



# FCC RF Test Report

**APPLICANT** : LC Future Center Limited Taiwan Branch  
**EQUIPMENT** : Notebook  
**BRAND NAME** : Lenovo  
**MODEL NAME** : TP00086B  
**FCC ID** : 2AJN7-TP00086B  
**STANDARD** : FCC 47 CFR Part 2, and 90(S)  
**CLASSIFICATION** : PCS Licensed Transmitter (PCB)

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

This is a partial report. The product was received on Dec. 21, 2017 and testing was completed on Jan. 18, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA-603-E and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



## **SPORTON INTERNATIONAL INC.**

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FCC ID : 2AJN7-TP00086B

Page Number : 1 of 14

Report Issued Date : Jan. 24, 2018

Report Version : Rev. 01

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## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG7O2534-06C	Rev. 01	Initial issue of report	Jan. 24, 2018



## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power	Reporting only	PASS	-
3.2	§2.1053 §90.691	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 34.39 dB at 4888.000 MHz

# 1 General Description

## 1.1 Applicant

LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

## 1.2 Manufacturer

LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

## 1.3 Feature of Equipment Under Test

Product Feature & Specification	
Product Name	Notebook
Brand Name	Lenovo
Model Name	TP00086B
FCC ID	2AJN7-TP00086B
Sample 1	EUT with Antenna 1
Sample 2	EUT with Antenna 2
Integrated WWAN Module	Brand Name: Fibocom Model Name: L850-GL

### Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. All test items were performed with Sample 1.
3. Equipment: Fibocom L850-GL tested inside of Lenovo Notebook.

L850-GL				3G & LTE
Antenna 1	Manufacturer	Amphenol	Peak gain	2.99
	P/N	LX-8905-16-000-C	Type	PIFA
Antenna 2	Manufacturer	Speedwire	Peak gain	2.72
	P/N	F.0G.ZV-0006-006-00	Type	PIFA

## 1.4 Modification of EUT

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

## 1.5 Testing Site

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	TH05-HY

<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>
	03CH11-HY

## 1.6 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
- FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02
- Interim Guidance for Equipment Authorization of Devices with Channel Bandwidths Combined Across Two Contiguous Service Rule Allocations OET/Lab/EACB, June 6, 2013

**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

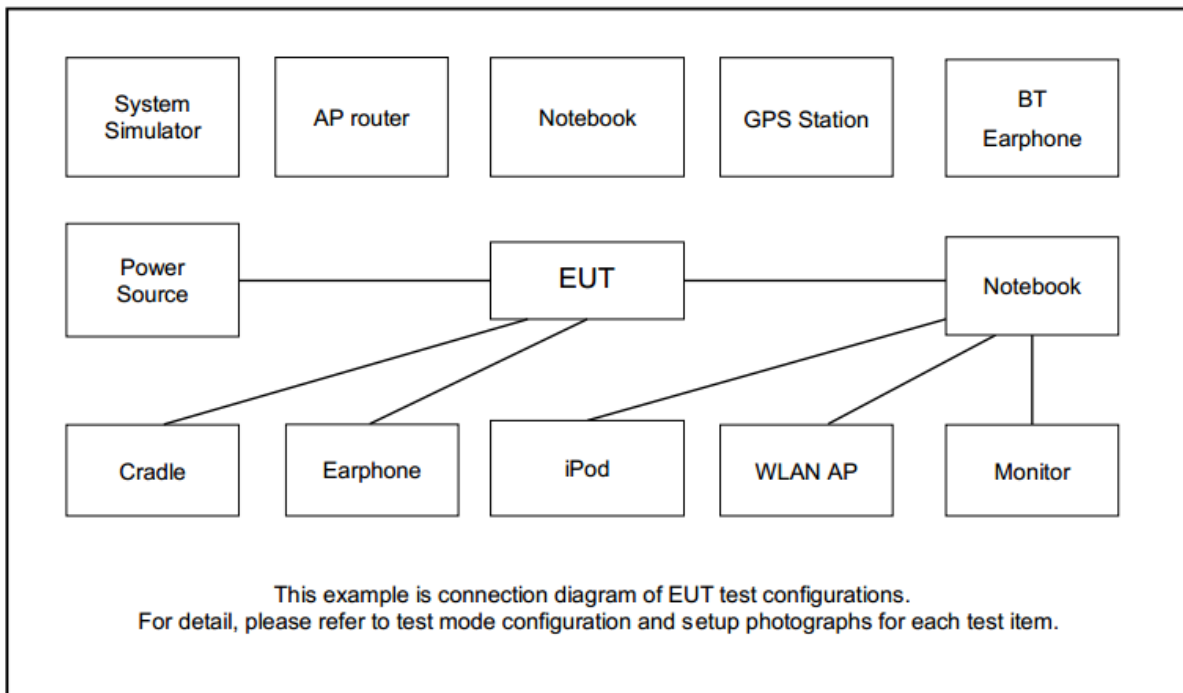
### 2.1 Test Mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

