



FCC RF Test Report

APPLICANT : LC Future Center
EQUIPMENT : Tablet PC
BRAND NAME : Lenovo
MODEL NAME : TP00089A
FCC ID : 2AJN7-TP00089ASI
STANDARD : FCC 47 CFR Part 2, 22(H), 24(E), 27(L)
CLASSIFICATION : PCS Licensed Transmitter (PCB)

The product were integrated the WWAN module (Model Name: EM7455, FCC ID: N7NEM7455) and the BT/WLAN module: 2x2 PCIe M.2 1216 SD adapter card (Brand Name: Intel, Model Name: 8265D2W, FCC ID: PD98265D2) during the test.

The product was received on Sep. 08, 2017 and testing was completed on Nov. 20, 2017. We, Sporton International (Kunshan) Inc. would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI/TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc. the test report shall not be reproduced except in full.



Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG790812A	Rev. 01	Initial issue of report	Nov. 29, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
	§22.913(a)(2)	Effective Radiated Power	< 7 Watts	PASS	-
	§24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts	PASS	-
	§27.50(d)(4)	Equivalent Isotropic Radiated Power	< 1 Watts	PASS	-
-	§24.232(d)	Peak-to-Average Ratio	< 13 dB	PASS	1
-	§2.1049 §22.917(b) §24.238(b) §27.53(g)	Occupied Bandwidth	Reporting Only	PASS	1
-	§2.1051 §22.917(a) §24.238(a) §27.53(h)	Band Edge Measurement	< 43+10log10(P[Watts])	PASS	1
-	§2.1051 §22.917(a) §24.238(a) §27.53(h)	Conducted Emission	< 43+10log10(P[Watts])	PASS	1
-	§2.1055 §22.355	Frequency Stability for Temperature & Voltage	< 2.5 ppm for Part 22H	PASS	1
	§2.1055 §24.235 §27.54		Within Authorized Band		
4.4	§2.1053 §22.917(a) §24.238(a) §27.53(h)	Field Strength of Spurious Radiation	< 43+10log10(P[Watts])	PASS	Under limit 28.29 dB at 2506.00 MHz
Remark 1: The conducted test items were leverage from module RF report "B15W50341-FCC-RF_Rev2".					



1 General Description

1.1 Applicant

LC Future Center

7F., No.780,Beian Rd., Zhongshan Dist.,Taipei. Taiwan

1.2 Manufacturer

Lenovo PC HK Limited

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, HongKong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Tablet PC
Brand Name	Lenovo
Model Name	TP00089A
FCC ID	2AJN7-TP00089ASI
EUT supports Radios application	WCDMA/HSPA/DC-HSDPA/ HSPA+ (16QAM uplink is not supported)/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth v3.0+EDR/ Bluetooth v4.0 LE/ Bluetooth v4.1 LE
IMEI Code	Conducted: 014583000473123 Radiation: 351822080258248
HW Version	1.0
SW Version	Win 10 Pro 10.0.15063
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are two samples of EUT, the only difference between two samples are just for the WWAN antenna and WLAN/BT antenna with different suppliers, they are equivalent-type antennas , antenna type and gain are all the same between sample 1 and sample 2 . According to the difference, we evaluate sample 1 for full test, sample 2 only verified the worst cases of sample 1 for RSE test item.
3. The worst cases of band 850/1700/1900 of RSE are located on LTE band, So the test result of Sample 2 are shown on LTE test report which can be referred to report number "FG790812B".

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	WCDMA: Band V: 826.4 MHz ~ 846.6 MHz Band II: 1852.4 MHz ~ 1907.6 MHz Band IV: 1712.4 MHz ~ 1752.6 MHz
Rx Frequency	WCDMA: Band V: 871.4 MHz ~ 891.6 MHz Band II: 1932.4 MHz ~ 1987.6 MHz Band IV: 2112.4 MHz ~ 2152.6 MHz
Maximum Output Power to Antenna	WCDMA: Band V: 23.10 dBm Band II: 23.72 dBm Band IV: 23.48 dBm
Antenna Type	LDS Antenna
Antenna Gain	Cellular Band: -3.0 dBi PCS Band: -2.5 dBi AWS Band: -3.4 dBi
Type of Modulation	WCDMA : BPSK (Uplink) HSDPA/DC-HSDPA : QPSK (Uplink) HSUPA : QPSK (Uplink) HSPA+ : 16QAM (16QAM uplink is not supported) DC-HSDPA : 64QAM

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Maximum ERP/EIRP Power

FCC Rule	System	Type of Modulation	Maximum ERP/EIRP (W)
Part 22H	WCDMA Band V RMC 12.2Kbps	BPSK	0.0624
Part 24E	WCDMA Band II RMC 12.2Kbps	BPSK	0.1324
Part 27L	WCDMA Band IV RMC 12.2Kbps	BPSK	0.1019

1.7 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No is CN5013.

