



FCC RADIO TEST REPORT

FCC ID : PU5-TP00127A
Equipment : Notebook Computer
Brand Name : Lenovo
Model Name : TP00127A
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: Quectel EM120R-GL tested inside of Lenovo Notebook Computer.

The product was received on Dec. 16, 2020 and testing was started from Dec. 27, 2020 and completed on Feb. 02, 2021. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications 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. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan



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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)(2)	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 34.31 dB at 7409.000 MHz

Note: The module (Model: EM120R-GL) 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: Wii Chang

Report Producer: Amy Chen



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00127A
FCC ID	PU5-TP00127A
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS/NFC/UWB
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Quectel EM120R-GL tested inside of Lenovo Notebook Computer.

WWAN Antenna Information				
Main Antenna	Manufacturer	AWAN	Peak gain (dBi)	2.19
	Part number	025.901S1.0021	Type	PIFA

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

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. EMC & Wireless Communications Laboratory
Test Site Location	No.58 , Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan
Test Site No.	Sporton Site No. 03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang and Chuan Chu
Temperature	22.3~26.4°C
Relative Humidity	58~66%

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

FCC Designation No.: TW0007

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.

For radiated measurement, pre-scanned in Tablet type (three orthogonal panels, X, Y, Z) and Notebook type. The worst cases (Z Plane for Cellular Band ; X Plane for AWS Band; Notebook Type for PCS Band) were recorded in this report.

Radiated emissions were investigated as following frequency range:

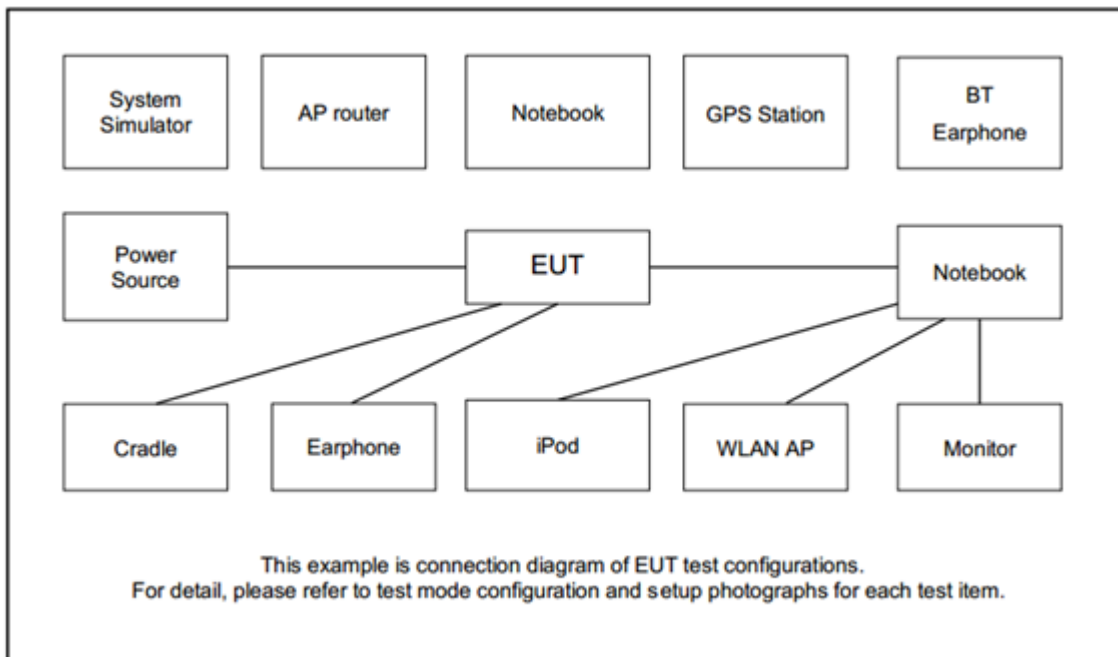
1. 30 MHz to 9000 MHz for WCDMA Band V
2. 30 MHz to 18000 MHz for WCDMA Band IV
3. 30 MHz to 19100 MHz for WCDMA Band II

All modes 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
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	Anritsu	MT8821C	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

