



FCC RADIO TEST REPORT

FCC ID : PU5-TP00127BLF
Equipment : Notebook Computer
Brand Name : Lenovo
Model Name : TP00127B
Applicant : Wistron Corporation
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist,
New Taipei City 221, Taiwan
Manufacturer : Lenovo PC HK Limited.
23/F, Lincoln House, Taikoo Place, 979 King's Road,
Quarry Bay, Hong Kong, China
Standard : FCC 47 CFR Part 2, and 90(S)

Equipment: Fibocom L860-GL-16 tested inside of Lenovo Notebook Computer.

The product was received on Nov. 18, 2021 and testing was performed from Jan. 03, 2022 to Jan. 25, 2022. 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.

Approved by: Louis Wu

Sportun International Inc. Wensan Laboratory



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History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046 §90.635	Conducted Output Power and Effective Radiated Power	Pass	-
-	-	Peak-to-Average Ratio	-	See Note
-	§2.1049 §90.209	Occupied Bandwidth and 26dB Bandwidth	-	See Note
-	§2.1051 §90.691	Emission masks – In-band emissions	-	See Note
-	§2.1051 §90.691	Emission masks – Out of band emissions	-	See Note
-	§2.1055 §90.213	Frequency Stability for Temperature & Voltage	-	See Note
3.3	§2.1053 §90.691	Field Strength of Spurious Radiation	Pass	Under limit 35.89 dB at 2456.000 MHz

Note:

1. The module (Model: L860-GL-16) makes no difference after verifying output power, this report reuses test data from the module report.
2. Conducted power was verified to be consistent with the original modular approval, so the output power level in the original modular grant is referenced in this report for determining ERP of this host product

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sheng Kuo**Report Producer: Amy Chen**



1 General Description

1.1 Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00127B
FCC ID	PU5-TP00127BLF
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 L860-GL-16 tested inside of Lenovo Notebook Computer.

WWAN Antenna Information				
Main Antenna	Manufacturer	AWAN	Peak gain (dBi)	LTE Band 26: -1.87
	Part number	025.901S1.0071	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 is subject to this standard	
Tx Frequency	814.7 ~ 823.3 MHz
Rx Frequency	859.7 ~ 868.3 MHz
Bandwidth	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz
Maximum Output Power to Antenna	22.93 dBm
Type of Modulation	QPSK / 16QAM / 64QAM

1.3 Modification of EUT

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



1.4 Testing Site

Test Site	Sportun International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333
Test Site No.	Sportun Site No.
	TH03-HY (TAF Code: 1190)
Test Engineer	HaoEn Zhang
Temperature (°C)	22.1~23.4
Relative Humidity (%)	51.8~55.6
Remark	The Conducted test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.

Test Site	Sportun International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010
Test Site No.	Sportun Site No.
	03CH20-HY
Test Engineer	Bill Chang and JC Liang
Temperature (°C)	20~23
Relative Humidity (%)	66~69

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

FCC Designation No.: TW1190 and TW3786

1.5 Applied Standards

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

- FCC 47 CFR Part 2, 90
- ANSI / TIA-603-E
- ANSI C63.26-2015
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- FCC KDB 414788 D01 Radiated Test Site v01r01
- Interim Guidance for Equipment Authorization of Devices with Channel Bandwidths Combined Across Two Contiguous Service Rule Allocations OET/Lab/EACB, June 6, 2013