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	TH01-KS	03CH03-KS	630927

Note: The test site complies with ANSI C63.4 2014 requirement.

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2, 22(H), 24(E), 27(L)
- ♦ ANSI/TIA-603-E
- ♦ FCC KDB 971168 D01 Power Meas License Digital Systems v03
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems V03 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

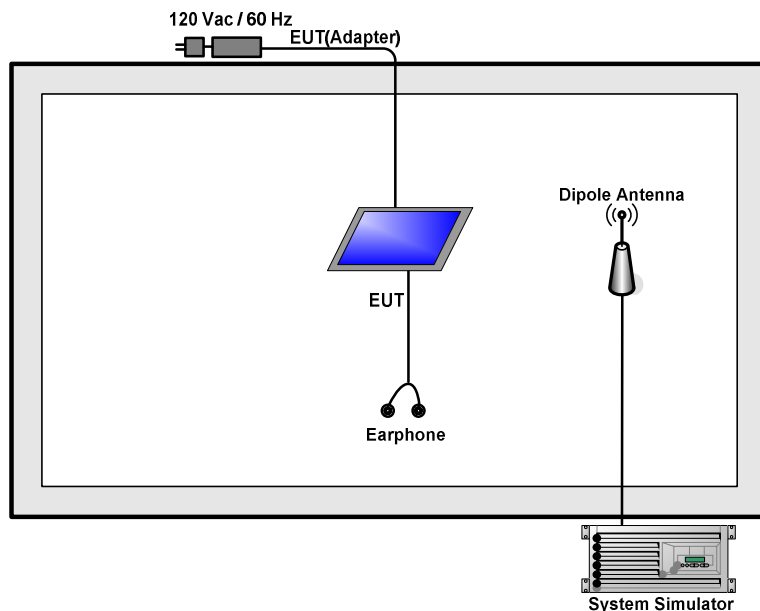
Radiated emissions were investigated from 30MHz To 10th harmonic.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Modes		
Band	Radiated TCs	Conducted TCs
WCDMA Band V	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link
WCDMA Band II	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link
WCDMA Band IV	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	DC Power Supply	GW	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
3.	Earphone	Lenovo	LH102	N/A	Unshielded, 1.2m	N/A

3 Conducted Test Result

3.1 Measuring Instruments

See list of measuring instruments of this test report.

3.2 Test Setup

3.2.1 Conducted Output Power



3.3 Test Result of Conducted Test

Please refer to Appendix A.

3.4 Conducted Output Power and ERP/EIRP

3.4.1 Description of the Conducted Output Power and ERP/EIRP

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 7 Watts for WCDMA Band V.

The EIRP of mobile transmitters must not exceed 2 Watts for WCDMA Band II.

The EIRP of mobile transmitters must not exceed 1 Watts for WCDMA Band IV.

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$, $ERP = EIRP - 2.15$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.4.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

