

# FCC TEST REPORT

## (PART 24)

**REPORT NO.:** RF150318C06-1

**MODEL NO.:** S50c

**FCC ID:** ZL5S50C

**RECEIVED:** Mar. 18, 2015

**TESTED:** Apr. 01, 2015 ~ Apr. 02, 2015

**ISSUED:** Apr. 21, 2015

**APPLICANT:** Bullitt Group

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**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch

**LAB ADDRESS:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist.,  
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**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil., Kwei Shan  
Dist., Taoyuan City 333, Taiwan, R.O.C.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF150318C06-1	Original release	Apr. 21, 2015



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## 1 CERTIFICATION

**PRODUCT:** Rugged Smart Phone

**MODEL:** S50c

**BRAND:** CAT

**APPLICANT:** Bullitt Group

**TESTED:** Apr. 01, 2015 ~ Apr. 02, 2015

**TEST SAMPLE:** Identical Prototype

**STANDARDS:** FCC Part 24, Subpart E

The above equipment (model: S50c) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY** : Ivonne Wu , **DATE** : Apr. 21, 2015  
Ivonne Wu / Supervisor

**APPROVED BY** : Sam Chen , **DATE** : Apr. 21, 2015  
Sam Chen / Senior Project Engineer

## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 24 & Part 2			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
2.1046 24.232	Equivalent Isotropic Radiated Power	PASS	Meet the requirement of limit.
2.1055 24.235	Frequency Stability	PASS	Meet the requirement of limit.
2.1049 24.238(b)	Occupied Bandwidth	PASS	Meet the requirement of limit.
24.232(d)	Peak to average ratio	PASS	Meet the requirement of limit.
24.238(b)	Band Edge Measurements	PASS	Meet the requirement of limit.
2.1051 24.238	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
2.1053 24.238	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -27.31dB at 167.70MHz.

### 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 2.2 TEST SITE AND INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2015	Jan. 21, 2016
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2014	Sep. 02, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 10, 2014	Dec. 09, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Feb. 04, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Feb. 09, 2015	Feb. 09, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Feb. 04, 2015	Feb. 04, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 12, 2014	Dec. 11, 2015
Preamplifier EMCI	EMC 184045	980116	Jan. 09, 2015	Jan. 08, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 27, 2014	Dec. 26, 2015
Power Meter Anritsu	ML2495A	1232002	Sep. 17, 2014	Sep. 16, 2015
Power Sensor Anritsu	MA2411B	1207325	Sep. 17, 2014	Sep. 16, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 18, 2014	Oct. 17, 2015
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Nov. 07, 2014	Nov. 06, 2015
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Radio Communication Analyzer	MT8820C	6201300640	Aug. 01, 2013	Jul. 31, 2015

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 10.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 690701.
5. The IC Site Registration No. is IC 7450F-10.

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	Rugged Smart Phone	
<b>MODEL NO.</b>	S50c	
<b>POWER SUPPLY</b>	5.0Vdc (adapter or host equipment) 3.75Vdc (battery)	
<b>MODULATION TYPE</b>	CDMA	QPSK, OQPSK, HPSK
<b>FREQUENCY RANGE</b>	CDMA	1851.3MHz ~ 1908.8MHz
<b>MAX. EIRP POWER</b>	CDMA	202.30mW
<b>EMISSION DESIGNATOR</b>	CDMA	1M27F9W
<b>ANTENNA TYPE</b>	Fixed Internal Antenna	
<b>I/O PORTS</b>	Refer to users' manual	
<b>DATA CABLE</b>	Refer to NOTE as below	
<b>ACCESSORY DEVICES</b>	Refer to NOTE as below	

#### NOTE:

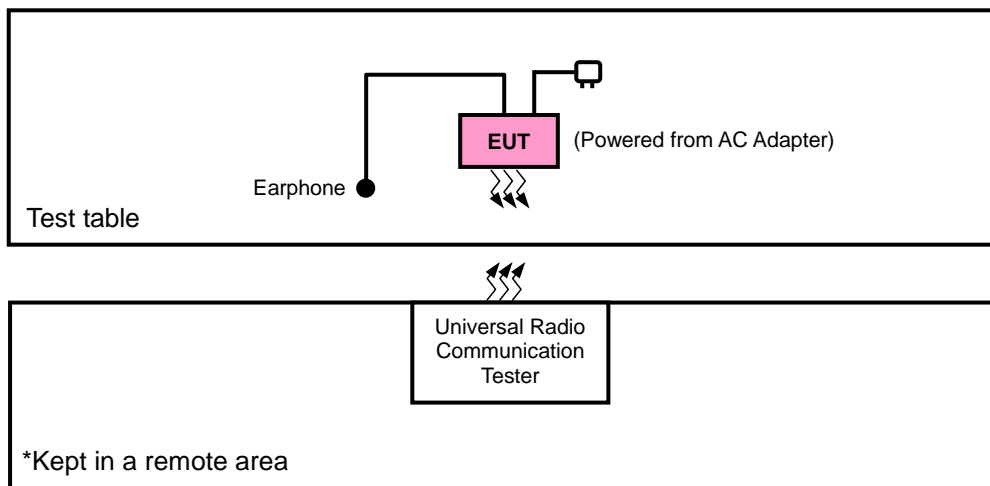
1. The EUT contains following accessory devices.