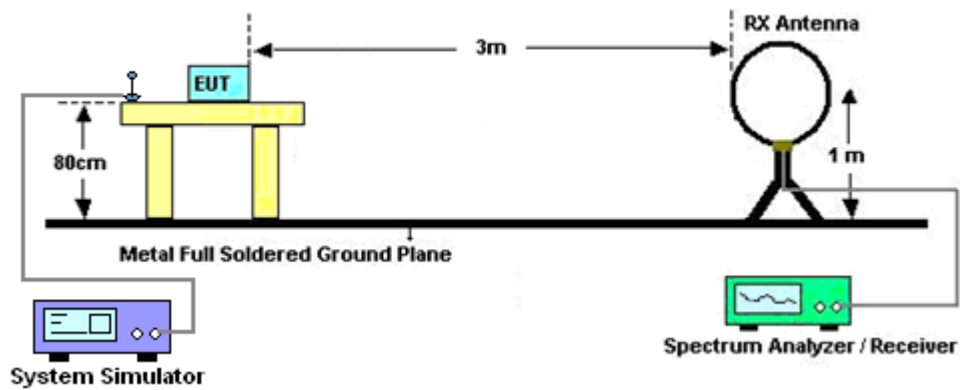
3 Radiated Test Items

3.1 Measuring Instruments

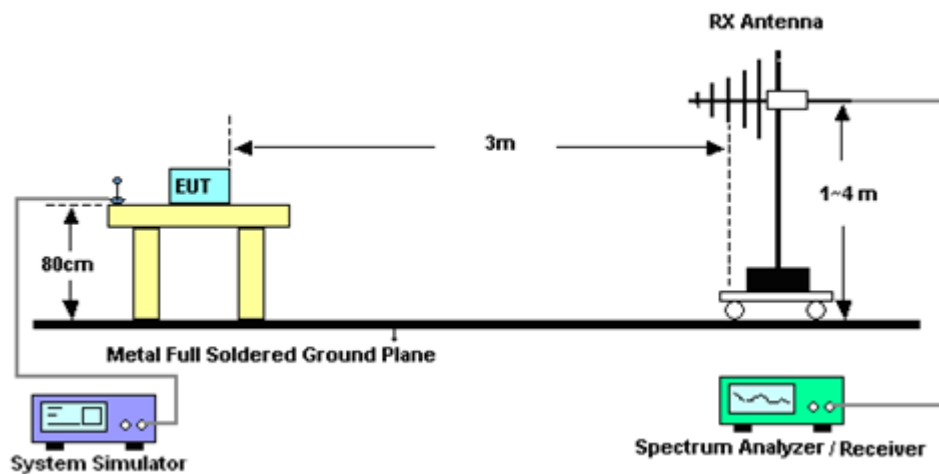
See list of measuring instruments of this test report.

3.2 Test Setup

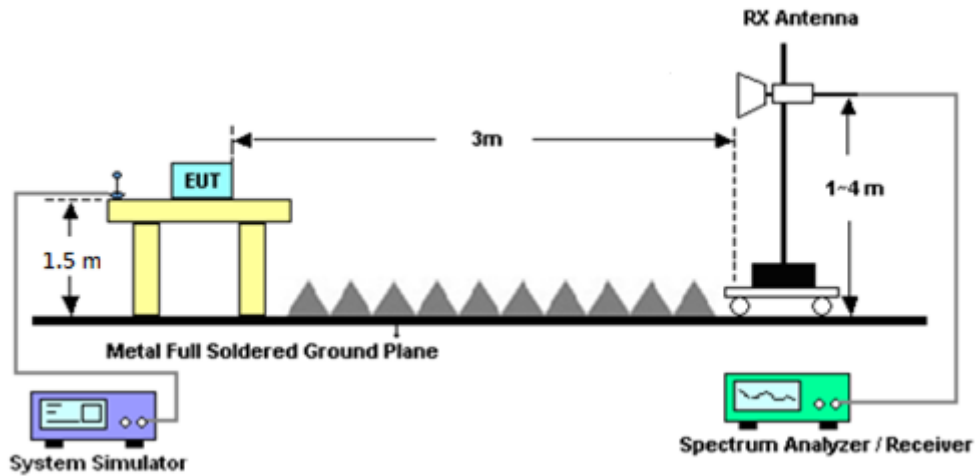
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.3 Test Result of Radiated Test

Please refer to Appendix A.

