Testing Laboratory 1190

FCC RADIO TEST REPORT

FCC ID	**:**	**PU5-TP00107B**
Equipment	**:**	**Notebook Computer**
Brand Name	**:**	**Lenovo**
Model Name	**:**	**TP00107B**
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, Part 27(D)**

Equipment: Fibocom L850-GL tested inside of Lenovo Notebook Computer

The product was received on Jan. 02, 2020 and testing was started from Feb. 05, 2020 and completed on Feb. 21, 2020. 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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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History of this test report

Report No.	Version	Description	Issued Date
FG9D2810-03D	01	Initial issue of report	Mar. 17, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power and Effective Isotropic Radiated Power	Reporting only	-
-	-	Peak-to-Average Ratio	-	See Note
-	§27.50 (a)(3)	EIRP Power Density	-	See Note
-	§2.1049	Occupied Bandwidth	-	See Note
-	§2.1051 §27.53 (a)(4)	Conducted Band Edge Measurement	-	See Note
-	§2.1051 §27.53 (a)(4)	Conducted Spurious Emission	-	See Note
-	§2.1055 §27.54	Frequency Stability Temperature & Voltage	-	See Note
4.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission	Pass	Under limit 0.48 dB at 11538.000 MHz

Note: The module (Model: L850-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: Yimin Ho

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00107B
FCC ID	PU5-TP00107B
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Fibocom L850-GL tested inside of Lenovo Notebook Computer.

Antenna Information				
WWAN				**3G&LTE (dBi)**
Antenna	**Manufacturer**	WNC	**Peak gain**	2.54
	Part number	025.901FP.0001	**Type**	PIFA

1.2 Product Specification of Equipment Under Test

Product Feature	
Tx Frequency	LTE Band 30 : 2307.5 MHz ~2312.5 MHz
Rx Frequency	LTE Band 30 : 2352.5 MHz ~ 2357.5 MHz
Bandwidth	5MHz / 10MHz
Maximum Output Power to Antenna	22.86 dBm
Type of Modulation	QPSK / 16QAM

1.3 Modification of EUT

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

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.52 , Huaya 1st Rd., Guishan Dist.,Taoyuan City, Taiwan	
Test Site No.	**Sporton Site No.**	
	TH05-HY	03CH07-HY
Test Engineer	Jacky Wang	Jesse Wang, Stan Hsieh, and Ken Wu
Temperature	23~25℃	20~24℃
Relative Humidity	52~55％	48~58％

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

FCC Designation No. TW1190

1.5 Applied Standards

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

- ANSI C63.26-2015
- 47 CFR Part 2, Part 27(D)
- ANSI / TIA-603-E
- FCC KDB 971168 Power Meas License Digital Systems D01 v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- FCC KDB 414788 D01 Radiated Test Site v01r01