ITEM	BRAND	MODEL	SPECIFICATION
Adapter	Liteon	PA-1050-05L3	I/P: 100-240Vac, 0.3A O/P: 5Vdc, 1A
Battery	Simplo Technology	A09TA008H	3.75Vdc, 2680Ah
USB Cable	BING CHUANG	BC-1.1M-AMCR5P	1m cable
LCD Panel	Truly	BTFTSZ0192	--
Photo Camera	Chicony	CBAE821	--
Video Camera	Chicony	CIFDF31-1	--
Main Board	AT&S	14H08	--
eMMC	Hynix	H26M41103HPR	8GB
CPU	Qualcomm	MSM 8926	Pin: 784

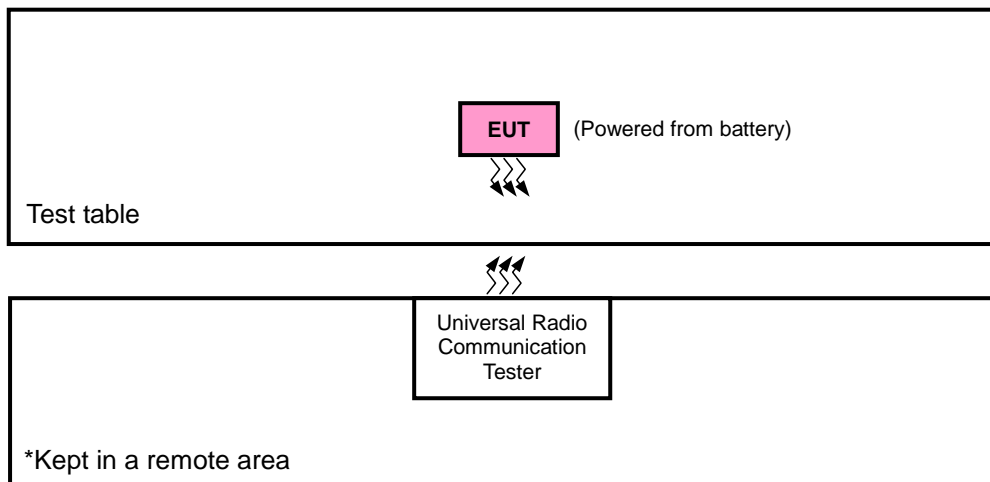
2. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 CONFIGURATION OF SYSTEM UNDER TEST

#### FOR RADIATION EMISSION TEST



#### FOR E.I.R.P. TEST







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### 3.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Earphone	Funkey	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

**NOTE:**

1. All power cords of the above support units are non shielded (1.8m).

### 3.4 TEST ITEM AND TEST CONFIGURATION

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on Z-plane for EIRP and X-axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

#### CDMA MODE

EUT CONFIGURE MODE	TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
-	EIRP	25 to 1175	25, 600, 1175	1xRTT
-	FREQUENCY STABILITY	25 to 1175	600	1xRTT
-	OCCUPIED BANDWIDTH	25 to 1175	25, 600, 1175	1xRTT
-	PEAK TO AVERAGE RATIO	25 to 1175	25, 600, 1175	1xRTT
-	BAND EDGE	25 to 1175	25, 1175	1xRTT
-	CONDUCTED EMISSION	25 to 1175	600	1xRTT
-	RADIATED EMISSION	25 to 1175	600	1xRTT

#### TEST CONDITION:

Test Item	Environmental Conditions	Input Power	Tested by
ERP	26deg. C, 58%RH	3.75Vdc	Taylor Liu
FREQUENCY STABILITY	26deg. C, 58%RH	3.75Vdc	Taylor Liu
OCCUPIED BANDWIDTH	26deg. C, 58%RH	3.75Vdc	Taylor Liu
PEAK TO AVERAGE RATIO	26deg. C, 58%RH	3.75Vdc	Taylor Liu
BAND EDGE	26deg. C, 58%RH	3.75Vdc	Taylor Liu
CONDUCTED EMISSION	26deg. C, 58%RH	3.75Vdc	Taylor Liu
RADIATED EMISSION	25deg. C, 65%RH	120Vac, 60Hz	Hwa Chiang

### **3.5 EUT OPERATING CONDITIONS**

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

### **3.6 GENERAL DESCRIPTION OF APPLIED STANDARDS**

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 24**

**ANSI/TIA/EIA-603-C 2004**

**NOTE:** All test items have been performed and recorded as per the above standards.

## 4 TEST TYPES AND RESULTS

### 4.1 OUTPUT POWER MEASUREMENT

#### 4.1.1 LIMITS OF OUTPUT POWER MEASUREMENT

Mobile and portable stations are limited to 2 watts EIRP.

