FCC RADIO TEST REPORT

FCC ID	:	**PU5-TP00132A**
Equipment	:	**Notebook Computer**
Brand Name	:	**Lenovo**
Model Name	:	**TP00132A**
Applicant	:	**Wistron Corporation** **21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan**
Manufacturer	:	**Wistron Corporation** **21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan**
Standard	:	**FCC 47 CFR Part 2, 22(H), 24(E), 27(L)**

Equipment: Foxconn T99W175 tested inside of Lenovo Notebook Computer.

The product was received on May 04, 2021 and testing was started from May 19, 2021 and completed on Jun. 15, 2021. We, Sporton International Inc. Wensan Laboratory, 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 partial report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan

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History of this test report

Report No.	Version	Description	Issued Date
FG150417A	01	Initial issue of report	Jun. 29, 2021
FG150417A	02	Revise list of measuring equipment	Jul. 20, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	§2.1046	Conducted Output Power	-	See Note
	§22.913 (a)(5)	Effective Radiated Power (WCDMA Band V)		
	§24.232 (c)	Equivalent Isotropic Radiated Power (WCDMA Band II)		
	§27.50 (d)(4)	Equivalent Isotropic Radiated Power (WCDMA Band IV)		
-	§24.232 (d)	Peak-to-Average Ratio	-	See Note
-	§2.1049 §22.917 (b) §24.238 (b) §27.53 (g)	Occupied Bandwidth (WCDMA Band V) (WCDMA Band II) (WCDMA Band IV)	-	See Note
-	§2.1051 §22.917 (a) §24.238 (a) §27.53 (g)	Band Edge Measurement (WCDMA Band V) (WCDMA Band II) (WCDMA Band IV)	-	See Note
-	§2.1051 §22.917 (a) §24.238 (a) §27.53 (g)	Conducted Emission (WCDMA Band V) (WCDMA Band II) (WCDMA Band IV)	-	See Note
-	§2.1055 §22.355 §24.235 §27.54	Frequency Stability Temperature & Voltage	-	See Note
3.4	§2.1053 §22.917 (a) §24.238 (a) §27.53 (h)	Field Strength of Spurious Radiation (WCDMA Band V) (WCDMA Band II) (WCDMA Band IV)	Pass	Under limit 34.28 dB at 7410.000 MHz

Note: The module (Model: T99W175) makes no difference after verifying output power, this report reuses test data from the module report.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sheng Kuo

Report Producer: Celery Wei

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00132A
FCC ID	PU5-TP00132A
Sample 1	EUT with LUXSHARE-ICT Antenna
Sample 2	EUT with AVX/ Ethertronics Antenna
EUT supports Radios application	WCDMA/HSPA/LTE/5G NR/GNSS
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.

2. Equipment: Foxconn T99W175 tested inside of Lenovo Notebook Computer.

Antenna Information					
WWAN					**3G&LTE (dBi)**
Antenna	**Manufacturer**	AVX/ Ethertronics		**Peak gain**	1.93
	Part number	Main Antenna:	025.901TF.0001	**Type**	PIFA
		Auxiliary Antenna:	025.901TG.0001 (Rx only)		
		MIMO1 Antenna	025.901TF.0001 (Rx only)		
		MIMO2 Antenna	025.901TG.0001		
Antenna	**Manufacturer**	LUXSHARE-ICT		**Peak gain**	1.9
	Part number	Main Antenna:	025.901TK.0001	**Type**	PIFA
		Auxiliary Antenna:	025.901TL.0001 (Rx only)		
		MIMO1 Antenna	025.901TK.0001 (Rx only)		
		MIMO2 Antenna	025.901TL.0001		

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. All test items were performed with Main Antenna (AVX/ Ethertronics Antenna).

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
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
Type of Modulation	WCDMA: BPSK (Uplink) HSDPA: 64QAM (Downlink) HSUPA: QPSK (Uplink)

1.3 Modification of EUT

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

1.4 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan
Test Site No.	**Sporton Site No.**
	03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang and Chuan Chu
Temperature	22.3~26.4℃
Relative Humidity	58~66%

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

FCC Designation No.: TW3786

1.5 Applicable Standards

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

- ANSI C63.26-2015
- ANSI / TIA-603-E
- FCC 47 CFR Part 2, 22(H), 24(E), 27(L)
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 414788 D01 Radiated Test Site v01r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

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 v03r01 with maximum output power.

