.97	Pass

Note : Average result = Maximum field strength – Delta result

Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal





Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal

Level (dBuV/m)

117

59

0

2476

2480.8

2485.6

2490.4

2495.2

2500

1

2

FCC CLASS-B
-6dB

FCC CLASS-B (AVG)
-6dB

Date: 2011-01-04

Trace: (Discrete)

Site : 03CH07-HY

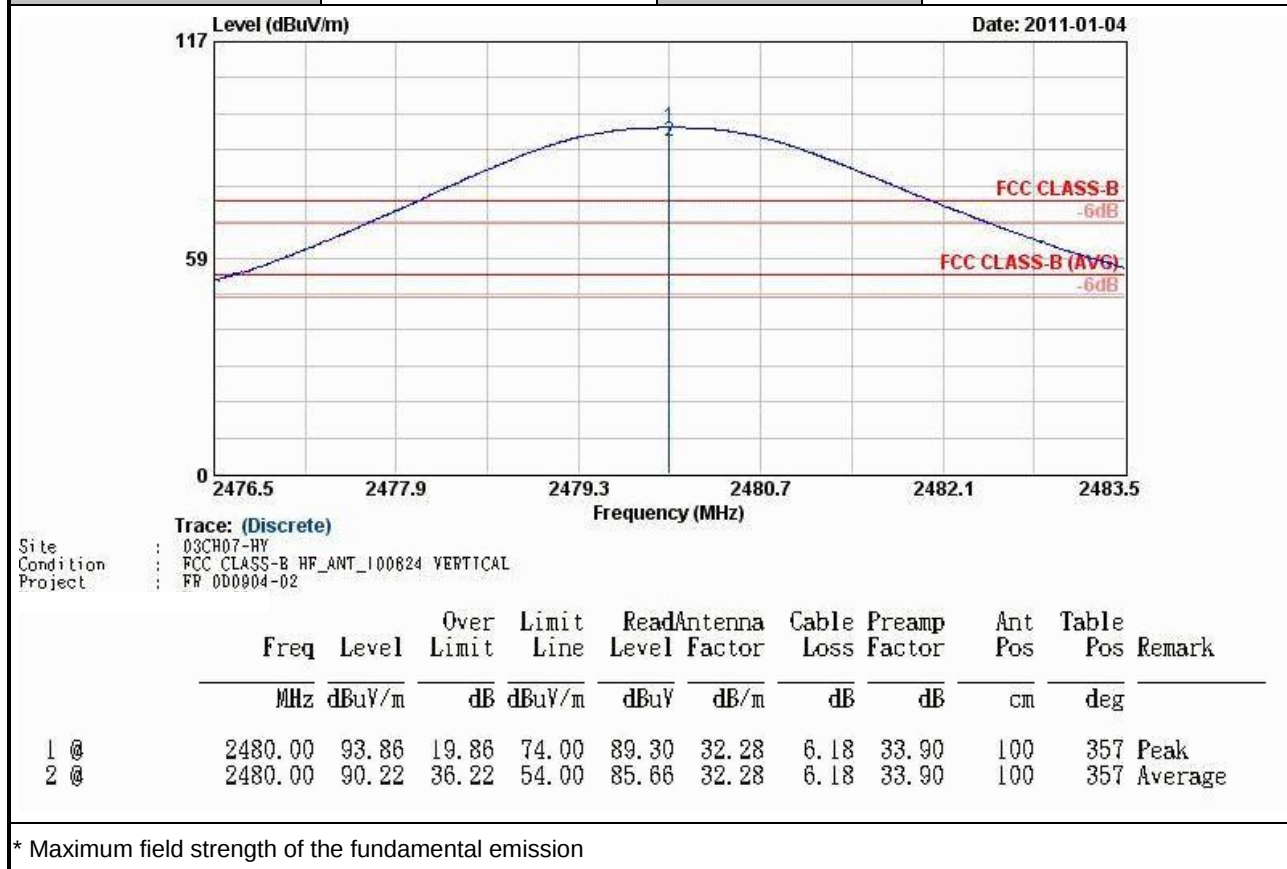
Condition : FCC CLASS-B HF_ANT_100824 HORIZONTAL

Project : FR 0D0904-02

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	Ant	Table	
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	Pos	Pos	Remark
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg
1 @	2480.00	98.97	24.97	74.00	94.41	32.28	6.18	33.90	100	306 Peak
2	2483.85	48.41	-25.59	74.00	43.85	32.28	6.18	33.90	100	306 Peak

* Marker-Delta Method (RBW/VBW=100KHz): 50.56 dB , Hopping Mode

Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical





Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical

Level (dBuV/m)

117

59

0

2476

2480.8

2485.6

2490.4

2495.2

2500

Frequency (MHz)

Date: 2011-01-04

FCC CLASS-B
-6dB

FCC CLASS-B (AVG)
-6dB

Trace: (Discrete)

Site : 03CH07-HY

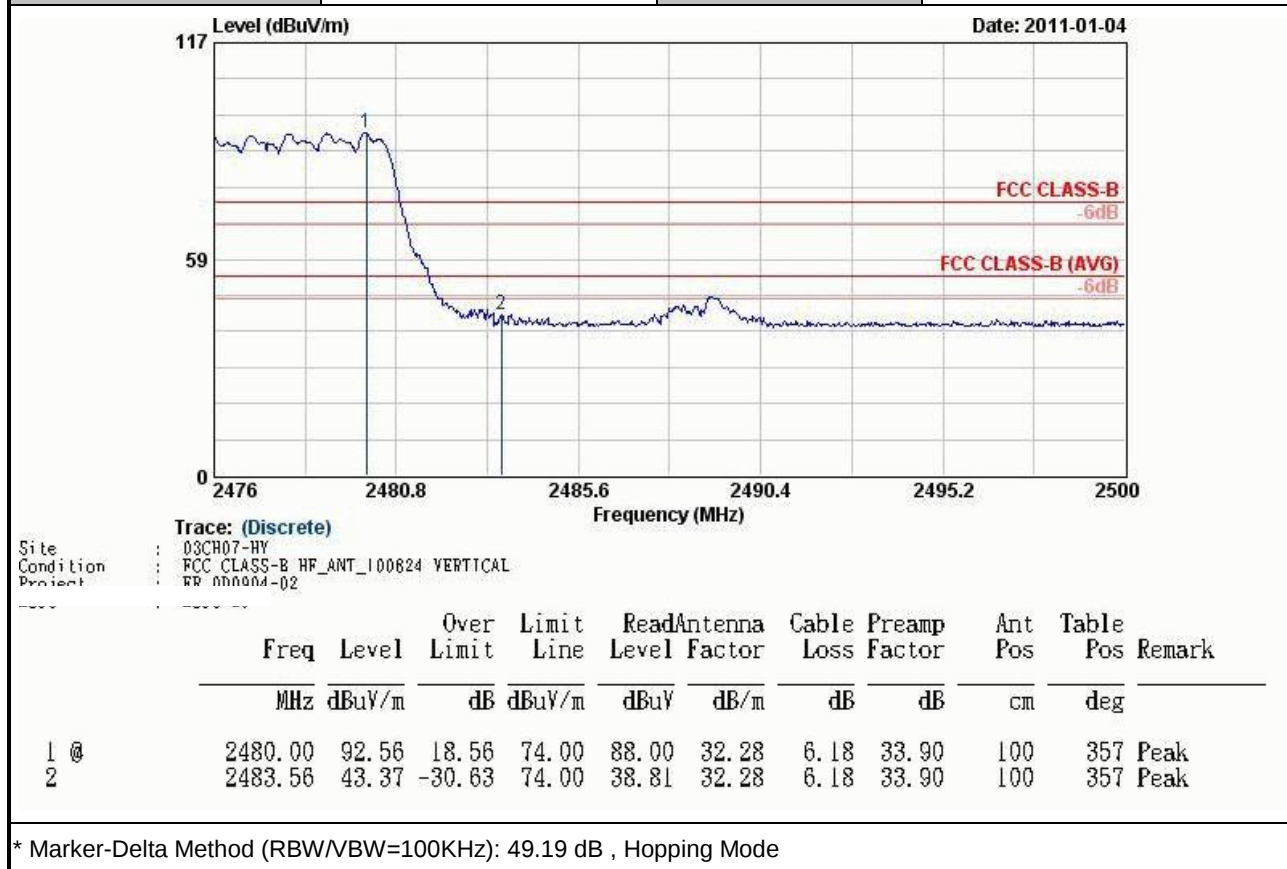
Condition : FCC CLASS-B HF_ANT_100624 VERTICAL