#### 4.1.2 TEST PROCEDURES

##### **EIRP MEASUREMENT:**

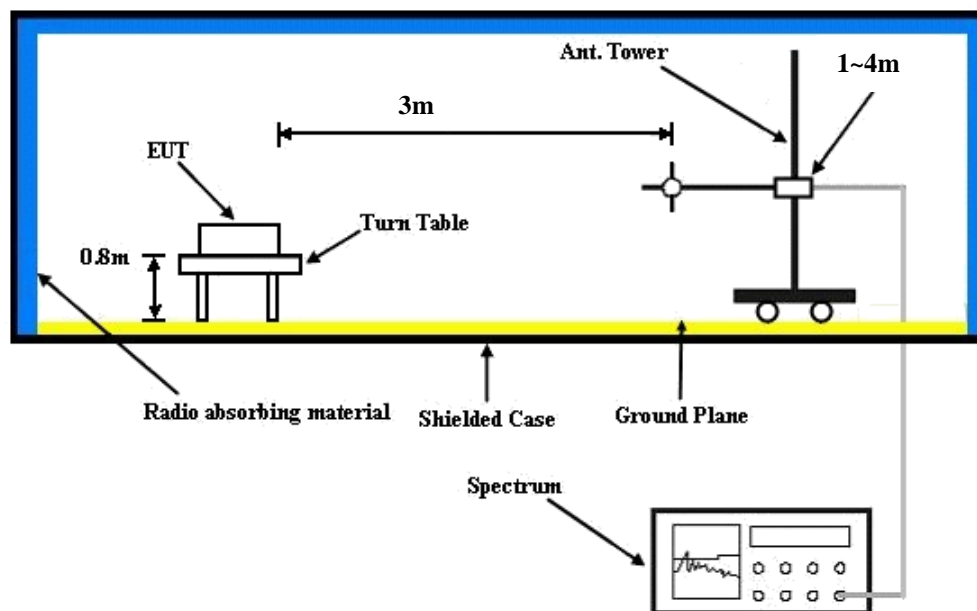
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 5MHz for CDMA mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G
- d.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$

##### **CONDUCTED POWER MEASUREMENT:**

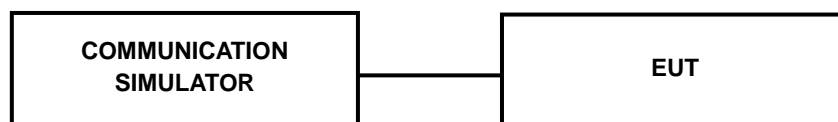
The EUT was set up for the maximum power with CDMA link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

### 4.1.3 TEST SETUP

#### EIRP / ERP MEASUREMENT:



#### CONDUCTED POWER MEASUREMENT:



#### 4.1.4 TEST RESULTS

##### CONDUCTED OUTPUT POWER (dBm)

Band	CDMA		
Channel	25	600	1175
Frequency (MHz)	1851.25	1880	1908.75
RC1+SO55	23.88	23.55	23.85
RC3+SO55	24.00	23.67	23.99
RC3+SO32(+ F-SCH)	23.89	23.52	23.86
RC3+SO32(+SCH)	23.93	23.52	23.86
RC1+SO3, 1/8 Rate	23.90	23.53	23.83
RTAP 153.6	23.80	23.42	23.86
RETAP 4096	23.82	23.44	23.90

##### EIRP POWER (dBm)

CDMA							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)	Polarization (H/V)
Z	25	1851.25	-23.28	44.70	21.42	138.68	H
	600	1880.00	-22.61	44.70	22.09	161.81	H
	1175	1908.75	-22.89	44.57	21.68	147.33	H
	25	1851.25	-22.00	44.27	22.27	168.66	V
	600	1880.00	-21.81	44.87	23.06	202.30	V
	1175	1908.75	-21.65	44.61	22.96	197.83	V

## 4.2 FREQUENCY STABILITY MEASUREMENT

### 4.2.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

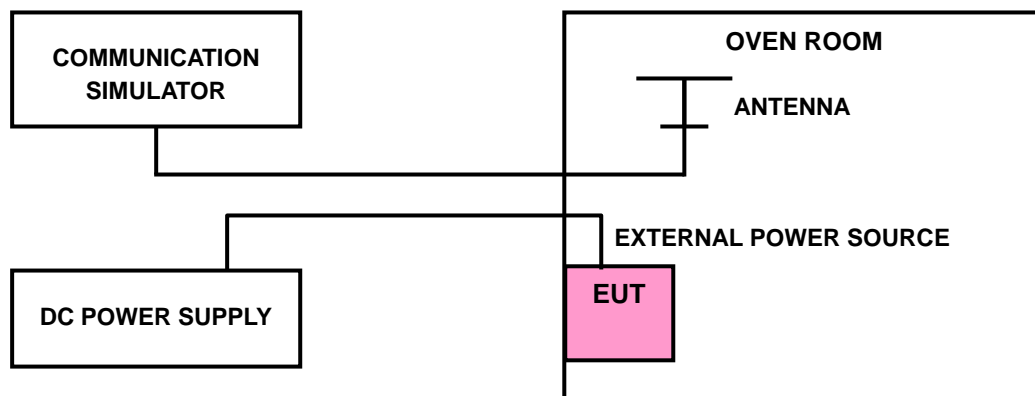
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### 4.2.2 TEST PROCEDURE