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

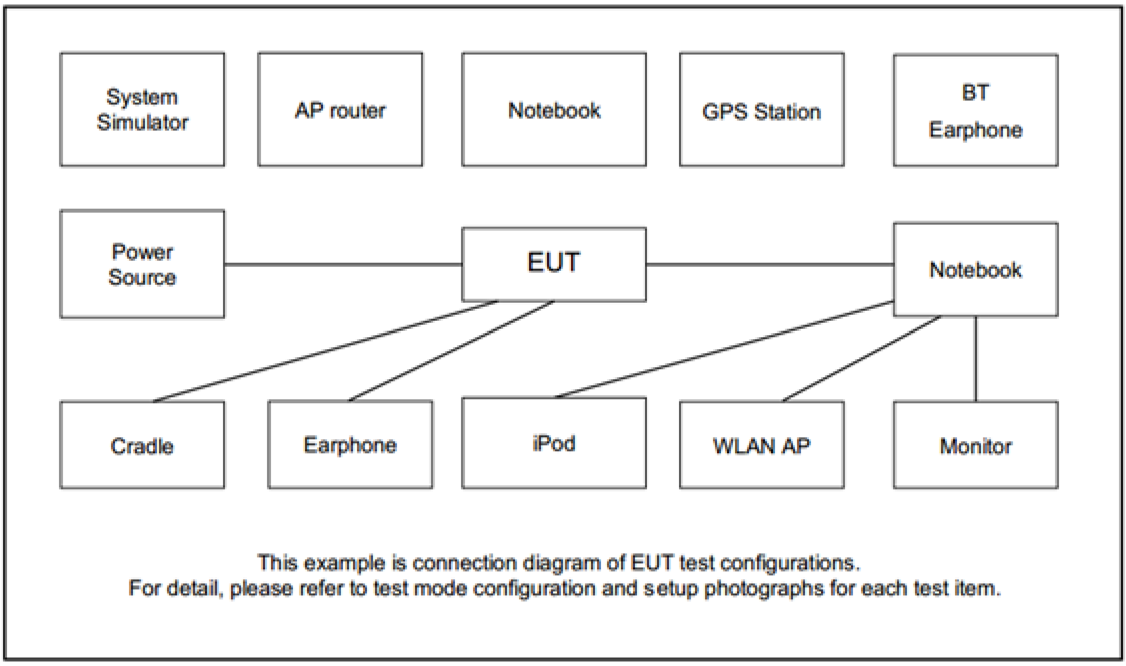
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in Notebook type and three orthogonal panels, X, Y, Z. The worst cases (Notebook type) were recorded in this report.

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max. Output Power	30	-	-	v	v	-	-	v	v	v	v	v	v	v	v
E.I.R.P	30	-	-	v	v	-	-	v	v	v	v	v	v	v	v
Radiated Spurious Emission	30	Worst Case											v	v	v
Remark	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. All the radiated test cases were performed with Adapter 2.														

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	8821C	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

LTE Band 30 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

3 Conducted Test Items

3.1 Measuring Instruments

See list of measuring instruments of this test report.

3.1.1 Test Setup

3.1.2 Conducted Output Power

3.1.3 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power Measurement and EIRP Measurement