Project : FR 0D0904-02

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	Ant	Table	
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	Pos	Pos	Remark
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg
1 X	2480.00	92.25	18.25	74.00	87.69	32.28	6.18	33.90	100	357 Peak
2	2483.50	44.11	-29.89	74.00	39.55	32.28	6.18	33.90	100	357 Peak

* Marker-Delta Method (RBW/VBW=100KHz): 48.14 dB , single carrier Mode

Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical



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 (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.

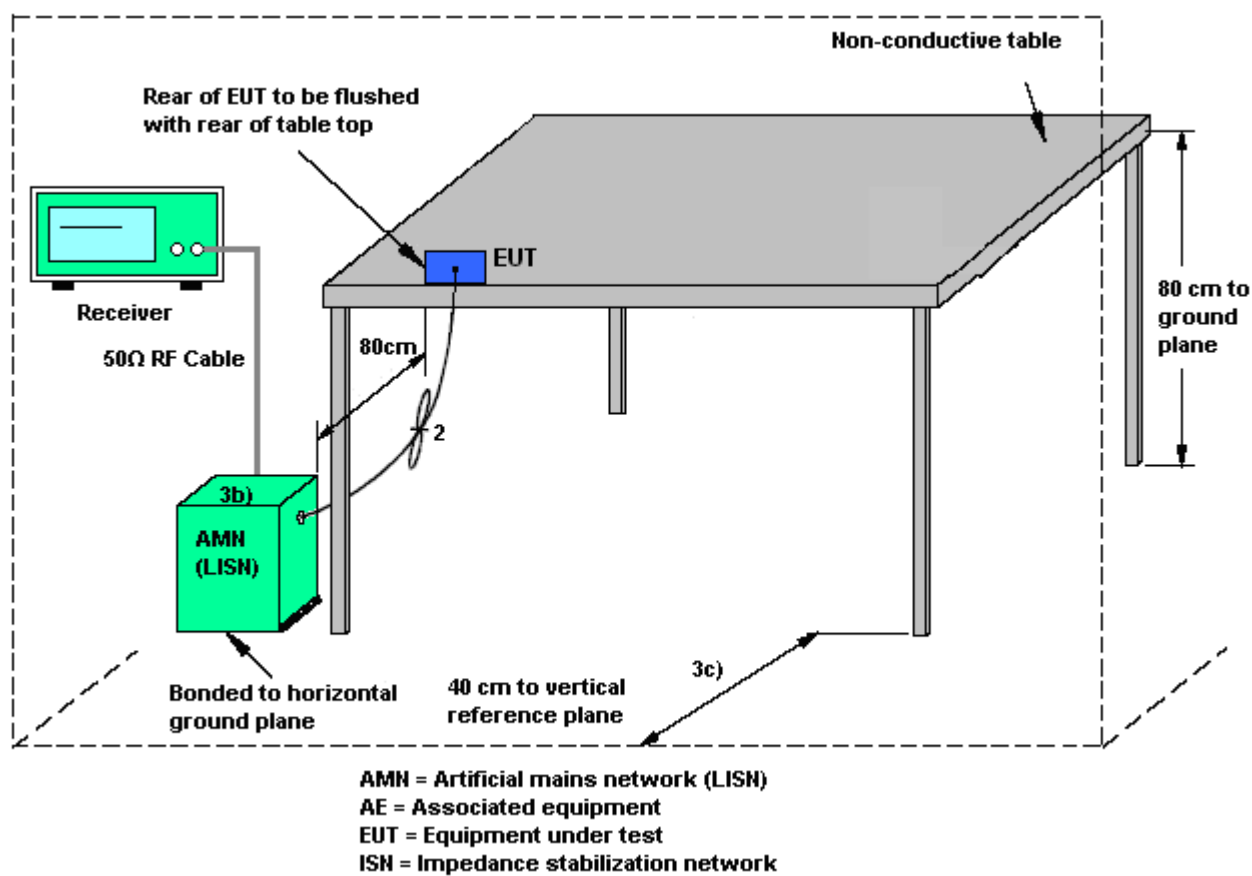
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

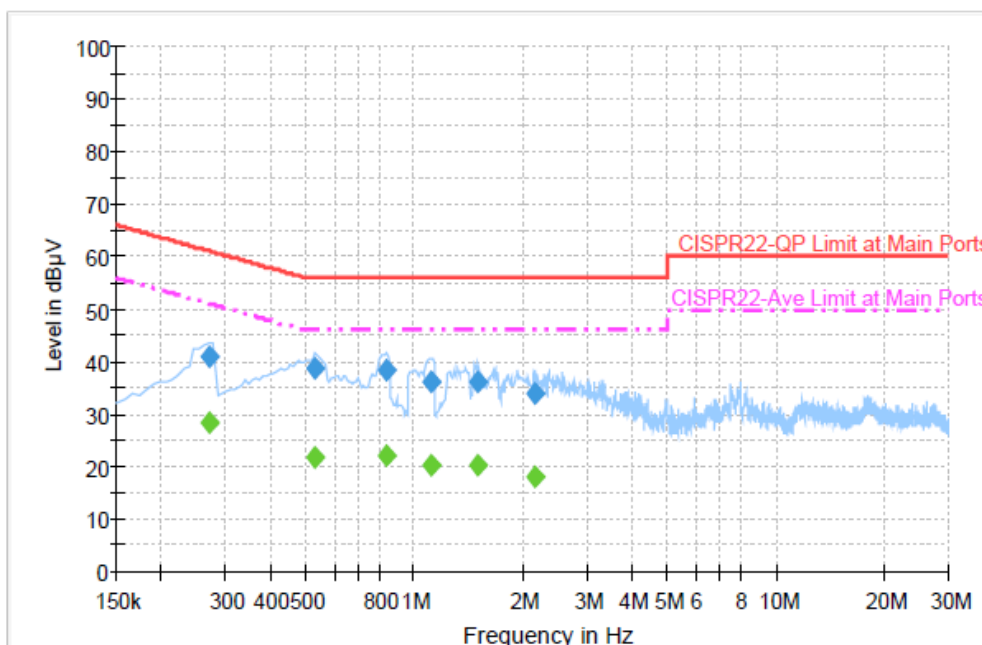
1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
1. Connect EUT to the power mains through a line impedance stabilization network (LISN).
2. All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