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

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	26	v	v	v	v	v	-	v	v	v	v	v	v	v	v
E.R.P.	26					v	-	v	v	v			v		
Radiated Spurious Emission	26	Worse Case											v	v	v
Note	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	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	8821C	N/A	N/A	N/A
2.	iPod Earphone	Apple	N/A	Verification	N/A	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 Test Result

#### 3.1 Conducted Output Power Measurement

##### 3.1.1 Description of the Conducted Output Power 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.

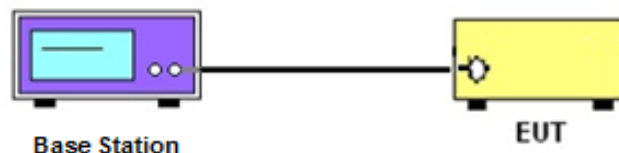
##### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

##### 3.1.3 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.

##### 3.1.4 Test Setup



##### 3.1.5 Test Result of Conducted Output Power

Please refer to Appendix A.

## **3.2 Field Strength of Spurious Radiation Measurement**

### **3.2.1 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.

### **3.2.2 Measuring Instruments**

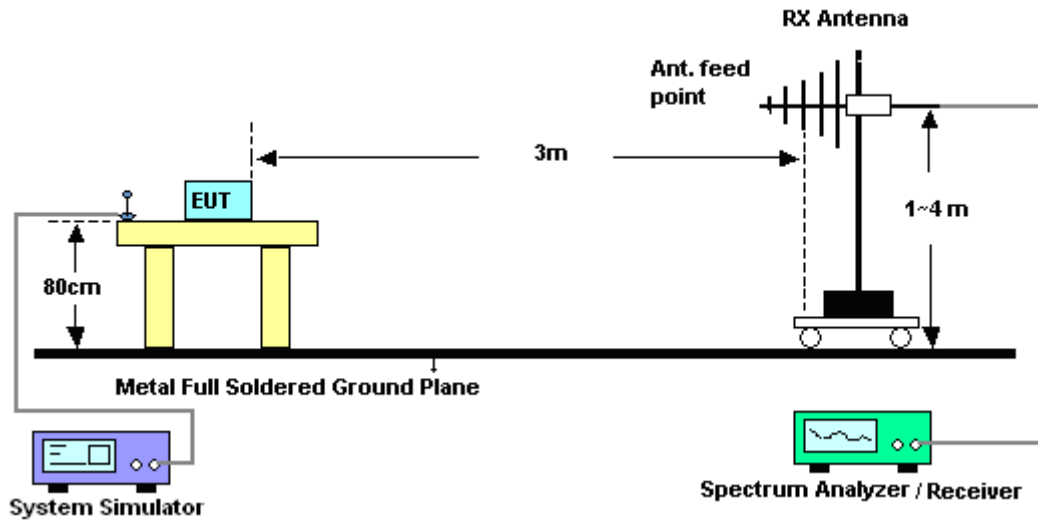
The measuring equipment is listed in the section 4 of this test report.

### **3.2.3 Test Procedures**

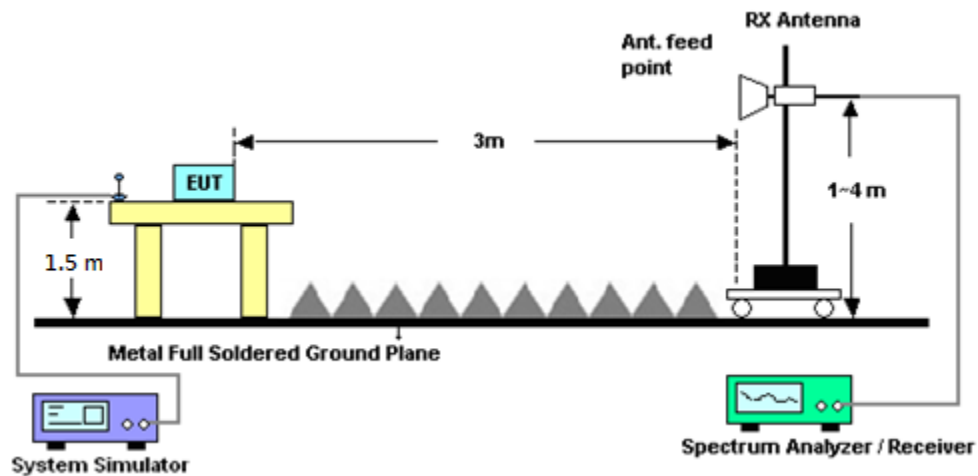
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position 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. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the 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.  $\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$
11.  $\text{ERP (dBm)} = \text{EIRP} - 2.15$
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)