Radiated emissions were investigated as following frequency range:

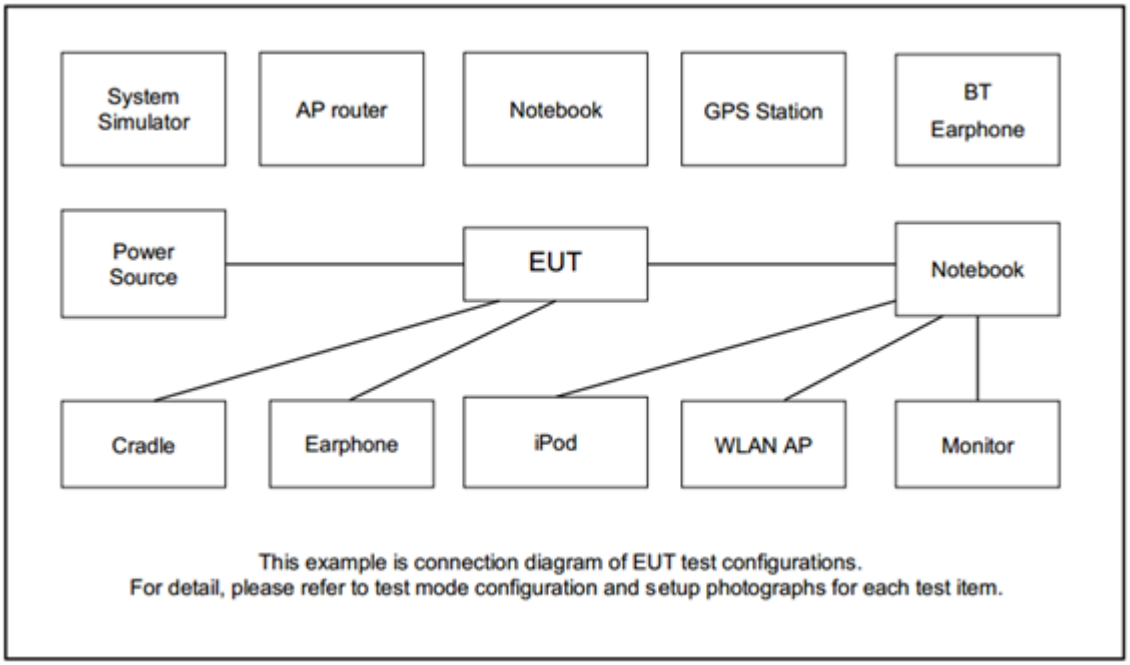
1. 30 MHz to 9000 MHz for WCDMA Band V
2. 30 MHz to 18000 MHz for WCDMA Band IV
3. 30 MHz to 19100 MHz for WCDMA Band II

All modes, data rates and positions were investigated.

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

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

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Brand 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.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.4 Frequency List of Low/Middle/High Channels

Frequency List				
Band	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
WCDMA Band V	Channel	4132	4182	4233
	Frequency	826.4	836.4	846.6
WCDMA Band II	Channel	9262	9400	9538
	Frequency	1852.4	1880.0	1907.6
WCDMA Band IV	Channel	1312	1413	1513
	Frequency	1712.4	1732.6	1752.6