3.2.4 Test Setup



3.2.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Cona Huang	Relative Humidity :	30~32%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN (2.4G) Link + GPS Rx + Scanner + Cradle + Adapter + RS232 Terminal + USB Cable (Link with Notebook) for Sample 2		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



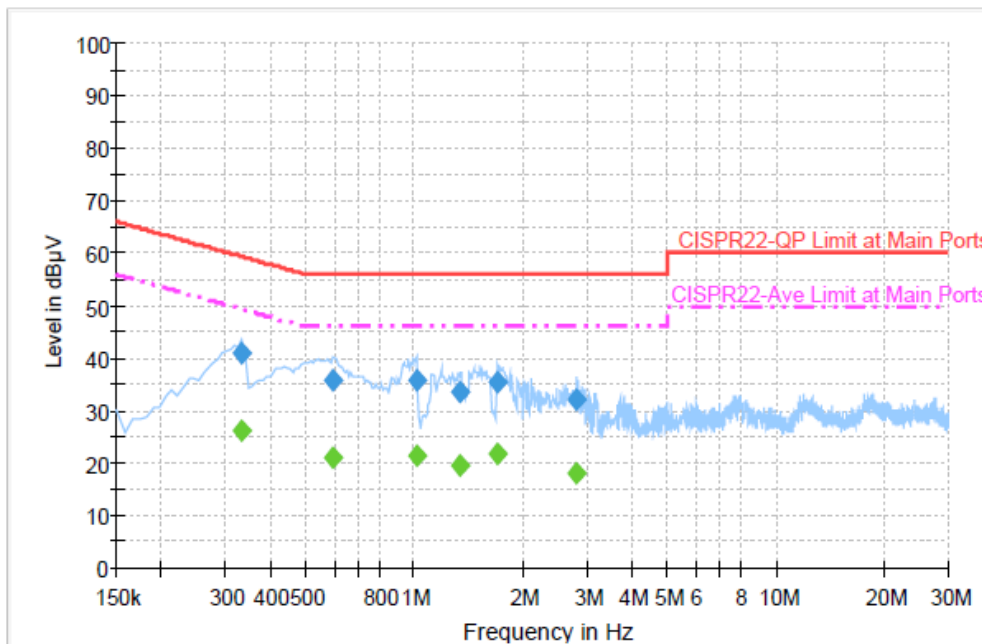
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.270000	40.9	Off	L1	19.3	20.2	61.1
0.534000	38.7	Off	L1	19.3	17.3	56.0
0.838000	38.3	Off	L1	19.5	17.7	56.0
1.118000	36.2	Off	L1	19.4	19.8	56.0
1.502000	36.0	Off	L1	19.4	20.0	56.0
2.166000	34.0	Off	L1	19.5	22.0	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.270000	28.6	Off	L1	19.3	22.5	51.1
0.534000	21.6	Off	L1	19.3	24.4	46.0
0.838000	22.3	Off	L1	19.5	23.7	46.0
1.118000	20.3	Off	L1	19.4	25.7	46.0
1.502000	20.5	Off	L1	19.4	25.5	46.0
2.166000	18.2	Off	L1	19.5	27.8	46.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Cona Huang	Relative Humidity :	30~32%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN (2.4G) Link + GPS Rx + Scanner + Cradle + Adapter + RS232 Terminal + USB Cable (Link with Notebook) for Sample 2		
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)
0.334000	41.1	Off	N	19.3	18.3	59.4
0.598000	35.8	Off	N	19.4	20.2	56.0
1.014000	35.6	Off	N	19.5	20.4	56.0
1.342000	33.6	Off	N	19.4	22.4	56.0
1.702000	35.3	Off	N	19.5	20.7	56.0
2.798000	32.0	Off	N	19.6	24.0	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.334000	26.1	Off	N	19.3	23.3	49.4
0.598000	20.9	Off	N	19.4	25.1	46.0
1.014000	21.5	Off	N	19.5	24.5	46.0
1.342000	19.5	Off	N	19.4	26.5	46.0
1.702000	21.8	Off	N	19.5	24.2	46.0
2.798000	17.9	Off	N	19.6	28.1	46.0

3.3 Radiated Emission Measurement

3.3.1 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

3.3.2 Measuring Instruments

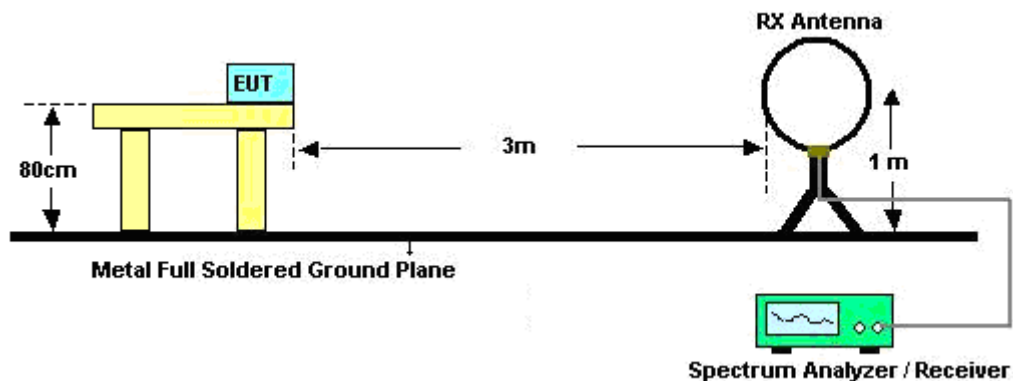
See list of measuring instruments of this test report.

3.3.3 Test Procedures

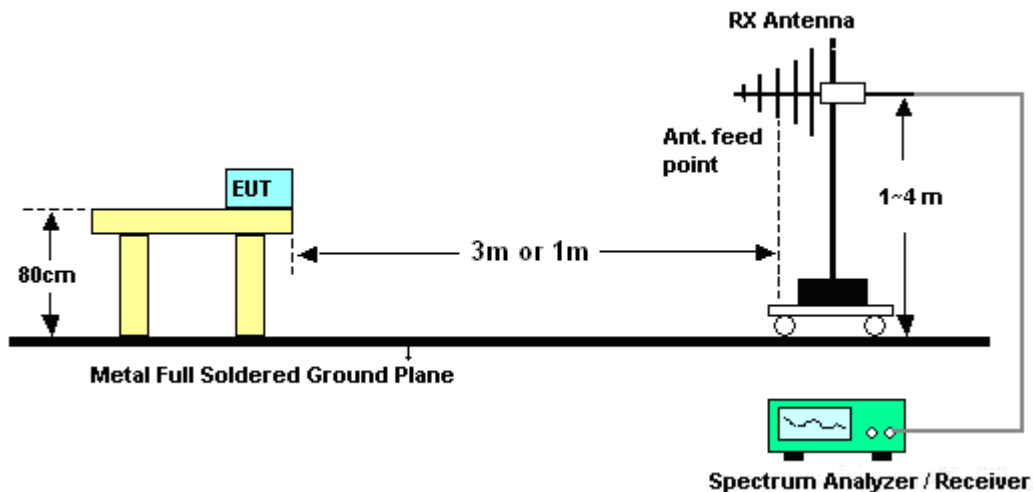
1. The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
2. Use the following spectrum analyzer settings:
 - (1) Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto;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

3.3.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



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

Test Engineer :	Ivan Chiang	Temperature :	22~23°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.