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

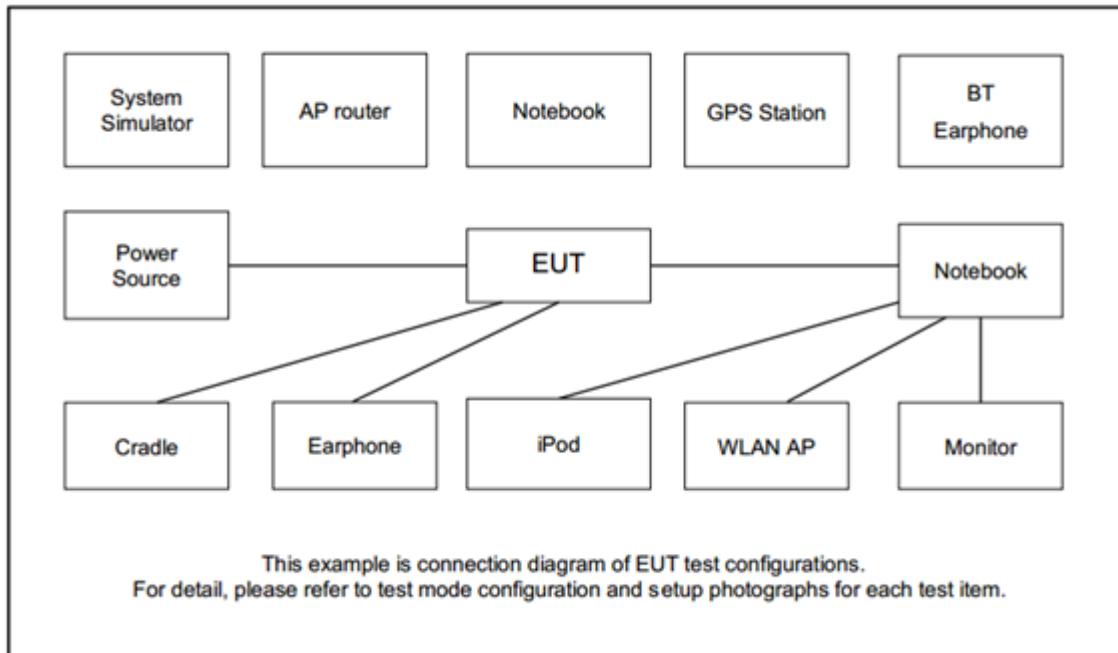
During all testing, EUT is in link mode with base station emulator at maximum power level.

Frequency range investigated for radiated emission is 30 MHz to 9000 MHz.

For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in Tablet Type (three orthogonal axis (X: flat, Y: portrait, Z: landscape)) and Notebook Type, and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and find Notebook Type as worst plane.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Max. Output Power	26	V	V	V	V	V	-	V	V	V	V			V	V	V
E.R.P.	26	V	V	V	V	V	-	V	V	V				Max. Power		
Radiated Spurious Emission	26	V		V	V		-	V			V			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. LTE Band26 transmit frequency for part22 rule is 824MHz-849MHz, for part90 rule is 814MHz-824MHz. ERP over 15MHz bandwidth complies the ERP limit line of part22 rule, therefore ERP of the partial frequency spectrum which falls within part 22 also complies.														

2.2 Connection Diagram of Test System





2.3 Support Unit used in test configuration and system

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

LTE Band 26 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
15	Channel	26765	-	-
	Frequency	821.5	-	-
10	Channel	-	26740	-
	Frequency	-	819	-
5	Channel	26715	26740	26765
	Frequency	816.5	819	821.5
3	Channel	26705	26740	26775
	Frequency	815.5	819	822.5
1.4	Channel	26697	26740	26783
	Frequency	814.7	819	823.3

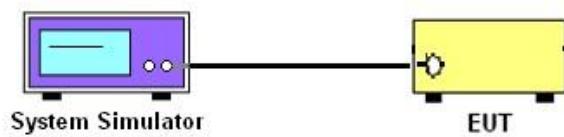
3 Conducted Test Items

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 ERP Measurement

3.2.1 Description of the Conducted Output Power Measurement and ERP Measurement

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 conducted output power of mobile transmitters must not exceed 100 Watts for LTE Band 26.

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 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.



3.3 Field Strength of Spurious Radiation Measurement

3.3.1 Description of Field Strength of Spurious Radiated Measurement

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

The power of any emission FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $43 + 10 \log(P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

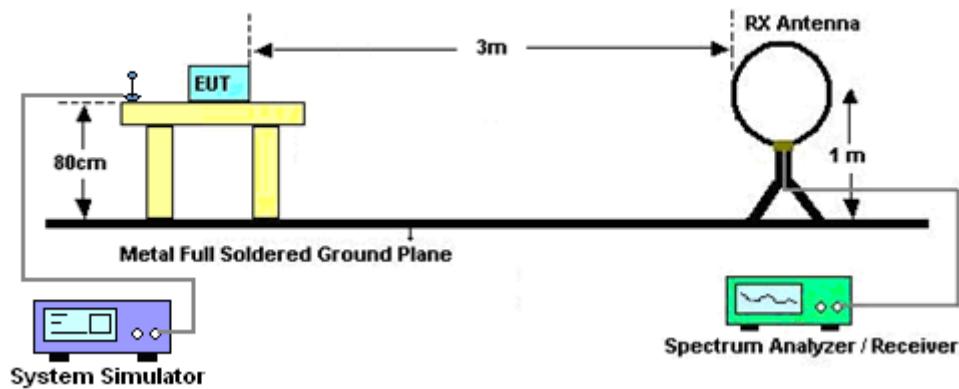
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43+10\log_{10}(P[\text{Watts}])$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.3.2 Test Procedures

