

# FCC RADIO TEST REPORT

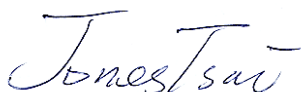
FCC ID : PU5-TP00107A  
Equipment : Notebook Computer  
Brand Name : Lenovo  
Model Name : TP00107A  
Applicant : Wistron Corporation  
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih  
Dist, New Taipei City 221, Taiwan R.O.C.  
Manufacturer : Wistron Corporation  
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih  
Dist, New Taipei City 221, Taiwan R.O.C.  
Standard : FCC 47 CFR Part 2, Part 27(D)

Equipment: Fibocom L850-GL and Intel 9560D2W tested inside of Lenovo Notebook Computer.

The product was received on Jan. 02, 2019 and testing was started from Jan. 28, 2019 and completed on Feb. 19, 2019. 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.



Approved by: Jones Tsai

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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## History of this test report

Report No.	Version	Description	Issued Date
FG910213D	01	Initial issue of report	Feb. 27, 2019

## 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	-
4.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission	Pass	Under limit 0.24 dB at 11556.000 MHz

**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:** Polly Tsai

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00107A
FCC ID	PU5-TP00107A
Sample 1	EUT with SKU 1
Sample 2	EUT with SKU 2
Sample 3	EUT with SKU 3
Sample 4	EUT with SKU 4
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS WLAN a/b/g/n HT20/40 WLAN ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

**Remark:**

1. The above EUT's information was declared by manufacturer.
2. Equipment: Fibocom L850-GL and Intel 9560D2W tested inside of Lenovo Notebook Computer.
3. All test items were performed with Sample 4.

**<Sample Information>**

Sample List		
SKU	Antenna Manufacturer	Color
SKU 1	Auden	Silver
SKU 2	WNC	Silver
SKU 3	Auden	Black
SKU 4	WNC	Black

Antenna Information				
WWAN				3G&LTE (dBi)
Antenna 1	Manufacturer	Auden	Peak gain	2.27
	Part number	025.901FP.0011	Type	PIFA
Antenna 2	Manufacturer	WNC	Peak gain	2.54
	Part number	025.901FP.0001	Type	PIFA

## 1.2 Product Specification of Equipment Under Test

Product Feature	
<b>Tx Frequency</b>	LTE Band 30 : 2307.5 MHz ~2312.5 MHz
<b>Rx Frequency</b>	LTE Band 30 : 2352.5 MHz ~ 2357.5 MHz
<b>Bandwidth</b>	5MHz / 10MHz
<b>Maximum Output Power to Antenna</b>	LTE Band 30 : 22.80 dBm
<b>Type of Modulation</b>	QPSK / 16QAM

## 1.3 Modification of EUT

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

## 1.4 Testing Site

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	TH05-HY
<b>Test Engineer</b>	Kurt Liu
<b>Temperature</b>	21°C
<b>Relative Humidity</b>	53%

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

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	03CH10-HY
<b>Test Engineer</b>	Yu Wang
<b>Temperature</b>	23~24°C
<b>Relative Humidity</b>	59~60%