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

Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	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
180.93	29.92	-13.58	43.5	51.16	9.04	1.25	31.53	100	94	Peak
223.86	26.16	-19.84	46	45.35	10.82	1.44	31.45	-	-	Peak
293.25	26.73	-19.27	46	42.99	13.35	1.71	31.32	-	-	Peak
335	27.88	-18.12	46	42.78	14.54	1.87	31.31	-	-	Peak
528.9	25.39	-20.61	46	35.24	18.66	2.51	31.02	-	-	Peak
778.1	23.14	-22.86	46	28.61	22.12	3.1	30.69	-	-	Peak
2334	45.12	-28.88	74	40.91	32.09	5.95	33.83	100	304	Peak
2334	33.26	-20.74	54	29.05	32.09	5.95	33.83	100	304	Average
2480	100.64	-	-	96.08	32.28	6.18	33.9	100	304	Peak
2480	97.26	-	-	92.7	32.28	6.18	33.9	100	304	Average
2483.5	65.56	-8.44	74	61	32.28	6.18	33.9	100	304	Peak
2483.5	47.24	-6.76	54	42.68	32.28	6.18	33.9	100	304	Average



Test Mode :	Mode 1	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	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
117.21	31.18	-12.32	43.5	50.37	11.28	1.09	31.56	-	-	Peak
182.01	31.27	-12.23	43.5	52.49	9.05	1.26	31.53	108	244	Peak
221.97	32.45	-13.55	46	51.8	10.68	1.43	31.46	-	-	Peak
365.8	25.8	-20.2	46	39.48	15.51	2.07	31.26	-	-	Peak
634.6	24.7	-21.3	46	32.65	20.15	2.79	30.89	-	-	Peak
995.8	26	-28	54	28.23	24.84	3.51	30.58	-	-	Peak
2332	45.76	-28.24	74	41.55	32.09	5.95	33.83	101	358	Peak
2332	33.04	-20.96	54	28.83	32.09	5.95	33.83	101	358	Average
2480	94.75	-	-	90.19	32.28	6.18	33.9	101	358	Peak
2480	91.32	-	-	86.76	32.28	6.18	33.9	101	358	Average
2483.5	59.67	-14.33	74	55.11	32.28	6.18	33.9	101	358	Peak
2483.5	43.49	-10.51	54	38.93	32.28	6.18	33.9	101	358	Average

Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	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
180.93	28.85	-14.65	43.5	50.09	9.04	1.25	31.53	110	144	Peak
223.86	25.85	-20.15	46	45.04	10.82	1.44	31.45	-	-	Peak
298.38	28.11	-17.89	46	44.24	13.44	1.76	31.33	-	-	Peak
337.8	26.89	-19.11	46	41.68	14.63	1.88	31.3	-	-	Peak
531	25.22	-20.78	46	35.04	18.69	2.51	31.02	-	-	Peak
780.9	24.71	-21.29	46	30.13	22.16	3.11	30.69	-	-	Peak
2350	44.78	-29.22	74	40.55	32.11	5.95	33.83	100	306	Peak
2350	33.31	-20.69	54	29.08	32.11	5.95	33.83	100	306	Average
2480	100.17	-	-	95.61	32.28	6.18	33.9	100	306	Peak
2480	96.5	-	-	91.94	32.28	6.18	33.9	100	306	Average
2483.5	64.89	-9.11	74	60.33	32.28	6.18	33.9	100	306	Peak
2483.5	46.62	-7.38	54	42.06	32.28	6.18	33.9	100	306	Average

Test Mode :	Mode 2	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	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
118.02	31.73	-11.77	43.5	50.84	11.36	1.09	31.56	131	268	Peak
180.93	30.24	-13.26	43.5	51.48	9.04	1.25	31.53	-	-	Peak
221.7	32.31	-13.69	46	51.66	10.68	1.43	31.46	-	-	Peak
388.2	24.74	-21.26	46	37.64	16.2	2.12	31.22	-	-	Peak
519.8	25.04	-20.96	46	35.05	18.53	2.49	31.03	-	-	Peak
702.5	25.74	-20.26	46	32.7	20.92	2.94	30.82	-	-	Peak
2340	45.68	-28.32	74	41.45	32.11	5.95	33.83	100	357	Peak
2340	33.34	-20.66	54	29.11	32.11	5.95	33.83	100	357	Average
2480	93.86	-	-	89.3	32.28	6.18	33.9	100	357	Peak
2480	90.24	-	-	85.68	32.28	6.18	33.9	100	357	Average
2483.5	58.76	-15.24	74	54.2	32.28	6.18	33.9	100	357	Peak
2483.5	42.08	-11.92	54	37.52	32.28	6.18	33.9	100	357	Average

3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Connected Construction

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

3.4.3 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
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)
ISN	Teseq GmbH	ISN T400A	25696	N/A	Jun. 19, 2010	Jun. 18, 2011	Conduction (CO05-HY)
ISN	Teseq GmbH	ISN T800	27134	N/A	Jun. 19, 2010	Jun. 18, 2011	Conduction (CO05-HY)
DC- LISN	R&S	ESH3-26	1000485	0.1MHz~200MHz	Jun. 17, 2010	Jun. 16, 2011	Conduction (CO05-HY)
DC- LISN	R&S	ESH3-26	1000484	0.1MHz~200MHz	Jun. 17, 2010	Jun. 16, 2011	Conduction (CO05-HY)
GPS Station	T&E	GS-50	N/A	N/A	N/A	N/A	Conduction (CO05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 31, 2010	Oct. 30, 2011	Radiation (03CH07-HY)
Spectrum Analyzer	R&S	FSP	101067	9KHz ~ 30GHz	Dec. 03, 2010	Dec. 02, 2011	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2010	Aug. 18, 2011	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 251	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A0236 2	1GHz~ 26.5GHz	Dec. 06, 2010	Dec. 05, 2011	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32 dB.GAIN	Mar. 27, 2010	Mar. 26, 2011	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH07-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 EP0D0904-04 as below.



1. External Photograph of EUT

Sample 1





Sample 2





Sample 3







2. Photograph of Accessory

List of Accessory:

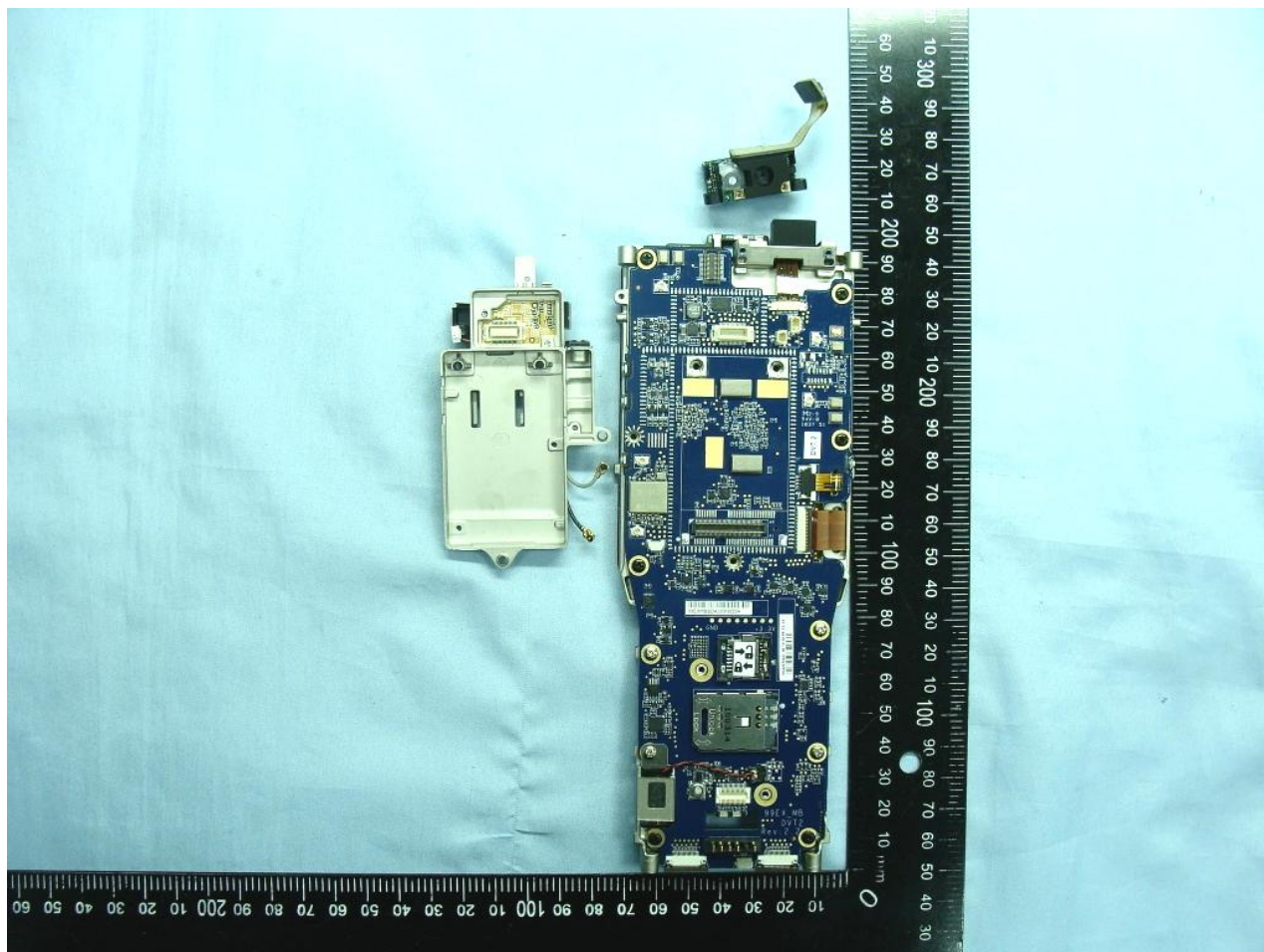
Specification of Accessory		
Battery	Brand Name	Honeywell
	Model Name	99EX-BTSC
Holster	Model Name	99EX-Holster
LCD Panel	Brand Name	Casio
	Model Name	OM37H3M04XLC
Camera	Brand Name	LITE-ON Semiconductor Corp.
	Model Name	DCM-300MCB

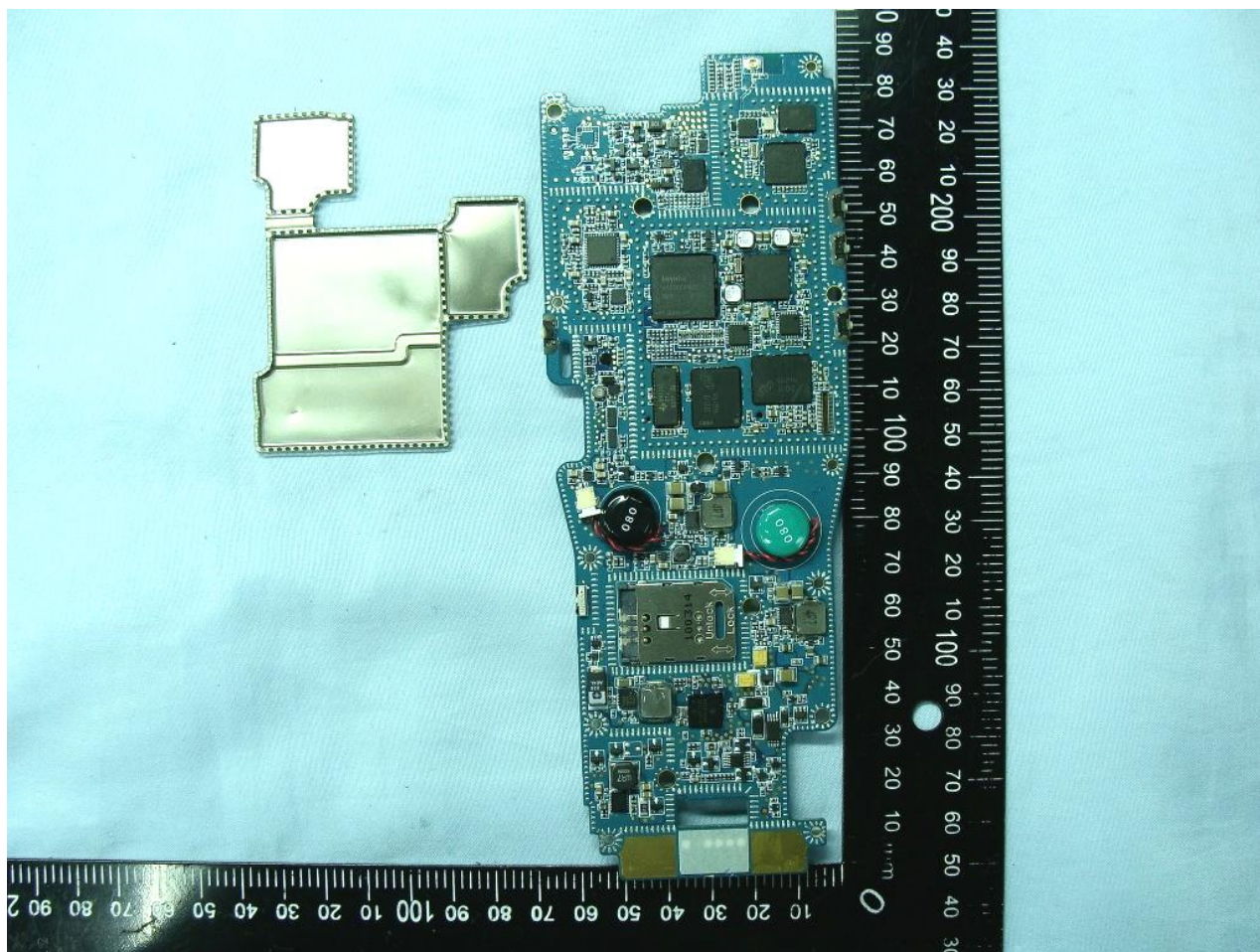
Remark: For accessories equipped with this EUT, please refer to the following photos.