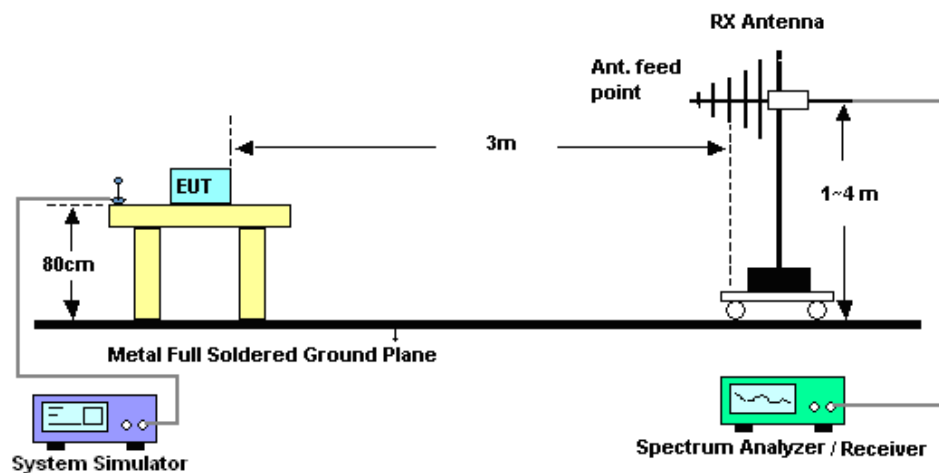
4 Radiated Test Items

4.1 Measuring Instruments

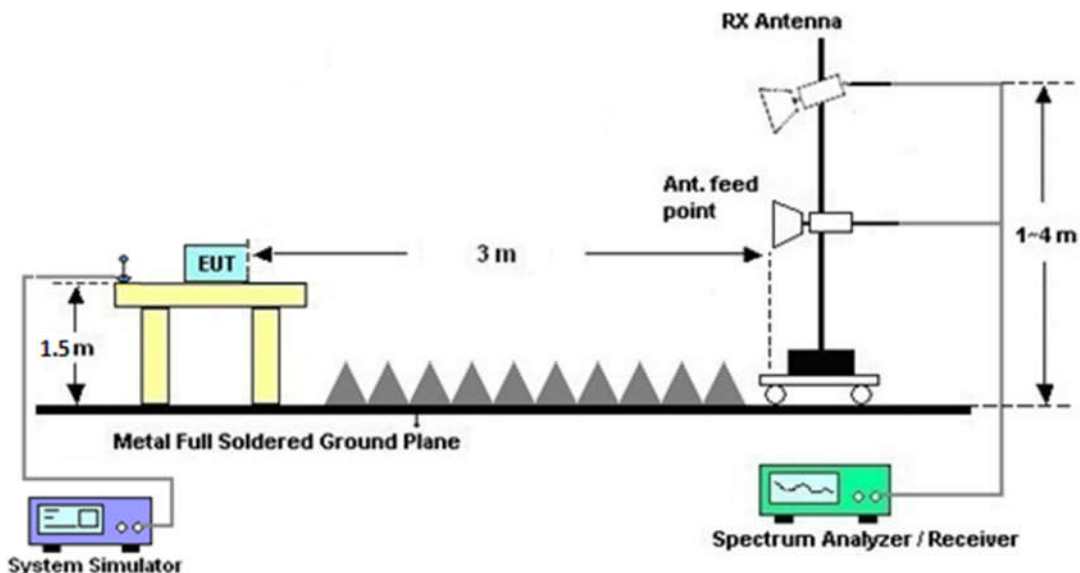
See list of measuring instruments of this test report.

4.2 Test Setup

4.2.1 For radiated test from 30MHz to 1GHz



4.2.2 For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

4.4 Field Strength of Spurious Radiation Measurement

4.4.1 Description of Field Strength of Spurious Radiated Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The testing follows FCC KDB 971168 D01 V03 Section 5.8 and ANSI / TIA-603-E Section 2.2.12.
2. The EUT was placed on a rotatable wooden table 0.8 meters for frequency below 1GHz and 1.5 meter for frequency above 1GHz above the ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
12. $ERP \text{ (dBm)} = EIRP - 2.15$
13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
14. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Radio communication analyzer	Anritsu	MT8820C	6201300652	2G/3G/LTE_full band	Aug. 08, 2017	Nov. 13, 2017	Aug. 07, 2018	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz~44GHz	Apr. 18, 2017	Nov. 20, 2017	Apr. 17, 2018	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	35406	25MHz~2GHz	Apr. 22, 2017	Nov. 20, 2017	Apr. 21, 2018	Radiation (03CH03-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1356	1GHz~18GHz	Apr. 22, 2017	Nov. 20, 2017	Apr. 21, 2018	Radiation (03CH03-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 15, 2017	Nov. 20, 2017	Feb. 14, 2018	Radiation (03CH03-KS)
Amplifier	com-power	PA-103A	161069	1MHz~1000MHz / 32 dB	Apr. 18, 2017	Nov. 20, 2017	Apr. 17, 2018	Radiation (03CH03-KS)
high gain Amplifier	MITEQ	AMF-7D-00 101800-30-1 0P	2025788	1GHz~18GHz	Apr. 18, 2017	Nov. 20, 2017	Apr. 17, 2018	Radiation (03CH03-KS)
Amplifier	Agilent	8449B	3008A02370	1GHz~26.5GHz	Oct. 12, 2017	Nov. 20, 2017	Oct. 11, 2018	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Nov. 20, 2017	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 20, 2017	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 20, 2017	NCR	Radiation (03CH03-KS)