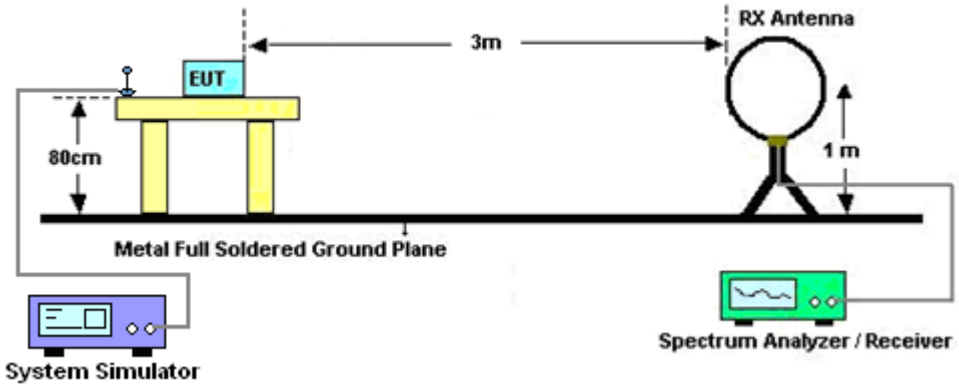
3 Radiated Test Items

3.1 Measuring Instruments

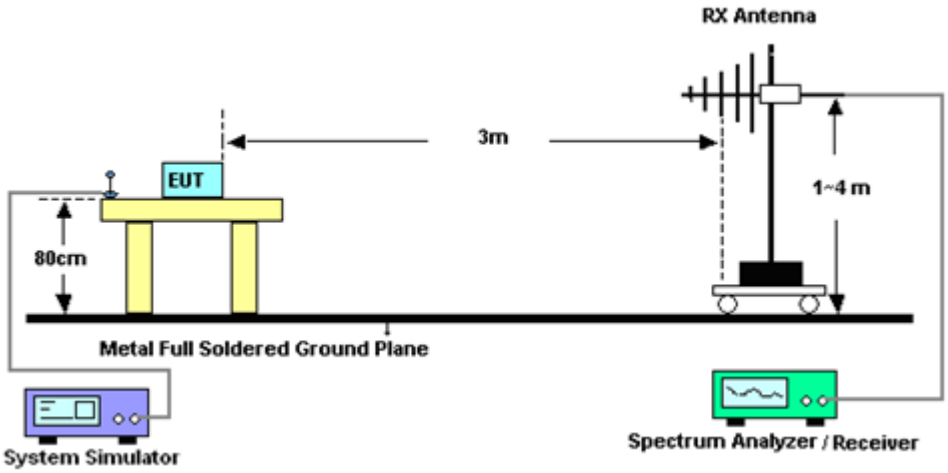
See list of measuring instruments of this test report.

3.2 Test Setup

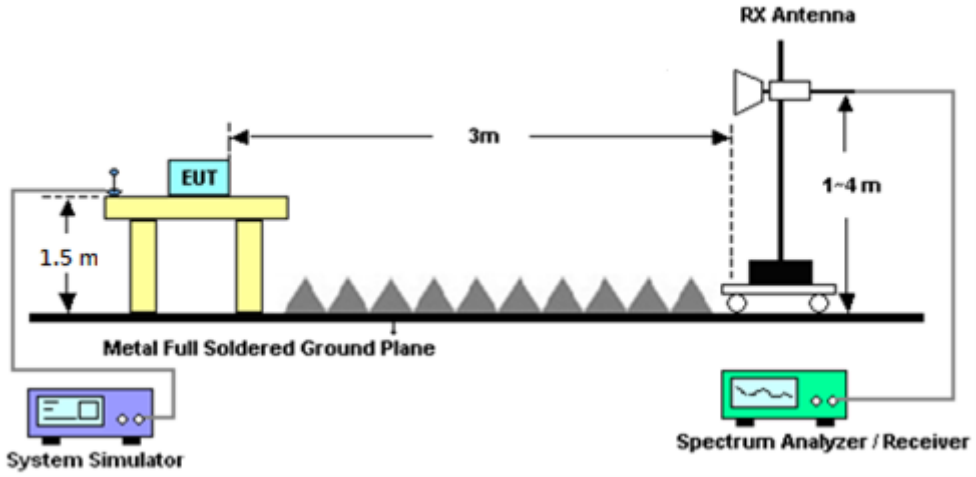
For radiated test below 30MHz



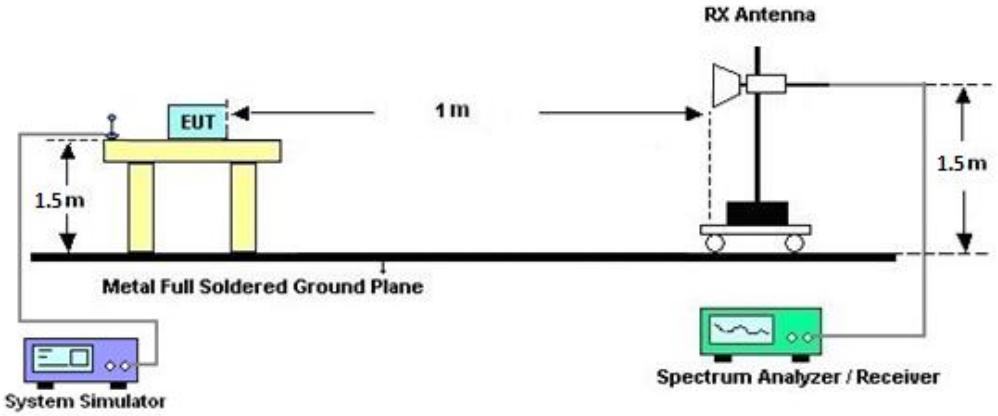
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.3 Test Result of Radiated Test

Please refer to Appendix A.