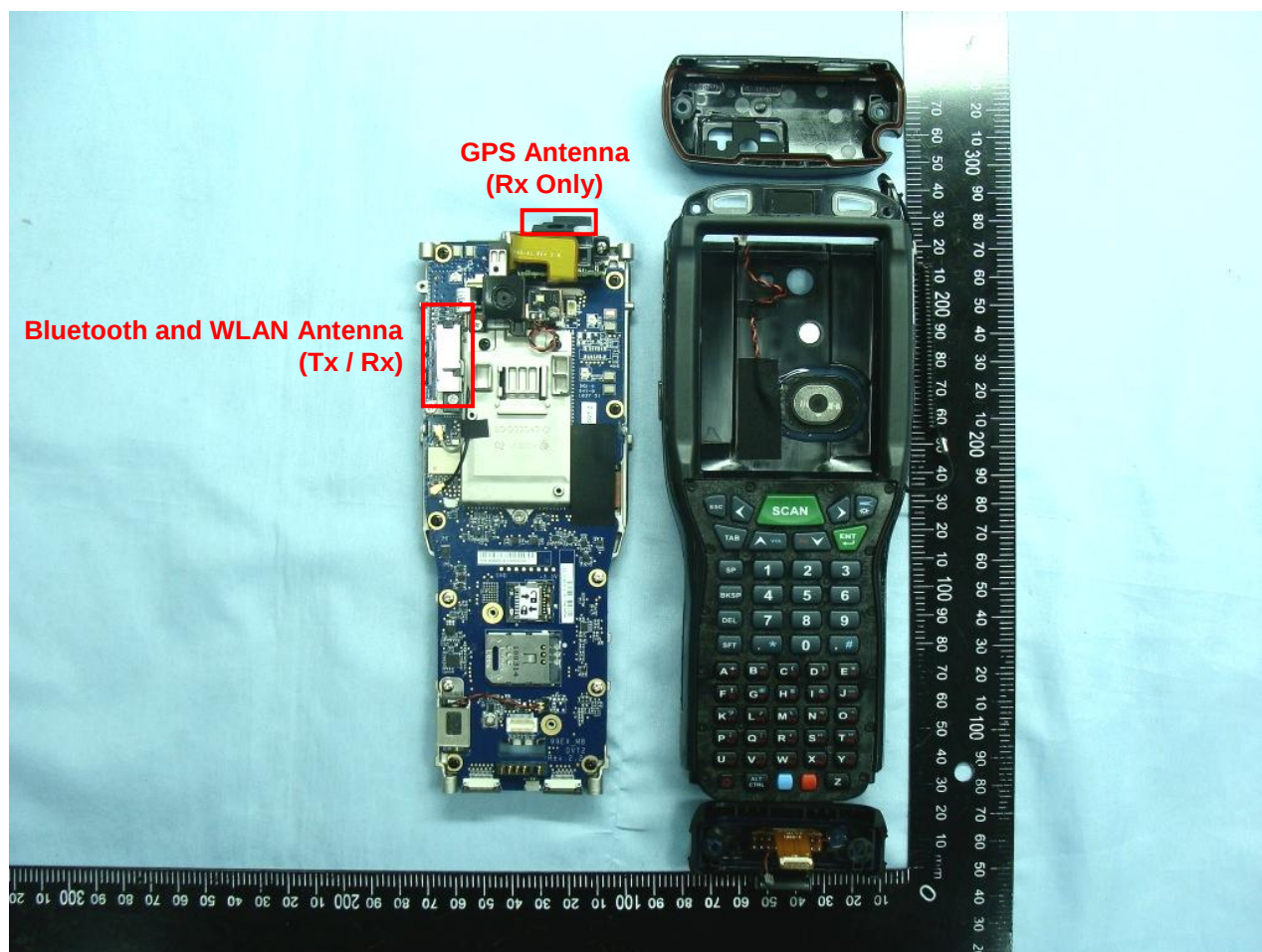


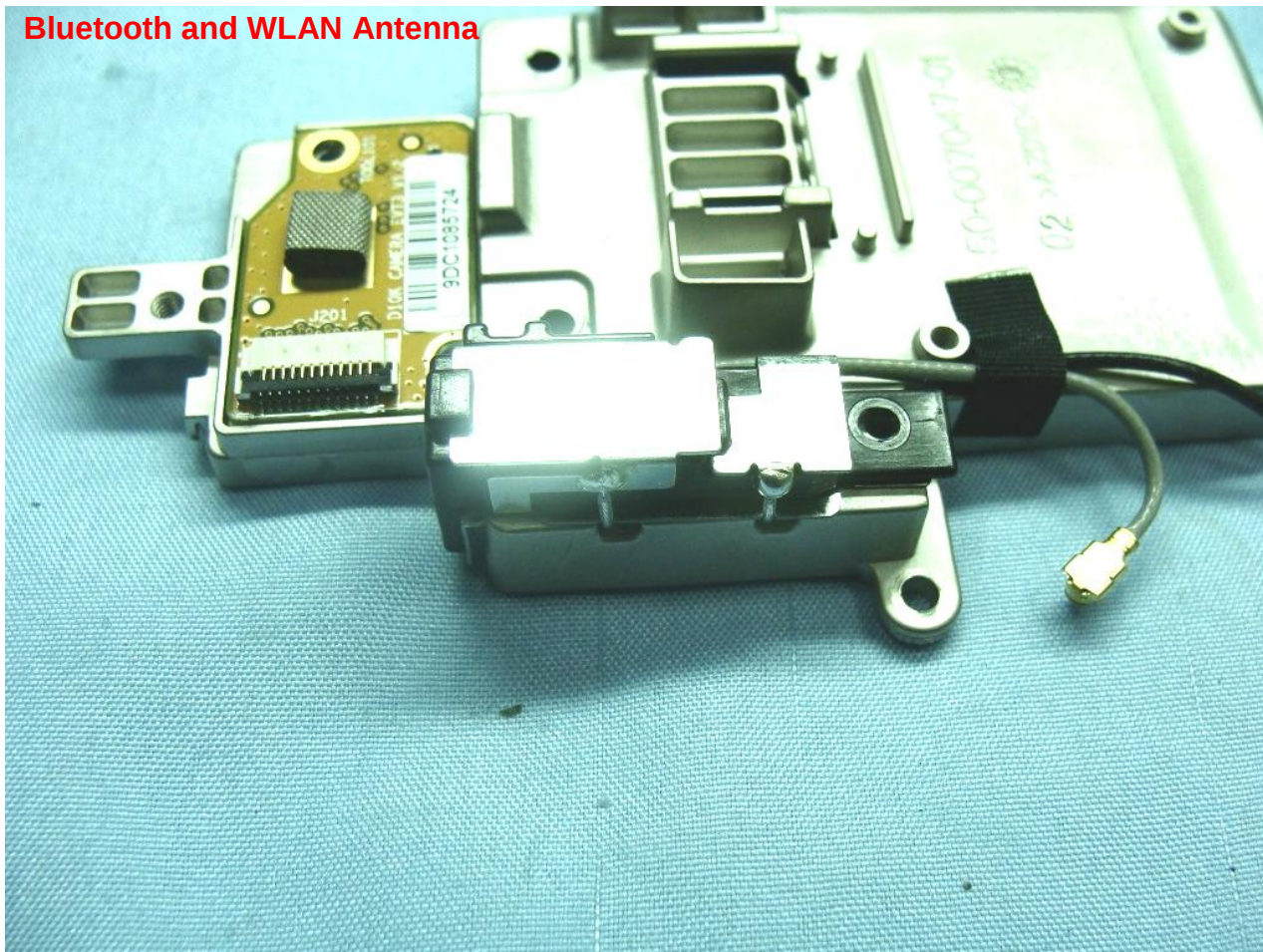


3. Internal Photograph of EUT



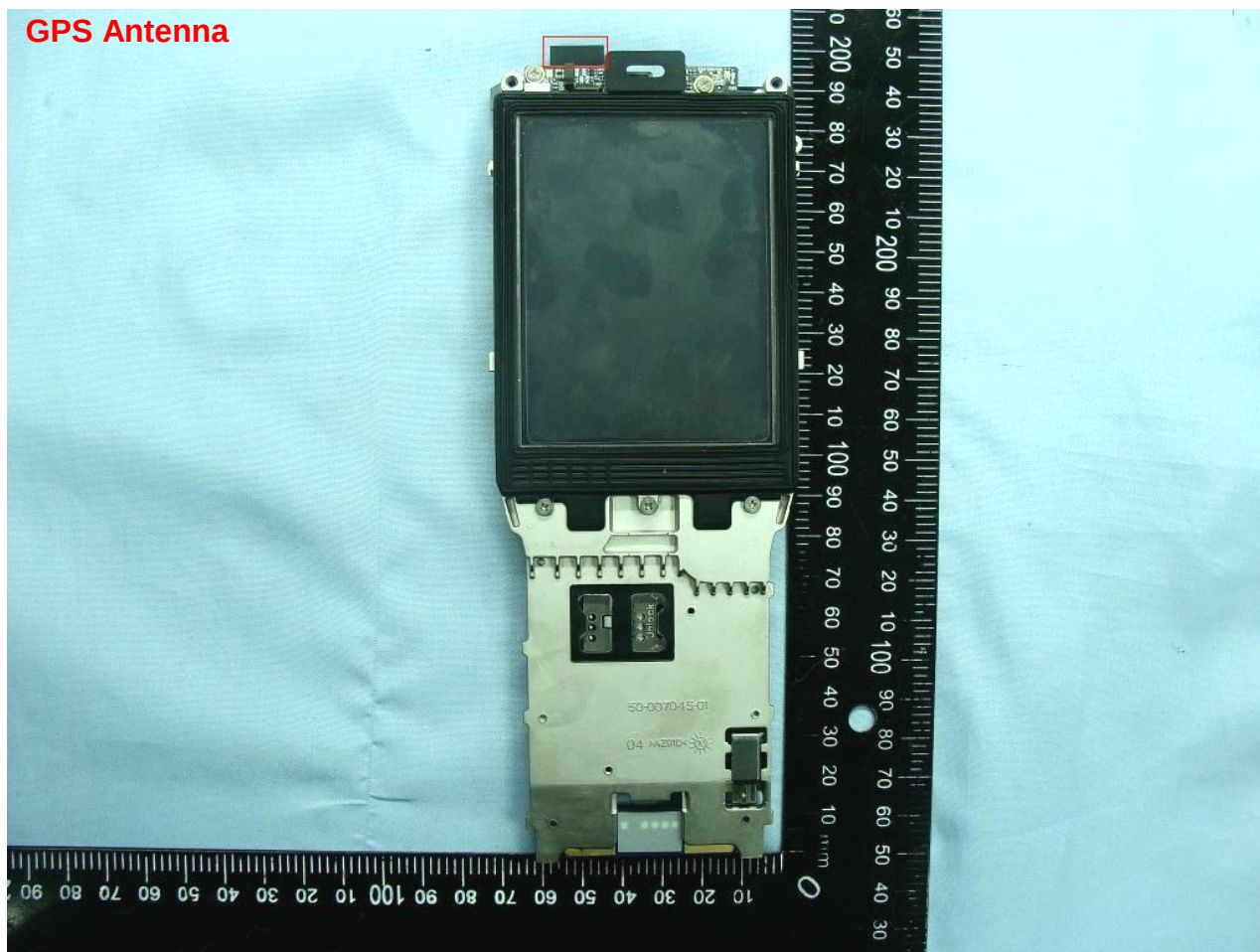