NCR: No Calibration Required

6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.8dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.3dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.3dB
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

Conducted Power (*Unit: dBm)									
Band	WCDMA Band V			WCDMA Band II			WCDMA Band IV		
Channel	4132	4182	4233	9262	9400	9538	1312	1413	1513
Frequency	826.4	836.4	846.6	1852.4	1880	1907.6	1712.4	1732.6	1752.6
RMC 12.2Kbps	22.92	22.88	23.10	23.68	23.72	23.54	23.34	23.30	23.48
HSDPA Subtest-1	21.75	21.62	21.72	22.33	22.50	22.37	22.25	22.22	22.30
HSDPA Subtest-2	21.77	21.66	21.78	22.36	22.53	22.40	22.28	22.25	22.34
HSDPA Subtest-3	21.25	21.15	21.28	21.49	22.02	21.90	21.76	21.75	21.82
HSDPA Subtest-4	20.89	21.15	21.27	21.84	22.02	21.53	21.76	21.74	21.82
DC-HSDPA Subtest-1	21.54	21.53	21.69	21.72	21.80	21.69	21.78	21.67	21.85
DC-HSDPA Subtest-2	21.53	21.54	21.68	21.73	21.75	21.66	21.77	21.64	21.88
DC-HSDPA Subtest-3	21.55	21.55	21.67	21.75	21.81	21.67	21.76	21.63	21.89
DC-HSDPA Subtest-4	21.51	21.52	21.66	21.74	21.89	21.63	21.79	21.65	21.90
HSUPA Subtest-1	21.48	21.40	21.38	22.10	22.25	22.09	21.97	21.89	22.04
HSUPA Subtest-2	20.65	20.66	20.78	21.40	21.56	21.45	21.26	21.21	21.30
HSUPA Subtest-3	20.33	20.30	20.31	21.01	21.18	21.05	20.88	20.80	20.94
HSUPA Subtest-4	20.92	20.62	20.66	21.29	21.45	21.34	21.14	21.10	21.19
HSUPA Subtest-5	21.70	21.60	21.80	22.40	22.60	22.40	22.30	22.20	22.30

**ERP/EIRP**

WCDMA Band V ($G_T - L_C = -3.0\text{dB}$)			
Channel	4132	4182	4233
	(Low)	(Mid)	(High)
Frequency	826.4	836.4	846.6
(MHz)			
Conducted Power (dBm)	22.92	22.88	23.10
Conducted Power (Watts)	0.1959	0.1941	0.2042
ERP(dBm)	17.77	17.73	17.95
ERP(Watts)	0.0598	0.0593	0.0624

WCDMA Band II ($G_T - L_C = -2.5\text{dB}$)			
Channel	9262	9400	9538
	(Low)	(Mid)	(High)
Frequency	1852.4	1880	1907.6
(MHz)			
Conducted Power (dBm)	23.68	23.72	23.54
Conducted Power (Watts)	0.2333	0.2355	0.2259
EIRP(dBm)	21.18	21.22	21.04
EIRP(Watts)	0.1312	0.1324	0.1271

WCDMA Band IV ($G_T - L_C = -3.40\text{dB}$)			
Channel	1312	1413	1513
	(Low)	(Mid)	(High)
Frequency	1712.4	1732.6	1752.6
(MHz)			
Conducted Power (dBm)	23.34	23.30	23.48
Conducted Power (Watts)	0.2158	0.2138	0.2228
EIRP(dBm)	19.94	19.90	20.08
EIRP(Watts)	0.0986	0.0977	0.1019