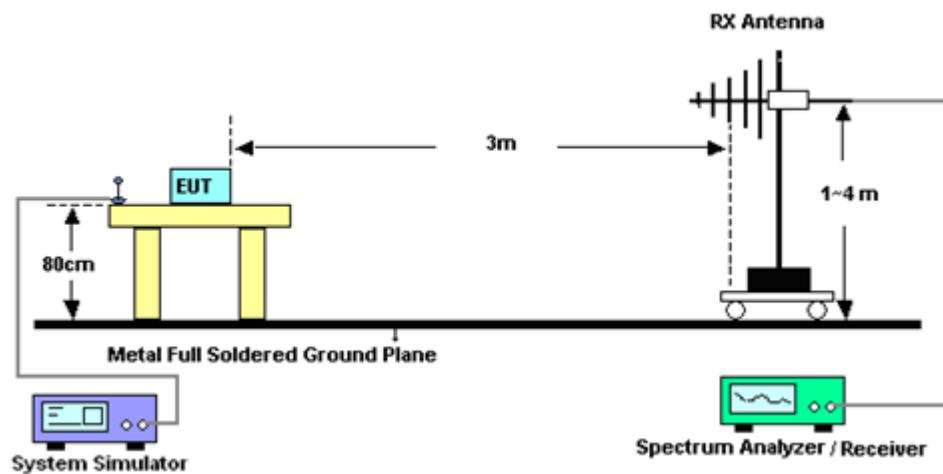
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. For testing below 1GHz, make the measurement with the spectrum analyzer's RBW = 100 kHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. For testing above 1GHz, make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, 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.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
12. ERP (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)

3.3.3 Test Setup

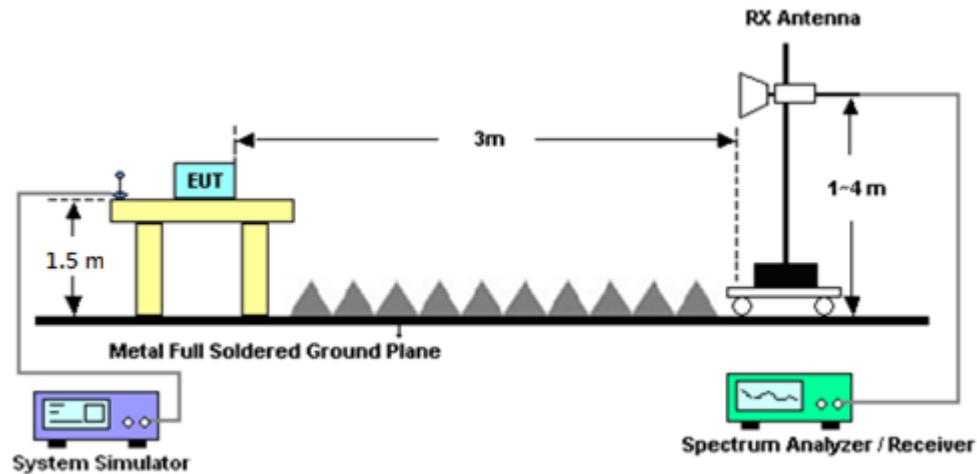
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.3.4 Test Result of Field Strength of Spurious Radiated