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the  $\pm 0.5^{\circ}\text{C}$  during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

**NOTE:** The frequency error was recorded frequency error from the communication simulator.

### 4.2.3 TEST SETUP



#### 4.2.4 TEST RESULTS

##### FREQUENCY ERROR vs. VOLTAGE

VOLTAGE (Volts)	FREQUENCY ERROR (ppm)	LIMIT (ppm)
	CDMA	
3.8	0.001	2.5
3.6	0.002	2.5
4.2	0.001	2.5

**NOTE:** The applicant defined the normal working voltage of the battery is from 3.6Vdc to 4.2Vdc.

##### FREQUENCY ERROR vs. TEMPERATURE

TEMP. (°C)	FREQUENCY ERROR (ppm)	LIMIT (ppm)
	CDMA	
-20	0.001	2.5
-10	0.001	2.5
0	-0.002	2.5
10	-0.002	2.5
20	-0.001	2.5
30	-0.001	2.5
40	-0.002	2.5
50	0.001	2.5
60	0.001	2.5

**Note:**

1. The applicant declared that the normal operating temperature of the EUT is from -20°C to 60°C.
2. The EUT would shut down automatically as below -20°C.

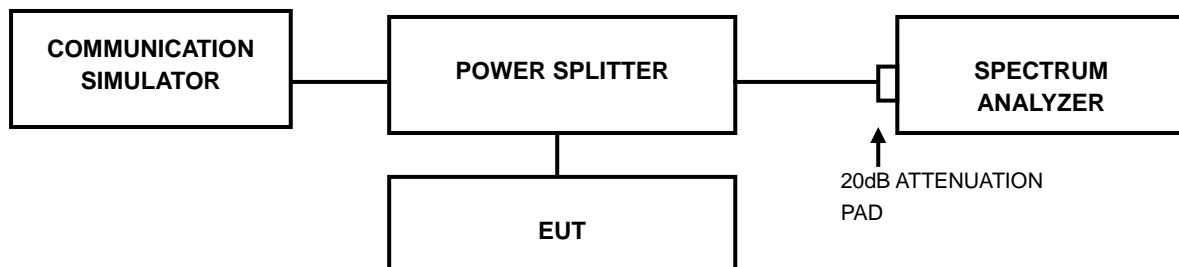


## 4.3 OCCUPIED BANDWIDTH MEASUREMENT

### 4.3.1 TEST PROCEDURES

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

### 4.3.2 TEST SETUP

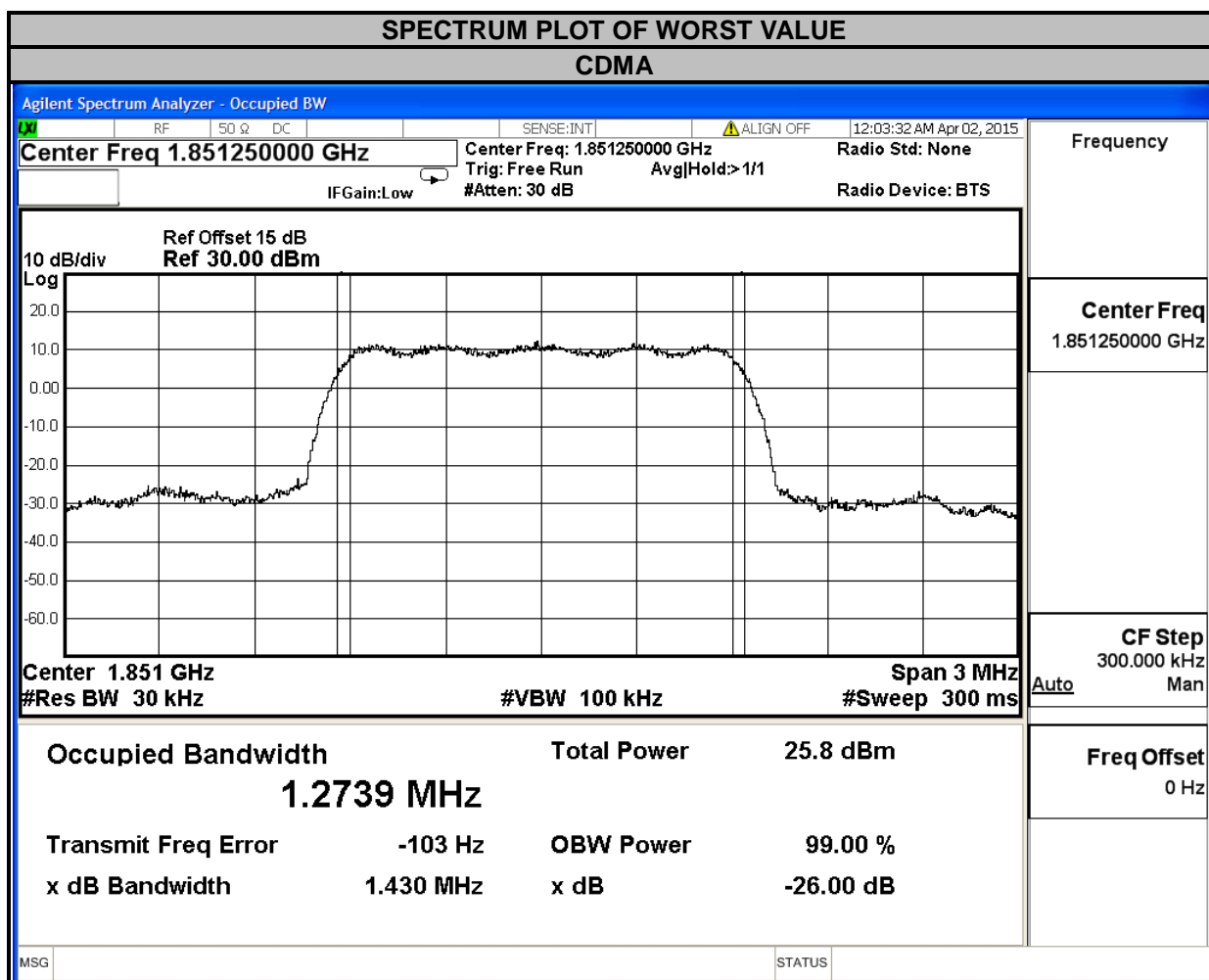




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## 4.3.3 TEST RESULTS

CDMA			
CHANNEL	FREQUENCY	99% OCCUPIED BANDWIDTH (MHz)	26dB BANDWIDTH (MHz)
25	1851.25	1.2739	1.430
600	1880.00	1.2725	1.419
1175	1908.75	1.2725	1.423

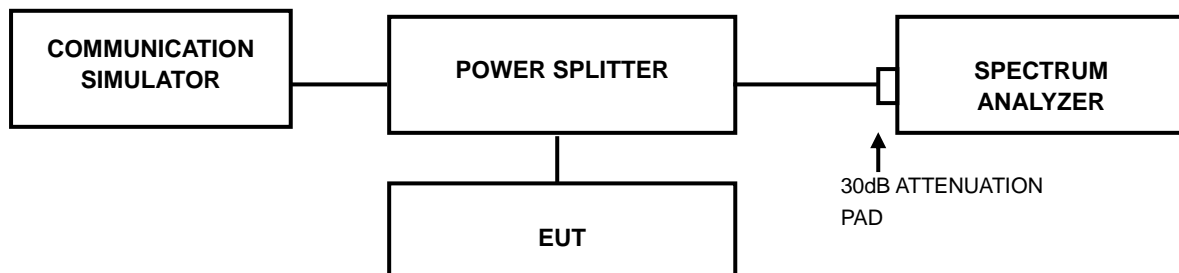


## 4.4 PEAK TO AVERAGE RATIO

### 4.4.1 LIMITS OF PEAK TO AVERAGE RATIO MEASUREMENT

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

### 4.4.2 TEST SETUP

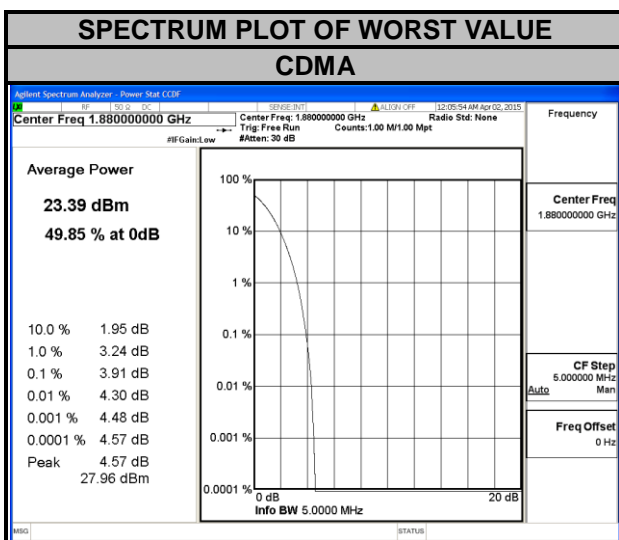


### 4.4.3 TEST PROCEDURES

1. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

#### 4.4.4 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)
		CDMA
25	1851.25	3.58
600	1880.00	3.91
1175	1908.75	3.91