Note:

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.4 Field Strength of Spurious Radiation Measurement

3.4.1 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.

3.4.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a rotatable wooden table 0.8 meters for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz above the ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. 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.
5. Make the measurement with the spectrum analyzer's RBW = 1 MHz, VBW = 3 MHz, taking record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Take the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
11. ERP (dBm) = EIRP - 2.15
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
13. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jul. 14, 2020	May 19, 2021~ Jun. 15, 2021	Jul. 13, 2021	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	37059 & 01	30MHz~1GHz	Oct. 11, 2020	May 19, 2021~ Jun. 15, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 11, 2020	May 19, 2021~ Jun. 15, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 23, 2020	May 19, 2021~ Jun. 15, 2021	Nov. 22, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz~18GHz	May 18, 2021	May 19, 2021~ Jun. 15, 2021	May 17, 2022	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 19, 2020	May 19, 2021~ Jun. 15, 2021	Nov. 18, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170980	18GHz~40GHz	Jan. 11, 2021	May 19, 2021~ Jun. 15, 2021	Jan. 10, 2022	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 24, 2021	May 19, 2021~ Jun. 15, 2021	Mar. 23, 2022	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY57280120	1GHz~26.5GHz	Jul. 20, 2020	May 19, 2021~ Jun. 15, 2021	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	E-INSTRUMENT TECH LTD.	ERA-100M-18G-56-01-A70	EC1900249	1GHz~18GHz	Dec. 05, 2020	May 19, 2021~ Jun. 15, 2021	Dec. 04, 2021	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	May 19, 2021~ Jun. 15, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Sep. 14, 2020	May 19, 2021~ Jun. 15, 2021	Sep. 13, 2021	Radiation (03CH12-HY)
Signal Generator	Rohde & Schwarz	SMB100A	101107	100kHz~40GHz	Dec. 04, 2020	May 19, 2021~ Jun. 15, 2021	Dec. 03, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 11, 2020	May 19, 2021~ Jun. 15, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 22, 2021	May 19, 2021~ Jun. 15, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 22, 2021	May 19, 2021~ Jun. 15, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2GHz Low Pass Filter	Mar. 17, 2021	May 19, 2021~ Jun. 15, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60SS	SN1	1.2GHz High Pass Filter	Mar. 17, 2021	May 19, 2021~ Jun. 15, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3GHz High Pass Filter	Jul. 14, 2020	May 19, 2021~ Jun. 15, 2021	Jul. 13, 2021	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	May 19, 2021~ Jun. 15, 2021	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	May 19, 2021~ Jun. 15, 2021	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	May 19, 2021~ Jun. 15, 2021	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	May 19, 2021~ Jun. 15, 2021	N/A	Radiation (03CH12-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.07dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.21dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.80dB**

Appendix A. Test Results of Radiated Test

WCDMA 850

WCDMA 850									
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)
Lowest	1656	-53.44	-13	-40.44	-61.89	-59.06	0.92	8.69	H
	2480	-58.90	-13	-45.90	-72.36	-66.28	1.15	10.67	H
	3304	-57.52	-13	-44.52	-72.84	-66.07	1.32	12.03	H
									H
									H
									H
	1656	-55.83	-13	-42.83	-63.71	-61.45	0.92	8.69	V
	2480	-58.79	-13	-45.79	-72.42	-66.17	1.15	10.67	V
	3304	-56.97	-13	-43.97	-72.76	-65.52	1.32	12.03	V
									V
									V
									V
Middle	1672	-50.89	-13	-37.89	-59.39	-56.57	0.93	8.75	H
	2512	-57.69	-13	-44.69	-71.18	-65.10	1.15	10.71	H
	3344	-57.57	-13	-44.57	-72.79	-66.21	1.33	12.13	H
									H
									H
									H
	1672	-51.69	-13	-38.69	-59.56	-57.37	0.93	8.75	V
	2512	-58.59	-13	-45.59	-72.27	-66.00	1.15	10.71	V
	3344	-57.07	-13	-44.07	-72.74	-65.71	1.33	12.13	V
									V
									V
									V