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 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.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receicver	Keysight	N9010B	MY60241055	10Hz~44GHz	Jul. 12, 2021	Jan. 08, 2022~Jan. 25, 2022	Jul. 11, 2022	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 03, 2022	Jan. 08, 2022~Jan. 25, 2022	Jan. 02, 2023	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 15, 2021	Jan. 08, 2022~Jan. 25, 2022	Nov. 14, 2022	Radiation (03CH20-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Jan. 08, 2022~Jan. 25, 2022	Jan. 06, 2023	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802N 1D01N-06	55606 & 08	30MHz~1GHz	Oct. 17, 2021	Jan. 08, 2022~Jan. 25, 2022	Oct. 16, 2022	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802N 1D01N-06	37059 & 01	30MHz~1GHz	Oct. 09, 2021	Jan. 08, 2022~Jan. 25, 2022	Oct. 08, 2022	Radiation (03CH20-HY)
Horn Antenna	SCHWARZB ECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 23, 2021	Jan. 08, 2022~Jan. 25, 2022	Jun. 22, 2022	Radiation (03CH20-HY)
Horn Antenna	SCHWARZB ECK	BBHA 9120 D	02360	1GHz~18GHz	Nov. 02, 2021	Jan. 08, 2022~Jan. 25, 2022	Nov. 01, 2022	Radiation (03CH20-HY)
Hygrometer	TECPTEL	DTM-303B	TP200728	N/A	Mar. 09, 2021	Jan. 08, 2022~Jan. 25, 2022	Mar. 08, 2022	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,8040 15/2,804027/2	N/A	Jan. 20, 2021	Jan. 08, 2022~Jan. 18, 2022	Jan. 19, 2022	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,8040 15/2,804027/2	N/A	Jan. 19, 2022	Jan. 19, 2022~Jan. 25, 2022	Jan. 18, 2023	Radiation (03CH20-HY)
Software	Audix	E3 6.2009-8-24	RK-002156	N/A	N/A	Jan. 08, 2022~Jan. 25, 2022	N/A	Radiation (03CH20-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jan. 08, 2022~Jan. 25, 2022	N/A	Radiation (03CH20-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jan. 08, 2022~Jan. 25, 2022	N/A	Radiation (03CH20-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jan. 08, 2022~Jan. 25, 2022	N/A	Radiation (03CH20-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Dec. 08, 2021	Jan. 08, 2022~Jan. 25, 2022	Dec. 07, 2022	Radiation (03CH20-HY)
Radio Communication Analyzer	Anritsu	MT8821C	6201664755	2/3/4G/LTE FDD/TDD with44)/LTE-3C C DLCA/2CC ULCA, CatM1/NB1/NB2	Jul. 21, 2021	Jan. 03, 2022~Jan. 07, 2022	Jul. 20, 2022	Conducted (TH03-HY)
Coupler	Warison	20dB 25W SMA Directional Coupler	#B	1-18GHz	Jan. 09, 2021	Jan. 03, 2022~Jan. 07, 2022	Jan. 08, 2022	Conducted (TH03-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))	3.33 dB
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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))	3.63 dB
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Appendix A. Test Results of Conducted Test

Conducted Output Power (Average power) & ERP

LTE Band 26 Maximum Average Power [dBm] (GT - LC = -1.87 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
15	1	0	QPSK	22.92	-	-	18.9	0.0776
15	1	74		22.69	-	-		
15	75	0		21.63	-	-		
15	1	0	16-QAM	21.96	-	-	17.94	0.0622
15	1	0	64-QAM	20.68	-	-	16.66	0.0463
Limit	Conducted power < 100W			Result			Pass	

LTE Band 26 Maximum Average Power [dBm] (GT - LC = -1.87 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
10	1	0	QPSK	-	22.93	-	18.91	0.0778
10	1	0	16-QAM	-	21.72	-	17.7	0.0589
10	1	0	64-QAM	-	20.89	-	16.87	0.0486
Limit	Conducted power < 100W			Result			Pass	

LTE Band 26 Maximum Average Power [dBm] (GT - LC = -1.87 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
5	1	0	QPSK	22.63	22.89	22.89	18.87	0.0771
5	1	0	16-QAM	21.86	22.36	21.85	18.34	0.0682
5	1	0	64-QAM	20.96	20.72	21.23	17.21	0.0526
Limit	Conducted power < 100W			Result			Pass	

LTE Band 26 Maximum Average Power [dBm] (GT - LC = -1.87 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
3	1	0	QPSK	22.63	22.86	22.92	18.9	0.0776
3	1	0	16-QAM	21.72	22.58	21.68	18.56	0.0718
3	1	0	64-QAM	20.78	21.63	20.69	17.61	0.0577
Limit	Conducted power < 100W			Result			Pass	

LTE Band 26 Maximum Average Power [dBm] (GT - LC = -1.87 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
1.4	1	0	QPSK	22.69	22.21	22.85	18.83	0.0764
1.4	1	0	16-QAM	21.85	22.36	22.18	18.34	0.0682
1.4	1	0	64-QAM	20.69	21.21	21.25	17.23	0.0528
Limit	Conducted power < 100W			Result			Pass	