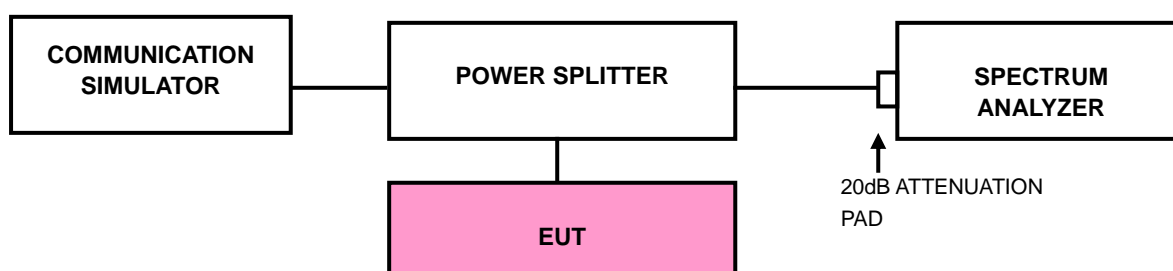


## 4.5 BAND EDGE MEASUREMENT

### 4.5.1 LIMITS OF BAND EDGE MEASUREMENT

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

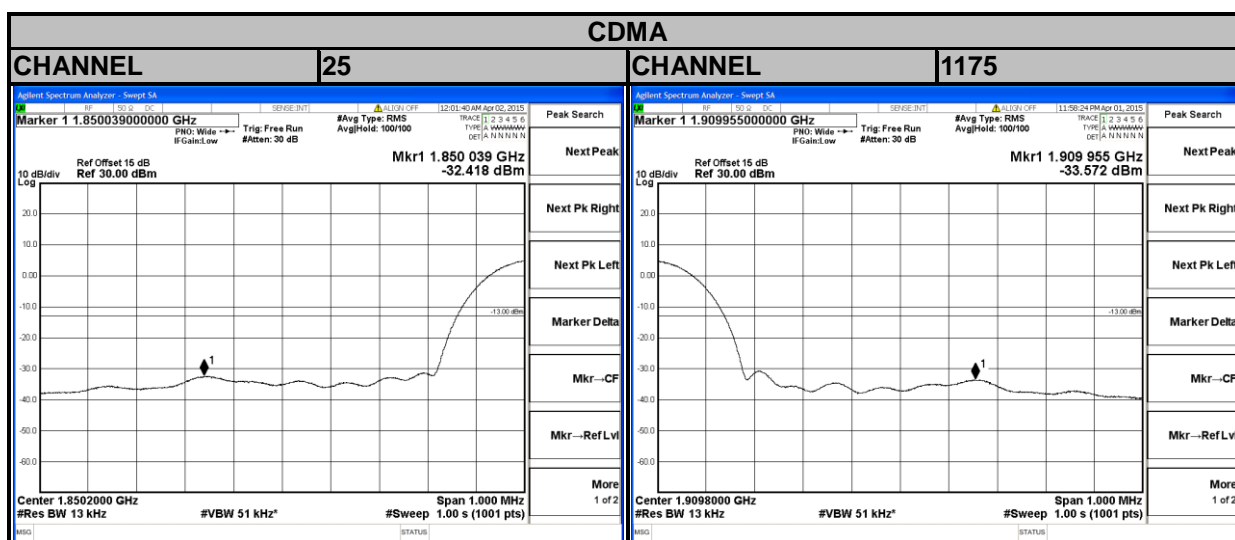
### 4.5.2 TEST SETUP



### 4.5.3 TEST PROCEDURES

- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 13kHz and VB of the spectrum is 51kHz (CDMA).
- Record the max trace plot into the test report.

### 4.5.4 TEST RESULTS



## 4.6 CONDUCTED SPURIOUS EMISSIONS

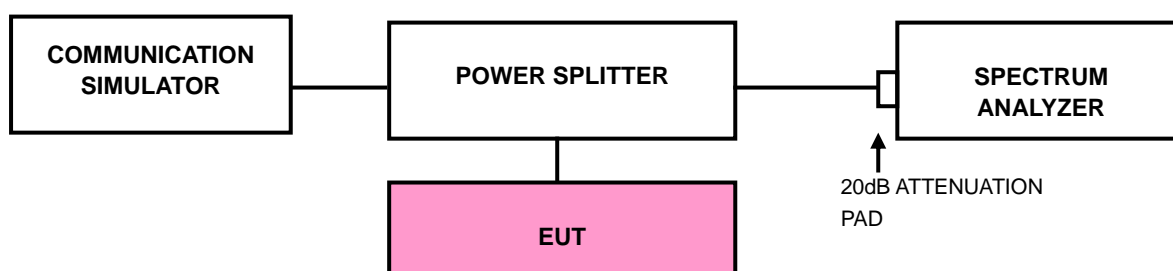
### 4.6.1 LIMITS OF CONDUCTED SPURIOUS EMISSIONS MEASUREMENT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit is equal to -13dBm.