Highest	1696	-52.05	-13	-39.05	-60.61	-57.81	0.94	8.84	H
	2536	-57.65	-13	-44.65	-71.14	-65.08	1.16	10.74	H
	3384	-57.46	-13	-44.46	-72.59	-66.19	1.34	12.22	H
									H
									H
									H
	1696	-55.06	-13	-42.06	-62.91	-60.82	0.94	8.84	V
	2536	-56.01	-13	-43.01	-69.63	-63.44	1.16	10.74	V
	3384	-57.05	-13	-44.05	-72.62	-65.78	1.34	12.22	V
									V
									V
									V

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

WCDMA 1700

WCDMA 1700									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3427	-56.75	-13	-43.75	-72.74	-67.73	1.35	12.32	H
	5135	-52.12	-13	-39.12	-74.07	-63.26	1.65	12.79	H
	6850	-49.06	-13	-36.06	-74.47	-59.43	1.74	12.11	H
									H
									H
									H
	3427	-56.41	-13	-43.41	-72.81	-67.39	1.35	12.32	V
	5135	-52.16	-13	-39.16	-73.86	-63.30	1.65	12.79	V
	6850	-49.35	-13	-36.35	-74.35	-59.72	1.74	12.11	V
									V
									V
									V
Middle	3462	-56.58	-13	-43.58	-72.91	-67.64	1.35	12.41	H
	5198	-52.22	-13	-39.22	-74.15	-63.44	1.66	12.88	H
	6927	-48.09	-13	-35.09	-73.88	-58.36	1.73	12.00	H
									H
									H
									H
	3462	-55.90	-13	-42.90	-72.62	-66.96	1.35	12.41	V
	5198	-52.74	-13	-39.74	-74.51	-63.96	1.66	12.88	V
	6927	-48.66	-13	-35.66	-74	-58.93	1.73	12.00	V
									V
									V
									V

Highest	3504	-56.04	-13	-43.04	-72.76	-67.18	1.36	12.50	H
	5254	-52.64	-13	-39.64	-74.77	-63.92	1.68	12.96	H
	7011	-47.44	-13	-34.44	-73.65	-57.60	1.73	11.88	H
									H
									H
									H
	3504	-55.72	-13	-42.72	-72.79	-66.86	1.36	12.50	V
	5254	-52.60	-13	-39.60	-74.5	-63.88	1.68	12.96	V
	7011	-47.86	-13	-34.86	-73.58	-58.02	1.73	11.88	V
									V
									V
									V

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

WCDMA 1900

WCDMA 1900									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3702	-54.92	-13	-41.92	-72.85	-66.13	1.41	12.62	H
	5556	-50.67	-13	-37.67	-73.82	-62.23	1.74	13.30	H
	7410	-47.28	-13	-34.28	-74.07	-56.58	1.94	11.24	H
									H
									H
									H
	3702	-54.76	-13	-41.76	-72.84	-65.97	1.41	12.62	V
	5556	-51.06	-13	-38.06	-73.75	-62.62	1.74	13.30	V
	7410	-47.49	-13	-34.49	-74.13	-56.79	1.94	11.24	V
									V
									V
									V
Middle	3762	-54.56	-13	-41.56	-72.76	-65.79	1.43	12.66	H
	5640	-50.73	-13	-37.73	-73.95	-62.30	1.73	13.30	H
	7518	-47.83	-13	-34.83	-74.11	-56.94	1.99	11.10	H
									H
									H
									H
	3762	-54.22	-13	-41.22	-72.64	-65.45	1.43	12.66	V
	5640	-51.17	-13	-38.17	-73.98	-62.74	1.73	13.30	V
	7518	-47.58	-13	-34.58	-73.82	-56.69	1.99	11.10	V
									V
									V
									V

Highest	3816	-54.69	-13	-41.69	-73.1	-65.94	1.44	12.69	H
	5724	-50.35	-13	-37.35	-74	-61.92	1.73	13.30	H
	7632	-48.25	-13	-35.25	-74.1	-57.37	2.01	11.13	H
									H
									H
									H
	3816	-54.43	-13	-41.43	-73.08	-65.68	1.44	12.69	V
	5724	-51.21	-13	-38.21	-74.23	-62.78	1.73	13.30	V
	7632	-48.20	-13	-35.20	-73.96	-57.32	2.01	11.13	V
									V
									V
									V

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