Appendix B. Test Results of Radiated Test

Radiated Spurious Emission

WCDMA Band V(RMC 12.2Kbps)									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Low	1652	-64.32	-13	-51.32	-66.92	-66.64	1.33	5.80	H
	2484	-45.85	-13	-32.85	-57.23	-49.02	1.58	6.90	H
	3306	-61.94	-13	-48.94	-71.15	-65.44	1.85	7.50	H
	1652	-65.02	-13	-52.02	-66.89	-67.34	1.33	5.80	V
	2482	-51.74	-13	-38.74	-60.63	-54.91	1.58	6.90	V
	3306	-61.72	-13	-48.72	-70.74	-65.22	1.85	7.50	V
Middle	1674	-54.12	-13	-41.12	-58.35	-56.44	1.33	5.80	H
	2506	-41.29	-13	-28.29	-53.54	-44.46	1.58	6.90	H
	3345	-62.31	-13	-49.31	-71.52	-65.81	1.85	7.50	H
	1672	-64.78	-13	-51.78	-66.65	-67.10	1.33	5.80	V
	2508	-53.14	-13	-40.14	-61.27	-56.31	1.58	6.90	V
	3345	-63.16	-13	-50.16	-72.18	-66.66	1.85	7.50	V
High	1694	-63.90	-13	-50.90	-66.50	-66.22	1.33	5.80	H
	2536	-51.30	-13	-38.30	-60.91	-54.47	1.58	6.90	H
	3387	-62.62	-13	-49.62	-71.83	-66.12	1.85	7.50	H
	1694	-64.99	-13	-51.99	-66.86	-67.31	1.33	5.80	V
	2536	-53.06	-13	-40.06	-61.21	-56.23	1.58	6.90	V
	3387	-62.27	-13	-49.27	-71.29	-65.77	1.85	7.50	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



WCDMA Band II(RMC 12.2Kbps)									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Low	3696	-59.79	-13	-46.79	-67.17	-64.96	1.83	7.00	H
	5544	-57.55	-13	-44.55	-69.72	-65.17	2.18	9.80	H
	7392	-52.42	-13	-39.42	-69.65	-62.09	2.53	12.20	H
	3696	-58.99	-13	-45.99	-67.84	-64.16	1.83	7.00	V
	5544	-53.96	-13	-40.96	-68.13	-61.58	2.18	9.80	V
	7392	-47.87	-13	-34.87	-68.97	-57.54	2.53	12.20	V
Middle	3760	-60.13	-13	-47.13	-67.51	-65.30	1.83	7.00	H
	5640	-55.80	-13	-42.80	-67.97	-63.42	2.18	9.80	H
	7520	-52.47	-13	-39.47	-69.70	-62.14	2.53	12.20	H
	3760	-59.09	-13	-46.09	-67.94	-64.26	1.83	7.00	V
	5640	-55.24	-13	-42.24	-69.41	-62.86	2.18	9.80	V
	7520	-48.27	-13	-35.27	-69.37	-57.94	2.53	12.20	V
High	3807	-60.20	-13	-47.20	-67.58	-65.37	1.83	7.00	H
	5709	-57.05	-13	-44.05	-69.22	-64.67	2.18	9.80	H
	7614	-51.57	-13	-38.57	-68.80	-61.24	2.53	12.20	H
	3807	-57.45	-13	-44.45	-66.3	-62.62	1.83	7.00	V
	5709	-54.37	-13	-41.37	-68.54	-61.99	2.18	9.80	V
	7614	-48.96	-13	-35.96	-70.06	-58.63	2.53	12.20	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



WCDMA Band IV(RMC 12.2Kbps)									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Low	3426	-58.53	-13	-45.53	-66.81	-63.67	1.81	6.95	H
	5136	-52.64	-13	-39.64	-67.20	-59.71	2.23	9.30	H
	6849	-55.10	-13	-42.10	-74.45	-63.38	2.60	10.88	H
	3426	-65.38	-13	-52.38	-71.18	-70.52	1.81	6.95	V
	5136	-59.15	-13	-46.15	-73.45	-66.22	2.23	9.30	V
	6849	-56.04	-13	-43.04	-74.58	-64.32	2.6	10.88	V
Middle	3465	-57.85	-13	-44.85	-66.13	-62.99	1.81	6.95	H
	5199	-52.31	-13	-39.31	-66.87	-59.38	2.23	9.30	H
	6930	-50.56	-13	-37.56	-69.91	-58.84	2.60	10.88	H
	3465	-60.69	-13	-47.69	-66.49	-65.83	1.81	6.95	V
	5199	-54.90	-13	-41.90	-69.2	-61.97	2.23	9.30	V
	6930	-52.15	-13	-39.15	-70.69	-60.43	2.6	10.88	V
High	3504	-58.97	-13	-45.97	-67.25	-64.11	1.81	6.95	H
	5259	-54.70	-13	-41.70	-69.26	-61.77	2.23	9.30	H
	7011	-54.84	-13	-41.84	-74.19	-63.12	2.60	10.88	H
	3504	-65.55	-13	-52.55	-71.35	-70.69	1.81	6.95	V
	5259	-58.86	-13	-45.86	-73.16	-65.93	2.23	9.30	V
	7011	-54.89	-13	-41.89	-73.43	-63.17	2.6	10.88	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.