Note:

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

There is a comparison data 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 1GHz and 1.5 meter for frequency above 1GHz 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 = 1MHz, VBW = 3MHz, 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. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
11. $ERP \text{ (dBm)} = EIRP - 2.15$
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
13. The limit line is derived from $43 + 10\log(P)$ 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	Dec. 27, 2020~ Feb. 02, 2021	Jul. 13, 2021	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	40103 & 07	30MHz~1GHz	Apr. 29, 2020	Dec. 27, 2020~ Feb. 02, 2021	Apr. 28, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 23, 2020	Dec. 27, 2020~ Feb. 02, 2021	Nov. 22, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120D	9120D-1212	1GHz ~ 18GHz	May 20, 2020	Dec. 27, 2020~ Feb. 02, 2021	May 19, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170584	18GHz~40GHz	Dec. 11, 2020	Dec. 27, 2020~ Feb. 02, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170980	18GHz ~ 40GHz	Jan. 10, 2020	Dec. 27, 2020~ Jan. 08, 2021	Jan. 09, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170980	18GHz ~ 40GHz	Jan. 11, 2021	Jan. 11, 2021~ Feb. 02, 2021	Jan. 10, 2022	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 25, 2020	Dec. 27, 2020~ Feb. 02, 2021	Mar. 24, 2021	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY57280120	1GHz~26.5GHz	Jul. 20, 2020	Dec. 27, 2020~ Feb. 02, 2021	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03K	171000180005 4002	1GHz~18GHz	Feb. 07, 2020	Dec. 27, 2020~ Feb. 02, 2021	Feb. 06, 2021	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Dec. 27, 2020~ Feb. 02, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY54200485	10Hz~44GHz	Feb. 10, 2020	Dec. 27, 2020~ Feb. 02, 2021	Feb. 09, 2021	Radiation (03CH12-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Feb. 15, 2020	Dec. 27, 2020~ Feb. 02, 2021	Feb. 14, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 12, 2020	Dec. 27, 2020~ Feb. 02, 2021	Mar. 11, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 11, 2020	Dec. 27, 2020~ Feb. 02, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 25, 2020	Dec. 27, 2020~ Feb. 02, 2021	Feb. 24, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 25, 2020	Dec. 27, 2020~ Feb. 02, 2021	Feb. 24, 2021	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Dec. 27, 2020~ Feb. 02, 2021	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1m~4m	N/A	Dec. 27, 2020~ Feb. 02, 2021	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Dec. 27, 2020~ Feb. 02, 2021	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Dec. 27, 2020~ Feb. 02, 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% ($U = 2Uc(y)$)	3.07
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.21
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.80
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Appendix A. Test Results of Radiated Test

WCDMA Band V

WCDMA Band V									
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	1652	-57.47	-13	-44.47	-65.99	-63.08	0.92	8.68	H
	2479	-59.09	-13	-46.09	-72.65	-66.47	1.15	10.67	H
	3305	-57.83	-13	-44.83	-73.02	-66.39	1.32	12.03	H
									H
									H
									H
	1652	-59.87	-13	-46.87	-67.76	-65.48	0.92	8.68	V
	2479	-58.35	-13	-45.35	-72.11	-65.73	1.15	10.67	V
	3305	-57.28	-13	-44.28	-72.93	-65.84	1.32	12.03	V
									V
									V
									V
Middle	1672	-62.02	-13	-49.02	-70.54	-67.70	0.93	8.75	H
	2509	-58.80	-13	-45.80	-72.36	-66.21	1.15	10.71	H
	3345	-57.42	-13	-44.42	-72.61	-66.07	1.33	12.13	H
									H
									H
									H
	1672	-61.63	-13	-48.63	-69.52	-67.31	0.93	8.75	V
	2509	-58.48	-13	-45.48	-72.24	-65.89	1.15	10.71	V
	3345	-56.76	-13	-43.76	-72.41	-65.41	1.33	12.13	V
									V
									V
									V