Bluetooth and WLAN Antenna



GPS Antenna

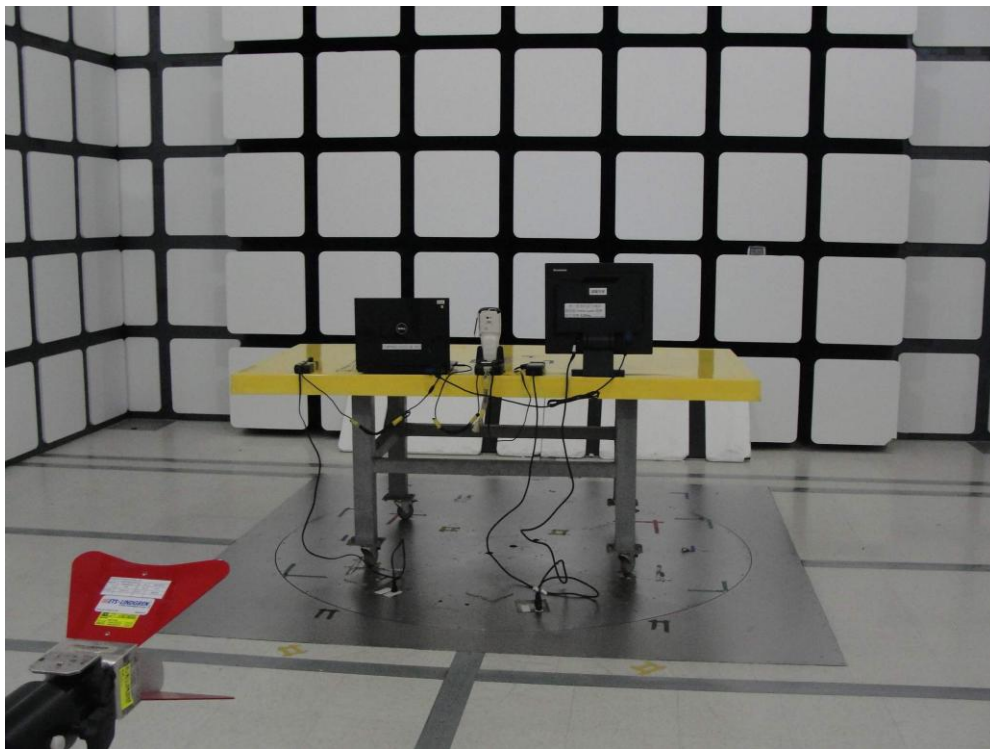
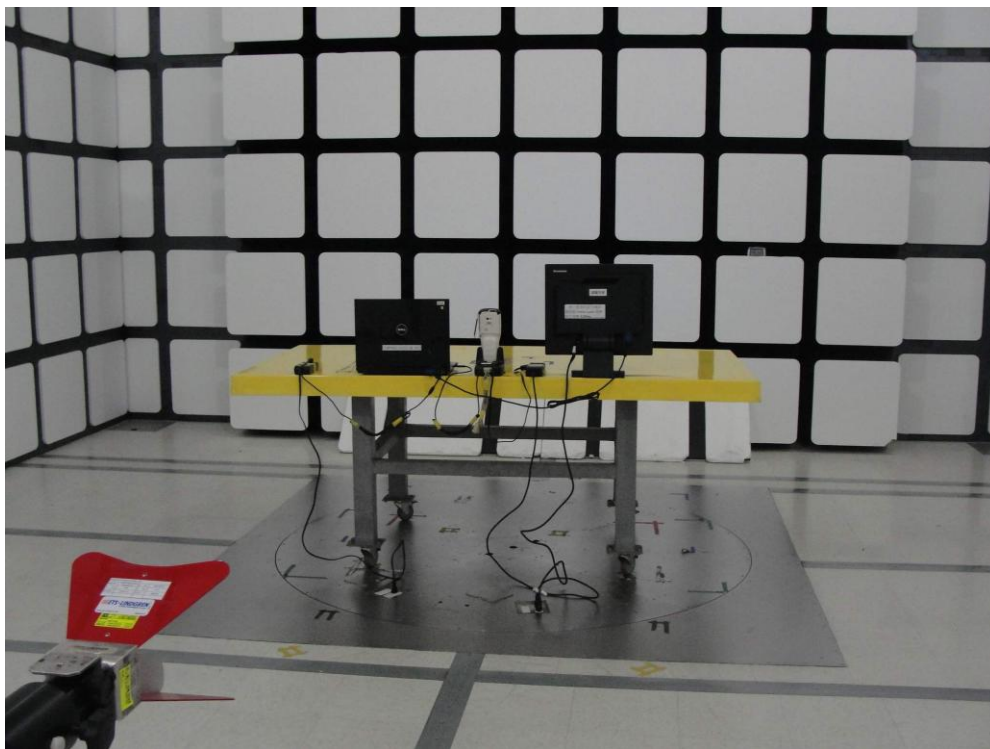