3.2.1 Description of the Conducted Output Power Measurement and EIRP Measurement

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

According to KDB 412172 D01 Power Approach,

EIRP = $P_T + G_T - L_C$, 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

3.2.2 Test Procedures

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

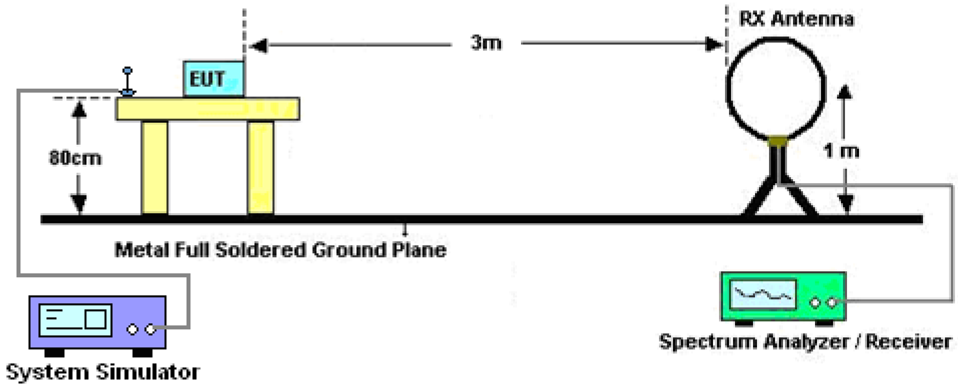
4 Radiated Test Items

4.1 Measuring Instruments

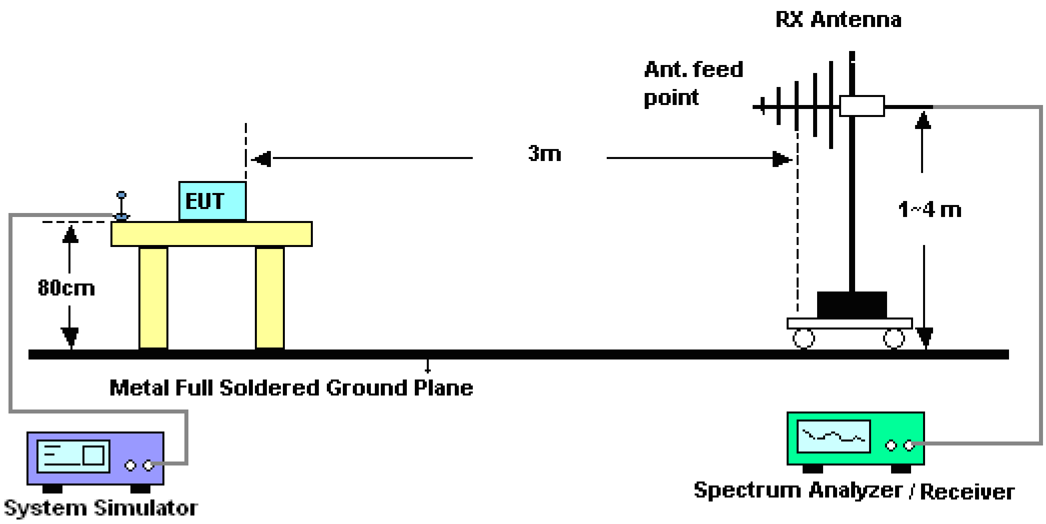
See list of measuring instruments of this test report.

4.1.1 Test Setup

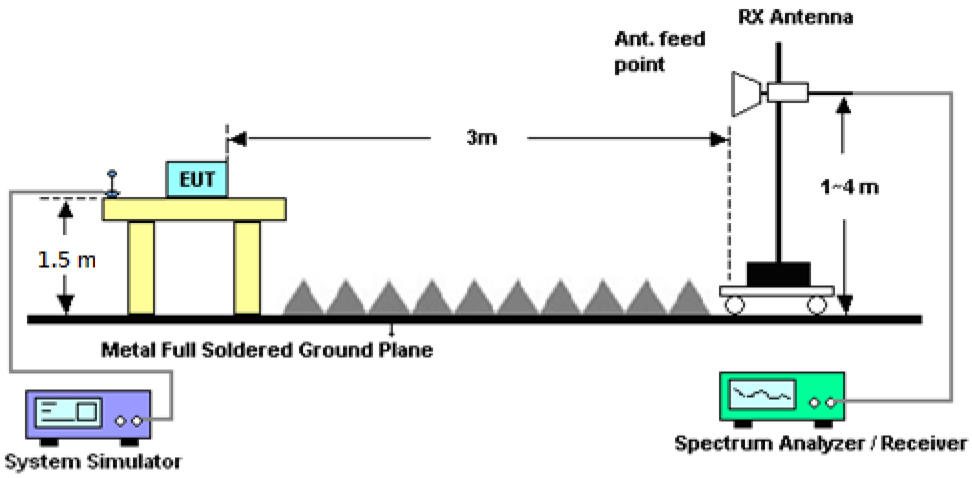
For radiated emissions below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

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.

4.2 Radiated Spurious Emission Measurement

4.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E

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 70 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.2.2 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 turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna 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 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the 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.

   EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain

   ERP (dBm) = EIRP - 2.15
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

   The limit line is derived from 70 + 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [70 + 10log(P)] (dB)

   = [30 + 10log(P)] (dBm) - [70 + 10log(P)] (dB)

   = -40dBm.