Highest	1693	-59.98	-13	-46.98	-68.56	-65.73	0.94	8.83	H
	2539	-59.48	-13	-46.48	-73.05	-66.92	1.16	10.75	H
	3386	-57.34	-13	-44.34	-72.43	-66.08	1.34	12.23	H
									H
									H
									H
	1693	-61.04	-13	-48.04	-68.92	-66.79	0.94	8.83	V
	2539	-59.35	-13	-46.35	-73.04	-66.79	1.16	10.75	V
	3386	-57.50	-13	-44.50	-73.02	-66.24	1.34	12.23	V
									V
									V
									V

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



WCDMA Band IV

WCDMA Band IV									
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	-57.11	-13	-44.11	-73.1	-68.09	1.35	12.32	H
	5135	-51.70	-13	-38.70	-73.65	-62.84	1.65	12.79	H
	6850	-49.05	-13	-36.05	-74.46	-59.42	1.74	12.11	H
									H
									H
									H
	3427	-55.58	-13	-42.58	-71.98	-66.56	1.35	12.32	V
	5135	-52.63	-13	-39.63	-74.33	-63.77	1.65	12.79	V
	6850	-49.62	-13	-36.62	-74.62	-59.99	1.74	12.11	V
									V
									V
									V
Middle	3462	-56.83	-13	-43.83	-73.16	-67.89	1.35	12.41	H
	5198	-52.67	-13	-39.67	-74.6	-63.89	1.66	12.88	H
	6927	-48.07	-13	-35.07	-73.86	-58.34	1.73	12.00	H
									H
									H
									H
	3462	-56.07	-13	-43.07	-72.79	-67.13	1.35	12.41	V
	5198	-52.77	-13	-39.77	-74.54	-63.99	1.66	12.88	V
	6927	-48.72	-13	-35.72	-74.06	-58.99	1.73	12.00	V
									V
									V
									V



Highest	3504	-56.21	-13	-43.21	-72.93	-67.35	1.36	12.50	H
	5254	-52.43	-13	-39.43	-74.56	-63.71	1.68	12.96	H
	7011	-47.66	-13	-34.66	-73.87	-57.82	1.73	11.88	H
									H
									H
									H
	3504	-55.07	-13	-42.07	-72.14	-66.21	1.36	12.50	V
	5254	-52.96	-13	-39.96	-74.86	-64.24	1.68	12.96	V
	7011	-48.17	-13	-35.17	-73.89	-58.33	1.73	11.88	V
									V
									V
									V

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



WCDMA Band II

WCDMA Band II									
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	-56.15	-13	-43.15	-74.11	-67.36	1.41	12.62	H
	5557	-51.19	-13	-38.19	-74.34	-62.75	1.74	13.30	H
	7409	-47.31	-13	-34.31	-74.1	-56.61	1.94	11.25	H
									H
									H
									H
	3702	-56.05	-13	-43.05	-74.15	-67.26	1.41	12.62	V
	5557	-52.06	-13	-39.06	-74.76	-63.62	1.74	13.30	V
	7409	-47.36	-13	-34.36	-74	-56.66	1.94	11.25	V
									V
									V
									V
Middle	3760	-55.99	-13	-42.99	-74.19	-67.22	1.43	12.66	H
	5640	-52.06	-13	-39.06	-75.28	-63.63	1.73	13.30	H
	7520	-47.81	-13	-34.81	-74.08	-56.92	1.99	11.10	H
									H
									H
									H
	3760	-55.63	-13	-42.63	-74.04	-66.86	1.43	12.66	V
	5640	-52.28	-13	-39.28	-75.09	-63.85	1.73	13.30	V
	7520	-48.27	-13	-35.27	-74.51	-57.38	1.99	11.10	V
									V
									V
									V



Highest	3815	-55.69	-13	-42.69	-74.1	-66.94	1.44	12.69	H
	5722	-50.79	-13	-37.79	-74.44	-62.36	1.73	13.30	H
	7630	-48.20	-13	-35.20	-74.05	-57.32	2.01	11.13	H
									H
									H
									H
	3815	-54.78	-13	-41.78	-73.42	-66.03	1.44	12.69	V
	5722	-51.40	-13	-38.40	-74.42	-62.97	1.73	13.30	V
	7630	-48.86	-13	-35.86	-74.62	-57.98	2.01	11.13	V
									V
									V
									V

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