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

FCC Designation No. TW1190 and TW0007



## 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

**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

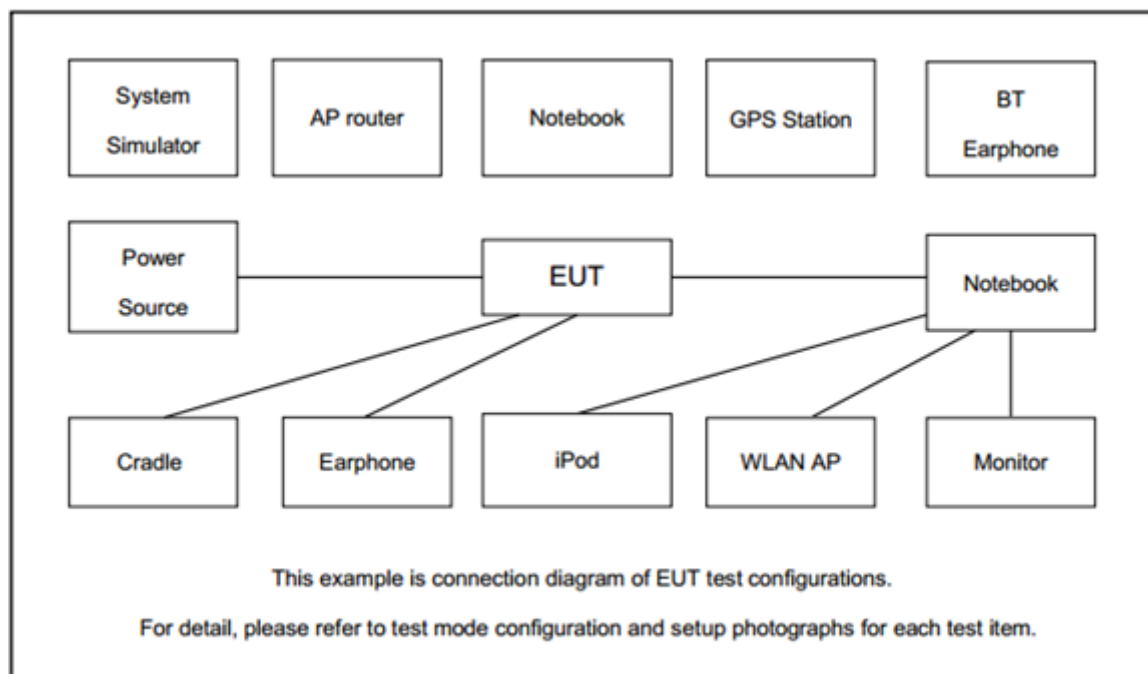
### 2.1 Test Mode

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
Radiated Spurious Emission	30	Worst Case											v	v	v
Remark	<div>1. The mark “v” means that this configuration is chosen for testing</div> <div>2. The mark “-” means that this bandwidth is not supported.</div> <div>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.</div> <div>4. All the radiated test cases were performed with Adapter 1 and Battery 2.</div>														

### 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	MT8820C	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

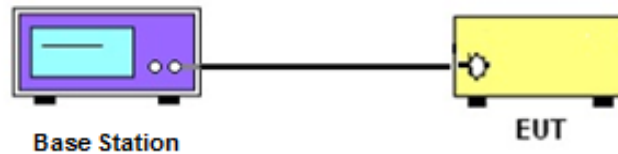
### 3 Conducted Test Items

#### 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.

The EIRP of mobile transmitters must not exceed 0.25 Watts for LTE Band 30 and Band 40.

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.