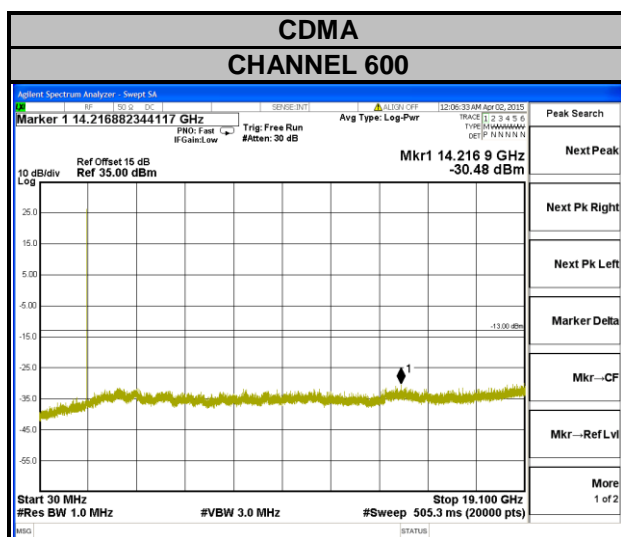
### 4.6.2 TEST PROCEDURE

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 30 MHz to 19.1GHz. 10dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.

### 4.6.3 TEST SETUP



### 4.6.4 TEST RESULTS



## 4.7 RADIATED EMISSION MEASUREMENT

### 4.7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit is equal to -13dBm.

### 4.7.2 TEST PROCEDURES

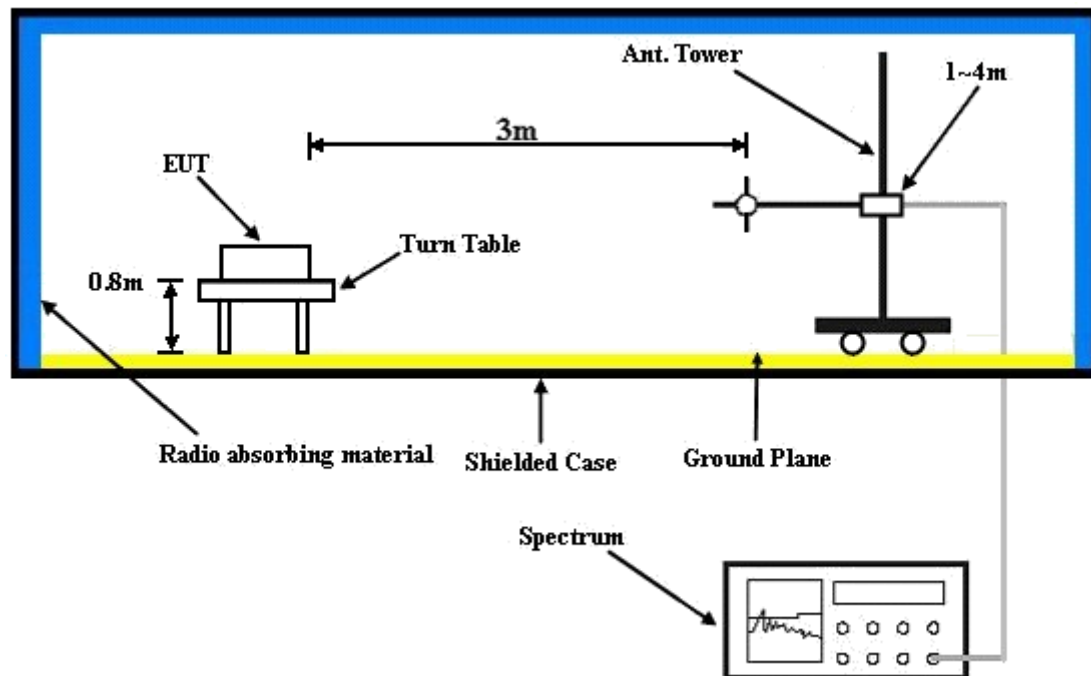
- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G
- c.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15\text{dBi}.$

**NOTE:** The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

### 4.7.3 DEVIATION FROM TEST STANDARD

No deviation

#### 4.7.4 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).



## 4.7.5 TEST RESULTS

CDMA:

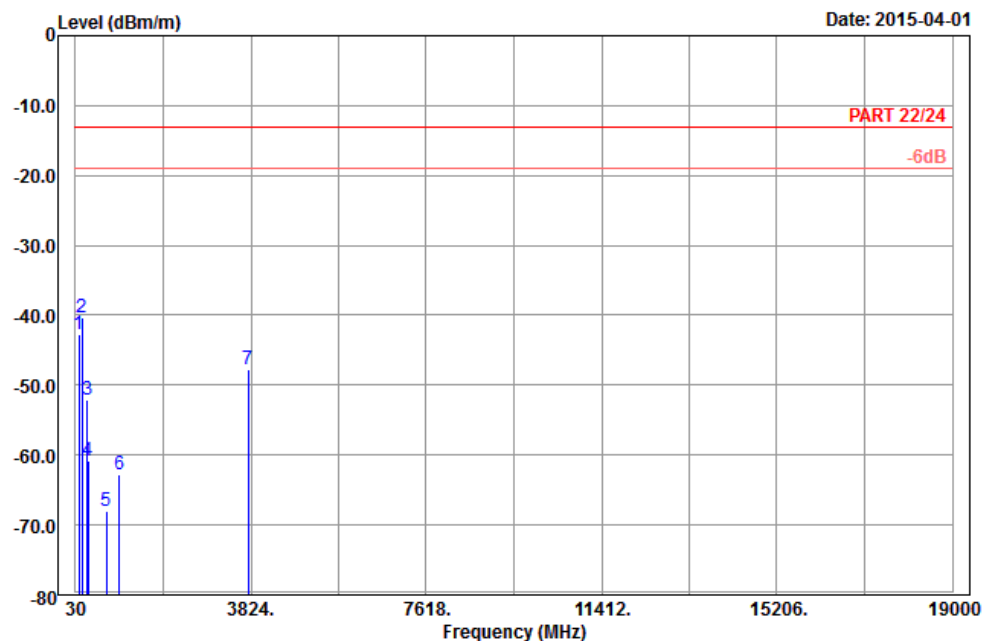


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Data: 13

Date: 2015-04-01



Site : 966 chamber 1  
Condition: PART 22/24 3m Horizontal  
Remark : BC1\_Link\_CH600  
Tested by: Hwa Chiang  
Plane : X

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	98.04	-42.83	-32.60	-13.00	-29.83	-10.23	Peak
2	167.70	-40.31	-33.41	-13.00	-27.31	-6.90	Peak
3	284.61	-52.14	-46.32	-13.00	-39.14	-5.82	Peak
4	300.70	-60.83	-54.88	-13.00	-47.83	-5.95	Peak
5	694.80	-67.94	-67.59	-13.00	-54.94	-0.35	Peak
6	975.50	-62.79	-67.98	-13.00	-49.79	5.19	Peak
7	3760.00	-47.66	-63.80	-13.00	-34.66	16.14	Peak



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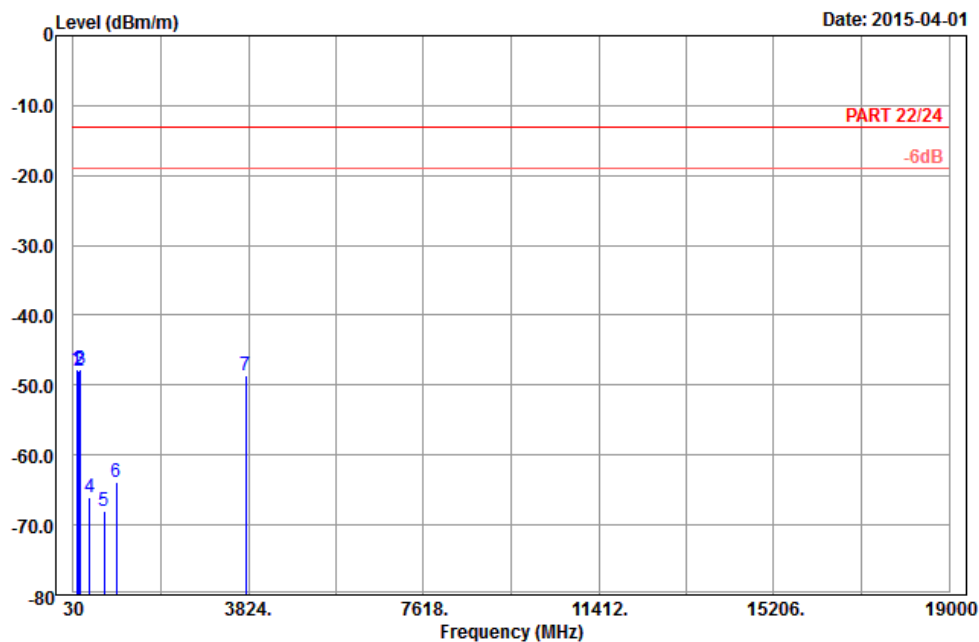


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Data: 14

Date: 2015-04-01



Site : 966 chamber 1  
Condition: PART 22/24 3m Vertical  
Remark : BC1\_Link\_CH600  
Tested by: Hwa Chiang  
Plane : X

			Read	Limit	Over	
	Freq	Level	Level	Line	Limit	Factor Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m
1 pp	97.77	-47.75	-37.52	-13.00	-34.75	-10.23 Peak
2	154.47	-47.98	-40.14	-13.00	-34.98	-7.84 Peak
3	188.22	-47.76	-42.06	-13.00	-34.76	-5.70 Peak
4	382.60	-66.04	-62.42	-13.00	-53.04	-3.62 Peak
5	689.90	-67.92	-67.59	-13.00	-54.92	-0.33 Peak
6	964.30	-63.93	-69.08	-13.00	-50.93	5.15 Peak
7	3760.00	-48.55	-64.69	-13.00	-35.55	16.14 Peak

## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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## 6 INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab:**

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.

## **7 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications were made to the EUT by the lab during the test.

**---END---**