Appendix B. Setup Photographs

<Conducted Emission>

Mode 1



<Radiated Emission>**Mode 1****Mode 2**



Appendix C. Original Report

Please refer to Sporton report number FR0D0904-02A as below.

FCC RF Test Report

APPLICANT : Honeywell International Inc.
EQUIPMENT : 99EX Mobile computer
BRAND NAME : Honeywell
MODEL NAME : 99EX
FCC ID : HD599EXL0
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : Digital Spread Spectrum (DSS)

The product was received on Dec. 06, 2010 and completely tested on Jan. 04, 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:



Anderson Chiu / Deputy 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
FR0D0904-02A	Rev. 01	Initial issue of report	Feb. 11, 2011
FR0D0904-02A	Rev. 02	Update report for revising address of applicant and manufacturer	Feb. 18, 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	-
3.2	-	Gen 4.4.1	99% Bandwidth	-	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 19.9 dB at 0.478 MHz
3.9	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 7.18 dB at 2483.50 MHz
3.10	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Honeywell International Inc.

9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.2 Manufacturer

Honeywell International Inc.

9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	99EX Mobile computer
Brand Name	Honeywell
Model Name	99EX
FCC ID	HD599EXL0
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) : 2.60 dBm (0.0018 W) Bluetooth EDR (2Mbps) : 2.99 dBm (0.0020 W) Bluetooth EDR (3Mbps) : 3.64 dBm (0.0023 W)
Antenna Type	PIFA Antenna with gain 2.5 dBi
HW Version	5
SW Version	26.02
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	03CH07-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.	GPS Station	T&E	GS-50	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A
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.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
7.	Cradle	Honeywell	99EX-HB	N/A	N/A	N/A
8.	Adapter	ENG	3A-902DB12	N/A	N/A	N/A
9.	USB Cable	N/A	N/A	N/A	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	$\pi/4$ -DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	2.40 dBm	2.67 dBm	3.38 dBm
Ch39	2441MHz	2.60 dBm	2.99 dBm	3.64 dBm
Ch78	2480MHz	2.09 dBm	2.51 dBm	3.23 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).

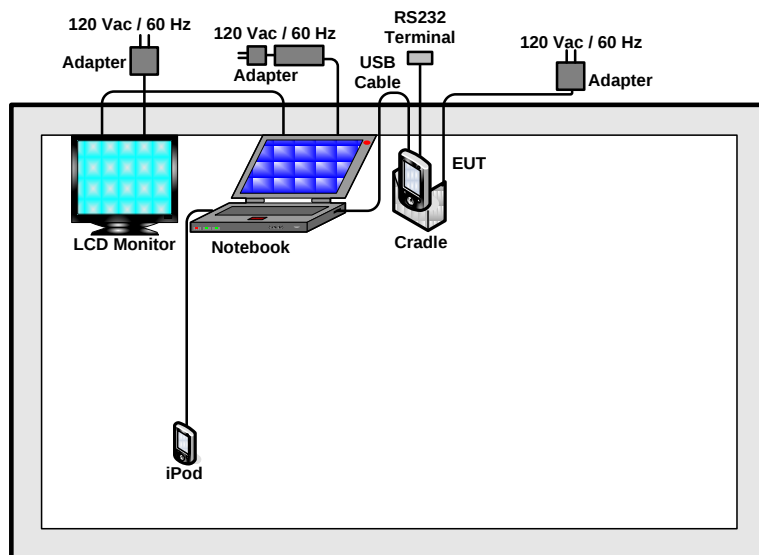
Pre-scanned tests were conducted to determine the final configuration from all possible combinations.

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

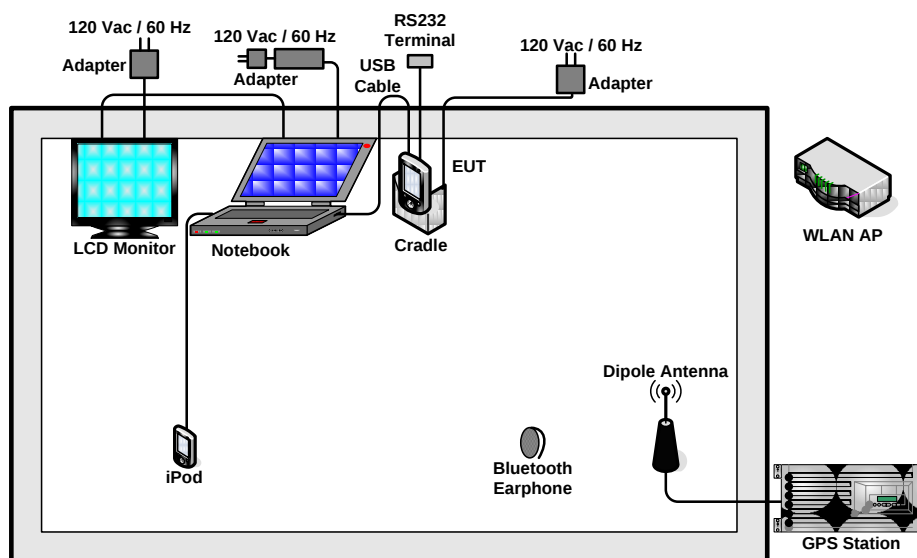
Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps π /4-DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	N/A	N/A	Mode 1: CH00_2402 MHz + TC Mode 2: CH39_2441 MHz + TC Mode 3: CH78_2480 MHz + TC
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN (2.4G) Link + GPS Rx + Scanner + Cradle + Adapter + RS232 Terminal + USB Cable (Link with Notebook)		
Remark:			
1. TC stands for Test Configuration, and consists of USB cable, RS232 terminal, cradle, and adapter.			
2. 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.			

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>



2.4 RF Utility

For Bluetooth function, the RF utility, "BT Tester" was installed in EUT which can send transmitting signal for all testing.

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.

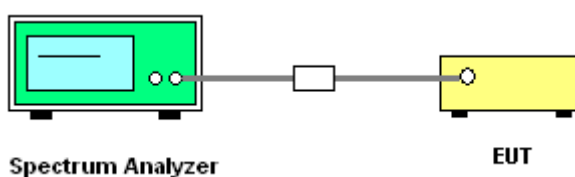
3.1.2 Measuring Instruments

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 7~9	Temperature :	22~24℃
Test Engineer :	Hank Yu	Relative Humidity :	40~43%
Number of Hopping Channels (Channel)		Limits (Channel)	Pass/Fail
79		> 15	Pass