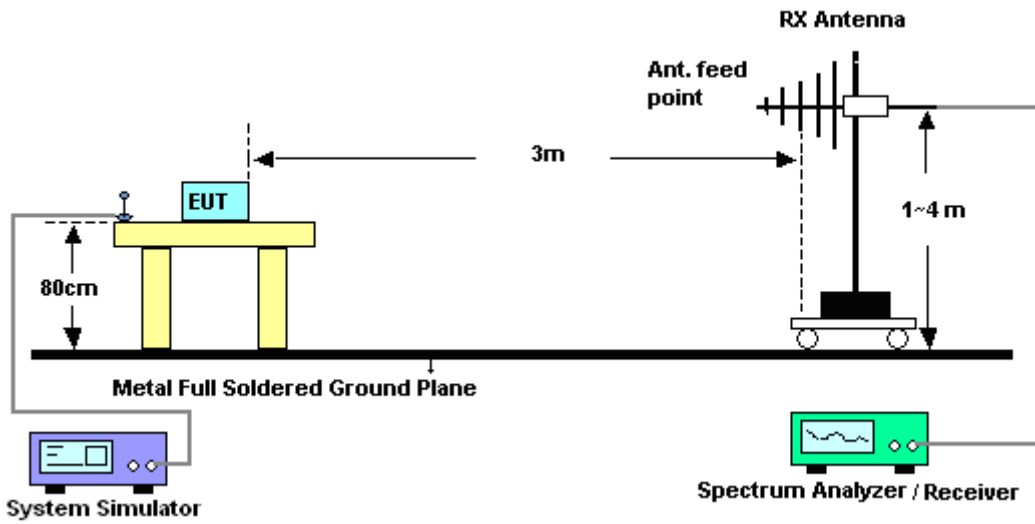
## 4 Radiated Test Items

### 4.1 Measuring Instruments

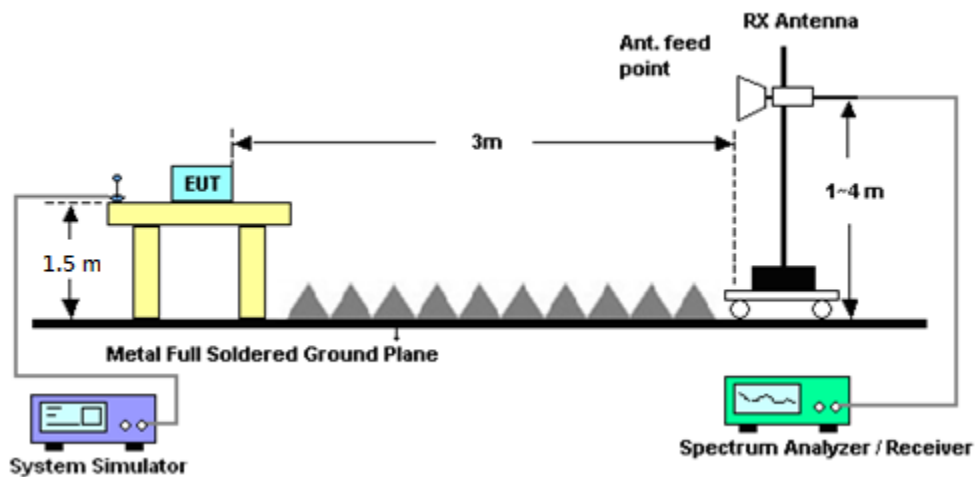
See list of measuring instruments of this test report.

#### 4.1.1 Test Setup

For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



#### 4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

## 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 5.8 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.

$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$$

$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$

9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

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

$$= P(W) - [70 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [70 + 10\log(P)] \text{ (dB)}$$

$$= -40\text{dBm}.$$



## 5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201432821	-	Oct. 14, 2018	Feb. 19, 2019	Oct. 13, 2019	Conducted (TH05-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 23, 2018	Jan. 28, 2019~ Feb. 14, 2019	Oct. 22, 2019	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35413&02	30MHz~1GHz	Jan. 10, 2019	Jan. 28, 2019~ Feb. 14, 2019	Jan. 09, 2020	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1325	1GHz ~ 18GHz	Oct. 02, 2018	Jan. 28, 2019~ Feb. 14, 2019	Oct. 01, 2019	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Oct. 28, 2018	Jan. 28, 2019~ Feb. 14, 2019	Oct. 27, 2019	Radiation (03CH10-HY)
Preamplifier	Jet-Power	JAP00101800- 30-10P	160118550004	1GHz~18GHz	Apr. 17, 2018	Jan. 28, 2019~ Feb. 14, 2019	Apr. 16, 2019	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Nov. 02, 2018	Jan. 28, 2019~ Feb. 14, 2019	Nov. 01, 2019	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jan. 28, 2019~ Feb. 14, 2019	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	Jan. 28, 2019~ Feb. 14, 2019	N/A	Radiation (03CH10-HY)
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Jan. 28, 2019~ Feb. 14, 2019	N/A	Radiation (03CH10-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 19, 2019	Jan. 28, 2019~ Feb. 14, 2019	Jan. 18, 2020	Radiation (03CH10-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104 / 102	MY11692/4PE, MY11693/4PE, MY2855/2	30M-1G	Nov. 08, 2018	Jan. 28, 2019~ Feb. 14, 2019	Nov. 07, 2019	Radiation (03CH10-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104 / 102	MY11692/4PE, MY11693/4PE, MY2855/2	1G-18G	Nov. 08, 2018	Jan. 28, 2019~ Feb. 14, 2019	Nov. 07, 2019	Radiation (03CH10-HY)

## 6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.17
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.48
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### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.00
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## 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		22.80	
10	1	25			22.79	
10	1	49			22.78	
10	25	0			21.88	
10	25	12			21.84	
10	25	25			21.85	
10	50	0			21.90	
10	1	0	16-QAM		21.98	
10	1	25			21.99	
10	1	49			21.90	
10	25	0			20.92	
10	25	12			20.88	
10	25	25			20.86	
10	50	0			20.92	
5	1	0	QPSK	22.73	22.72	22.73
5	1	12		22.75	22.75	22.76
5	1	24		22.78	22.78	22.68
5	12	0		21.83	21.79	21.84
5	12	7		21.79	21.77	21.83
5	12	13		21.81	21.78	21.81
5	25	0		21.88	21.90	21.90
5	1	0	16-QAM	21.89	21.97	21.93
5	1	12		21.89	21.92	21.89
5	1	24		21.88	21.88	21.85
5	12	0		20.85	20.88	20.84
5	12	7		20.86	20.83	20.84
5	12	13		20.79	20.79	20.82
5	25	0		20.87	20.83	20.85