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	35419 & 03	30MHz~1GHz	Apr. 30, 2019	Feb. 05, 2020~ Feb. 13, 2020	Apr. 29, 2020	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 12, 2019	Feb. 05, 2020~ Feb. 13, 2020	Oct. 11, 2020	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 06, 2019	Feb. 05, 2020~ Feb. 13, 2020	Dec. 05, 2020	Radiation (03CH07-HY)
Horn Antenna	ESCO	3117	00066584	1GHz ~18GHz	Sep. 25, 2019	Feb. 05, 2020~ Feb. 13, 2020	Sep. 24, 2020	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz~40GHz	May 14, 2019	Feb. 05, 2020~ Feb. 13, 2020	May 13, 2020	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Dec. 06, 2019	Feb. 05, 2020~ Feb. 13, 2020	Dec. 06, 2020	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Apr. 02, 2019	Feb. 05, 2020~ Feb. 13, 2020	Apr. 01, 2020	Radiation (03CH07-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 28, 2019	Feb. 05, 2020~ Feb. 13, 2020	Oct. 27, 2020	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590075	1GHz~18GHz	Apr. 24, 2019	Feb. 05, 2020~ Feb. 13, 2020	Apr. 23, 2020	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	May 20, 2019	Feb. 05, 2020~ Feb. 13, 2020	May 19, 2020	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Nov. 01, 2019	Feb. 05, 2020~ Feb. 13, 2020	Oct. 31, 2020	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 13, 2019	Feb. 05, 2020~ Feb. 13, 2020	Dec. 12, 2020	Radiation (03CH07-HY)
Filter	Microwave	H1G013G1	SN477215	1GHz High Pass Filter	Nov. 01, 2019	Feb. 05, 2020~ Feb. 13, 2020	Oct. 31, 2020	Radiation (03CH07-HY)
Filter	Microwave	H3G018G1	SN477220	3GHz High Pass Filter	Nov. 01, 2019	Feb. 05, 2020~ Feb. 13, 2020	Oct. 31, 2020	Radiation (03CH07-HY)
Filter	Wainwright	WHNX7.0-26.5G-6SS	SN7	7GHz High Pass Filter	Aug. 22, 2019	Feb. 05, 2020~ Feb. 13, 2020	Aug. 21, 2020	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4,MY24971/4,MY15682/4	30MHz~1GHz	Feb. 26, 2019	Feb. 05, 2020~ Feb. 13, 2020	Feb. 25, 2020	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4,MY24971/4,MY15682/4	1GHz~18GHz	Feb. 26, 2019	Feb. 05, 2020~ Feb. 13, 2020	Feb. 25, 2020	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 26, 2019	Feb. 05, 2020~ Feb. 13, 2020	Feb. 25, 2020	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Feb. 05, 2020~ Feb. 13, 2020	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Feb. 05, 2020~ Feb. 13, 2020	N/A	Radiation (03CH07-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Aug. 27, 2019	Feb. 05, 2020~ Feb. 13, 2020	Aug. 26, 2020	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	80504004656H	N/A	N/A	Feb. 05, 2020~ Feb. 13, 2020	N/A	Radiation (03CH07-HY)
LTE Base Station	Anritsu	MT8820C	6201107509	-	Jul. 03, 2019	Feb. 21, 2020	Jul. 02, 2020	Conducted (TH05-HY)

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))	3.23

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.63

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.70

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

LTE Band 30 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK	-	**22.86**	-
10	1	25			22.84	
10	1	49			22.69	
10	25	0			21.81	
10	25	12			21.79	
10	25	25			21.77	
10	50	0			21.89	
10	1	0	16-QAM		22.11	
10	1	25			22.13	
10	1	49			22.04	
10	25	0			20.82	
10	25	12			20.80	
10	25	25			20.81	
10	50	0			20.95	
5	1	0	QPSK	22.59	22.66	22.57
5	1	12		22.68	22.78	22.76
5	1	24		22.46	22.52	22.44
5	12	0		21.68	21.77	21.77
5	12	7		21.54	21.61	21.58
5	12	13		21.56	21.61	21.53
5	25	0		21.72	21.75	21.70
5	1	0	16-QAM	22.00	22.10	22.05
5	1	12		21.86	21.96	21.96
5	1	24		22.00	22.04	21.97
5	12	0		20.69	20.73	20.70
5	12	7		20.72	20.77	20.72
5	12	13		20.63	20.63	20.54
5	25	0		20.76	20.86	20.77