### 3.2.4 Test Setup

For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



### 3.2.5 Test Result of Field Strength of Spurious Radiated

Please refer to Appendix B.



## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201432821	GSM/GPRS /WCDMA/LTE	Oct. 13, 2017	Jan. 02, 2018	Oct. 12, 2018	Conducted (TH05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz,VS WR : 2.5:1 max	Jul. 18, 2017	Jan. 10, 2018~ Jan. 18, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Jan. 10, 2018~ Jan. 18, 2018.	Nov. 09, 2018	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0 602	30MHz~1GHz	Oct. 14, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBEC K	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBEC K	BBHA 9120 D	9120D-1522	1GHz ~ 18GHz	Mar. 17, 2017	Jan. 10, 2018~ Jan. 18, 2018	Mar. 16, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 22, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Jan. 10, 2018~ Jan. 18, 2018	Nov. 09, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-1080-1200-1500-60SS	SN2	1.2G High Pass	Sep. 18, 2017	Jan. 10, 2018~ Jan. 18, 2018	Sep. 17, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jan. 10, 2018~ Jan. 18, 2018	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jan. 10, 2018~ Jan. 18, 2018	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Nov. 02, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 01, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBEC K	BBHA 9170	BBHA9170576	18GHz- 40GHz	Apr. 27, 2017	Jan. 10, 2018~ Jan. 18, 2018	Apr. 26, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBEC K	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-1	1590074	1GHz~18GHz	May 22, 2017	Jan. 10, 2018~ Jan. 18, 2018	May 21, 2018	Radiation (03CH11-HY)

## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	3.37
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 9 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	3.67
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## Appendix A. Test Results of Conducted Test

### Conducted Output Power(Average power)

LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
15	1	0	QPSK	23.43	-	-
15	1	37		23.20	-	-
15	1	74		23.40	-	-
15	36	0		22.48	-	-
15	36	20		22.46	-	-
15	36	39		22.49	-	-
15	75	0		22.49	-	-
15	1	0	16-QAM	22.80	-	-
15	1	37		22.89	-	-
15	1	74		22.62	-	-
15	36	0		22.61	-	-
15	36	20		22.62	-	-
15	36	39		21.54	-	-
15	75	0		21.74	-	-
10	1	0	QPSK	-	23.45	-
10	1	25		-	23.41	-
10	1	49		-	23.49	-
10	25	0		-	23.44	-
10	25	12		-	22.48	-
10	25	25		-	22.42	-
10	50	0		-	22.49	-
10	1	0	16-QAM	-	22.78	-
10	1	25		-	22.76	-
10	1	49		-	22.85	-
10	25	0		-	22.42	-
10	25	12		-	22.49	-
10	25	25		-	21.51	-
10	50	0		-	21.54	-



LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
5	1	0	QPSK	23.28	23.29	23.39
5	1	12		23.41	23.35	23.46
5	1	24		23.50	23.41	23.40
5	12	0		22.35	22.36	22.40
5	12	7		22.45	22.43	22.48
5	12	13		22.46	22.40	22.50
5	25	0		22.35	22.41	22.51
5	1	0	16-QAM	22.65	22.65	22.74
5	1	12		22.80	22.62	22.74
5	1	24		22.81	22.62	22.81
5	12	0		21.40	21.40	21.41
5	12	7		21.49	21.41	21.39
5	12	13		21.51	21.41	21.42
5	25	0		21.42	21.40	21.50
3	1	0	QPSK	23.21	23.32	23.33
3	1	8		23.31	23.41	23.47
3	1	14		23.41	23.41	23.40
3	8	0		22.29	22.35	22.30
3	8	4		22.41	22.41	22.43
3	8	7		22.41	22.41	21.45
3	15	0		22.36	22.39	22.40
3	1	0	16-QAM	22.50	22.49	22.60
3	1	8		22.69	22.60	22.81
3	1	14		22.60	22.60	22.82
3	8	0		21.30	21.35	21.41
3	8	4		21.29	21.40	21.56
3	8	7		21.43	21.50	21.55
3	15	0		21.46	21.45	21.50





LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
1.4	1	0	QPSK	23.18	23.29	23.49
1.4	1	3		23.29	23.41	23.41
1.4	1	5		23.30	23.32	23.41
1.4	3	0		23.32	23.36	23.40
1.4	3	1		23.30	22.34	23.49
1.4	3	3		23.30	23.39	23.41
1.4	6	0		22.34	22.35	22.49
1.4	1	0	16-QAM	22.49	22.64	22.80
1.4	1	3		22.49	22.68	22.80
1.4	1	5		22.69	22.70	22.82
1.4	3	0		22.46	22.49	22.69
1.4	3	1		22.40	22.41	22.60
1.4	3	3		22.40	22.41	22.60
1.4	6	0		21.41	21.50	21.61



## Appendix B. Test Results of ERP and Radiated Test

### ERP

LTE Band 26 / 15MHz (Channel 26765)							
Channel	Mode	RB		Horizontal		Vertical	
		Size	Offset	ERP(dBm)	ERP(W)	ERP(dBm)	ERP(W)
Lowest	QPSK	1	0	23.43	0.22	21.87	0.15
Middle		-	-	-	-	-	-
Highest		-	-	-	-	-	-
Lowest	16QAM	1	37	22.89	0.19	21.33	0.14
Middle		-	-	-	-	-	-
Highest		-	-	-	-	-	-

**Radiated Spurious Emission****LTE Band 26(Part 90s)**

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	-54.58	-13	-41.58	-64.32	-61.5	0.52	9.59	H
	4888	-47.39	-13	-34.39	-68.2	-57.05	0.39	12.20	H
	5704	-50.72	-13	-37.72	-72.31	-60.66	0.99	13.08	H
									H
									H
									H
									H
	1632	-54.60	-13	-41.60	-64.2	-61.52	0.52	9.59	V
	4888	-51.09	-13	-38.09	-72.01	-60.75	0.39	12.20	V
	5704	-51.84	-13	-38.84	-73.63	-61.78	0.99	13.08	V
									V
									V
									V
									V
Middle	1632	-55.23	-13	-42.23	-65.01	-62.15	0.52	9.59	H
	4904	-47.78	-13	-34.78	-68.52	-57.36	0.47	12.20	H
	5720	-51.72	-13	-38.72	-73.3	-61.65	0.99	13.07	H
									H
									H
									H
									H
	1632	-55.36	-13	-42.36	-64.96	-62.28	0.52	9.59	V
	4904	-50.92	-13	-37.92	-71.77	-60.5	0.47	12.20	V
	5720	-53.03	-13	-40.03	-74.82	-62.96	0.99	13.07	V
									V
									V
									V
									V



Highest	1640	-54.61	-13	-41.61	-64.52	-61.54	0.52	9.61	H
	4920	-51.19	-13	-38.19	-71.85	-60.69	0.55	12.20	H
	5736	-53.31	-13	-40.31	-74.89	-63.23	0.99	13.06	H
									H
									H
									H
									H
	1640	-57.28	-13	-44.28	-66.9	-64.21	0.52	9.61	V
	4920	-52.96	-13	-39.96	-73.74	-62.46	0.55	12.20	V
	5736	-53.26	-13	-40.26	-75.05	-63.18	0.99	13.06	V
									V
									V
									V
									V
									V
									V

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



LTE Band 26 / 15MHz / 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	-55.11	-13	-42.11	-64.89	-62.03	0.52	9.59	H
	4888	-48.03	-13	-35.03	-68.84	-57.69	0.39	12.20	H
	5704	-51.40	-13	-38.40	-72.99	-61.34	0.99	13.08	H
									H
									H
									H
									H
	1632	-55.02	-13	-42.02	-64.62	-61.94	0.52	9.59	V
	4888	-52.30	-13	-39.30	-73.22	-61.96	0.39	12.20	V
	5704	-53.55	-13	-40.55	-75.34	-63.49	0.99	13.08	V
									V
									V
									V
									V

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