**Appendix B. Test Results of EIRP and Radiated Test****EIRP****<Reporting Only>**

LTE Band 30 / 5MHz (Average) (GT - LC = 0.64 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	1	24	22.78	0.1897	23.42	0.2198
Middle		1	24	22.78	0.1897	23.42	0.2198
Highest		1	24	22.68	0.1854	23.32	0.2148
Lowest	16QAM	1	0	21.89	0.1545	22.53	0.1791
Middle		1	0	21.97	0.1574	22.61	0.1824
Highest		1	0	21.93	0.1560	22.57	0.1807
Limit	EIRP < 0.25W			Result		PASS	

LTE Band 30 / 10MHz (Average) (GT - LC = 0.64 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	-	-	-	-	-	-
Middle		1	0	22.80	0.1905	23.44	0.2208
Highest		-	-	-	-	-	-
Lowest	16QAM	-	-	-	-	-	-
Middle		1	25	21.99	0.1581	22.63	0.1832
Highest		-	-	-	-	-	-
Limit	EIRP < 0.25W			Result		PASS	

**Radiated Spurious Emission****LTE Band 30**

LTE Band 30 / 5MHz / QPSK									
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	4620	-52.76	-40	-12.76	-42.86	-64.12	1.26	12.62	H
	6930	-50.85	-40	-10.85	-44.91	-60.51	2.21	11.87	H
	9234	-57.75	-40	-17.75	-56.5	-66.48	2.84	11.57	H
	11556	-43.13	-40	-3.13	-44.69	-51.62	3.17	11.66	H
									H
	4620	-52.03	-40	-12.03	-43.07	-63.39	1.26	12.62	V
	6930	-41.77	-40	-1.77	-36.34	-51.43	2.21	11.87	V
	9234	-56.32	-40	-16.32	-54.79	-65.05	2.84	11.57	V
	11556	-44.71	-40	-4.71	-46.85	-53.20	3.17	11.66	V
									V
Middle	4626	-46.00	-40	-6.00	-36.12	-57.36	1.27	12.63	H
	6936	-49.69	-40	-9.69	-43.75	-59.34	2.21	11.86	H
	9252	-55.85	-40	-15.85	-54.61	-64.55	2.85	11.55	H
	11556	-40.24	-40	-0.24	-41.81	-48.73	3.17	11.66	H
									H
	4626	-43.94	-40	-3.94	-34.99	-55.30	1.27	12.63	V
	6936	-43.87	-40	-3.87	-38.48	-53.52	2.21	11.86	V
	9252	-55.10	-40	-15.10	-53.56	-63.80	2.85	11.55	V
	11556	-45.96	-40	-5.96	-48.09	-54.45	3.17	11.66	V
									V



LTE Band 30 / 5MHz / QPSK									
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)
Highest	4632	-50.14	-40	-10.14	-40.27	-61.50	1.27	12.63	H
	6942	-48.96	-40	-8.96	-43.01	-58.60	2.22	11.86	H
	9252	-56.22	-40	-16.22	-54.98	-64.92	2.85	11.55	H
	11574	-41.84	-40	-1.84	-43.41	-50.37	3.18	11.71	H
									H
	4632	-49.38	-40	-9.38	-40.46	-60.74	1.27	12.63	V
	6942	-46.50	-40	-6.50	-41.11	-56.14	2.22	11.86	V
	9252	-54.80	-40	-14.80	-53.26	-63.50	2.85	11.55	V
	11574	-45.27	-40	-5.27	-47.36	-53.80	3.18	11.71	V
									V

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

LTE Band 30 / 10MHz / QPSK									
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)
Middle	4614	-51.24	-40	-11.24	-41.33	-62.60	1.26	12.62	H
	6918	-48.57	-40	-8.57	-42.63	-58.25	2.21	11.88	H
	9234	-57.17	-40	-17.17	-55.94	-65.90	2.84	11.57	H
	11520	-41.33	-40	-1.33	-42.88	-49.75	3.14	11.56	H
									H
	4614	-52.07	-40	-12.07	-43.08	-63.43	1.26	12.62	V
	6918	-48.98	-40	-8.98	-43.5	-58.66	2.21	11.88	V
	9234	-58.40	-40	-18.40	-56.87	-67.13	2.84	11.57	V
	11520	-43.44	-40	-3.44	-45.6	-51.86	3.14	11.56	V
									V

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