Appendix B. Test Results of Radiated Test

LTE Band 26

LTE Band 26 / 1.4MHz / 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	1632	-57.29	-13	-44.29	-67.15	-59.60	4.90	9.36	H
	2440	-51.23	-13	-38.23	-64.03	-53.55	6.03	10.50	H
	4072	-55.73	-13	-42.73	-75.02	-57.41	7.91	11.74	H
									H
									H
									H
	1632	-57.96	-13	-44.96	-67.58	-60.27	4.90	9.36	V
	2440	-52.38	-13	-39.38	-65.18	-54.70	6.03	10.50	V
	4072	-53.30	-13	-40.30	-72.51	-54.98	7.91	11.74	V
									V
Middle	1640	-56.59	-13	-43.59	-66.45	-58.95	4.91	9.42	H
	2456	-48.89	-13	-35.89	-61.74	-51.19	6.05	10.50	H
	4096	-55.58	-13	-42.58	-74.95	-57.29	7.93	11.79	H
									H
									H
									H
	1640	-57.49	-13	-44.49	-67.12	-59.85	4.91	9.42	V
	2456	-51.00	-13	-38.00	-63.83	-53.30	6.05	10.50	V
	4096	-51.02	-13	-38.02	-70.36	-52.73	7.93	11.79	V
									V
									V



Highest	1648	-57.06	-13	-44.06	-66.93	-59.47	4.92	9.48	H
	2472	-49.59	-13	-36.59	-62.49	-51.87	6.07	10.50	H
	4112	-54.79	-13	-41.79	-74.22	-56.50	7.94	11.80	H
									H
									H
									H
	1648	-57.49	-13	-44.49	-67.13	-59.90	4.92	9.48	V
	2472	-50.67	-13	-37.67	-63.52	-52.95	6.07	10.50	V
	4112	-50.51	-13	-37.51	-69.93	-52.22	7.94	11.80	V
									V
									V
									V

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



LTE Band 26 / 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	1632	-56.08	-13	-43.08	-65.94	-58.39	4.90	9.36	H
	2440	-51.65	-13	-38.65	-64.45	-53.97	6.03	10.50	H
	4072	-56.06	-13	-43.06	-75.35	-57.74	7.91	11.74	H
									H
									H
									H
	1632	-55.92	-13	-42.92	-65.54	-58.23	4.90	9.36	V
	2440	-53.36	-13	-40.36	-66.16	-55.68	6.03	10.50	V
	4072	-52.57	-13	-39.57	-71.78	-54.25	7.91	11.74	V
									V
Middle	1632	-54.56	-13	-41.56	-64.42	-56.87	4.90	9.36	H
	2448	-50.59	-13	-37.59	-63.41	-52.90	6.04	10.50	H
	4088	-55.53	-13	-42.53	-74.87	-57.23	7.93	11.78	H
									H
									H
									H
	1632	-56.26	-13	-43.26	-65.88	-58.57	4.90	9.36	V
	2448	-52.12	-13	-39.12	-64.93	-54.43	6.04	10.50	V
	4088	-52.91	-13	-39.91	-72.2	-54.61	7.93	11.78	V
									V
									V
									V



Highest	1640	-55.78	-13	-42.78	-65.64	-58.14	4.91	9.42	H
	2456	-50.20	-13	-37.20	-63.05	-52.50	6.05	10.50	H
	4096	-54.99	-13	-41.99	-74.36	-56.70	7.93	11.79	H
									H
									H
									H
	1640	-56.42	-13	-43.42	-66.05	-58.78	4.91	9.42	V
	2456	-52.53	-13	-39.53	-65.36	-54.83	6.05	10.50	V
	4096	-53.03	-13	-40.03	-72.37	-54.74	7.93	11.79	V
									V
									V
									V

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



LTE Band 26 / 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	1632	-56.57	-13	-43.57	-66.43	-58.88	4.90	9.36	H
	2448	-50.94	-13	-37.94	-63.76	-53.25	6.04	10.50	H
	4072	-53.17	-13	-40.17	-72.46	-54.85	7.91	11.74	H
									H
									H
									H
									H
	1632	-58.26	-13	-45.26	-67.88	-60.57	4.90	9.36	V
	2448	-51.82	-13	-38.82	-64.63	-54.13	6.04	10.50	V
	4072	-51.44	-13	-38.44	-70.65	-53.12	7.91	11.74	V
									V
									V
									V

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