Appendix B. Test Results of EIRP and Radiated Test

EIRP

<Reporting Only>

LTE Band 30 / 5MHz (Average) (GT - LC = -0.31 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	1	12	22.68	0.1854	22.37	0.1726
Middle		1	12	22.78	0.1897	22.47	0.1766
Highest		1	12	22.76	0.1888	22.45	0.1758
Lowest	16QAM	1	0	22.00	0.1585	21.69	0.1476
Middle		1	0	22.10	0.1622	21.79	0.1510
Highest		1	0	22.05	0.1603	21.74	0.1493

LTE Band 30 / 10MHz (Average) (GT - LC = -0.31 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	-	-	-	-	-	-
Middle		1	0	22.86	0.1932	22.55	0.1799
Highest		-	-	-	-	-	-
Lowest	16QAM	-	-	-	-	-	-
Middle		1	25	22.13	0.1633	21.82	0.1521
Highest		-	-	-	-	-	-

Radiated Spurious Emission

LTE Band 30

LTE Band 30 / 5MHz / QPSK									
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	4614	-53.29	-40	-13.29	-75.8	-60.1	2.11	8.93	H
	6924	-46.51	-40	-6.51	-73.73	-54.6	2.62	10.71	H
	9230	-50.92	-40	-10.92	-82.03	-61	2.53	12.61	H
	11538	-40.48	-40	-0.48	-76.15	-50.1	2.68	12.30	H
									H
									H
	4614	-52.09	-40	-12.09	-74.44	-58.9	2.11	8.93	V
	6924	-42.51	-40	-2.51	-69.97	-50.6	2.62	10.71	V
	9230	-51.02	-40	-11.02	-82.12	-61.1	2.53	12.61	V
	11538	-45.48	-40	-5.48	-81.06	-55.1	2.68	12.30	V
									V
									V
Middle	4620	-53.38	-40	-13.38	-75.89	-60.2	2.12	8.94	H
	6930	-46.40	-40	-6.40	-73.92	-54.5	2.61	10.72	H
	9240	-51.53	-40	-11.53	-82.58	-61.6	2.53	12.60	H
	11556	-41.88	-40	-1.88	-77.3	-51.5	2.68	12.30	H
									H
									H
	4620	-52.38	-40	-12.38	-74.88	-59.2	2.12	8.94	V
	6930	-42.40	-40	-2.40	-69.71	-50.5	2.61	10.72	V
	9240	-51.23	-40	-11.23	-82.5	-61.3	2.53	12.60	V
	11556	-44.98	-40	-4.98	-80.58	-54.6	2.68	12.30	V
									V
									V
Highest	4626	-54.77	-40	-14.77	-77.16	-61.6	2.12	8.95	H
	6936	-44.09	-40	-4.09	-71.58	-52.2	2.61	10.72	H
	9250	-51.14	-40	-11.14	-82.07	-61.2	2.54	12.60	H
	11556	-41.18	-40	-1.18	-76.7	-50.8	2.68	12.30	H
									H
									H
	4626	-53.27	-40	-13.27	-75.62	-60.1	2.12	8.95	V
	6936	-40.59	-40	-0.59	-67.96	-48.7	2.61	10.72	V
	9250	-50.84	-40	-10.84	-82.06	-60.9	2.54	12.60	V
	11556	-42.58	-40	-2.58	-78.31	-52.2	2.68	12.30	V
									V
									V

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

LTE Band 30 / 10MHz / QPSK									
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)**
Middle	4614	-53.69	-40	-13.69	-75.49	-60.5	2.11	8.93	H
	6918	-48.22	-40	-8.22	-74.73	-56.3	2.62	10.70	H
	9216	-51.42	-40	-11.42	-81.91	-61.5	2.53	12.61	H
	11520	-41.58	-40	-1.58	-76.8	-51.2	2.68	12.30	H
									H
									H
									H
	4614	-53.69	-40	-13.69	-75.67	-60.5	2.11	8.93	V
	6918	-41.52	-40	-1.52	-68.55	-49.6	2.62	10.70	V
	9216	-51.52	-40	-11.52	-82.44	-61.6	2.53	12.61	V
	11520	-45.18	-40	-5.18	-80.2	-54.8	2.68	12.30	V
									V
									V
									V

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