

# FCC RF Test Report

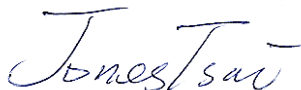
APPLICANT : LC Future Center Limited Taiwan Branch  
EQUIPMENT : Notebook  
BRAND NAME : Lenovo  
MODEL NAME : TP00086A  
FCC ID : 2AJN7-TP00086A  
STANDARD : FCC 47 CFR Part 2, and 90(S)  
CLASSIFICATION : PCS Licensed Transmitter (PCB)

This is a partial report which is included the Radiated Spurious Emission test item. The product was received on Nov. 08, 2016 and testing was completed on Nov. 25, 2016. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-D-2010 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



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FCC ID : 2AJN7-TP00086A

Page Number : 1 of 13

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Report Version : Rev. 01

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## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FW6N0822	Rev. 01	Initial issue of report	Dec. 27, 2016



## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1053 §90.691	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 52.37 dB at 3284.000 and 3256.000 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	
Equipment	Notebook
Brand Name	Lenovo
Model Name	TP00086A
FCC ID	2AJN7-TP00086A
Integrated WWAN Module	Manufacturer: Sierra Wireless Brand Name: AirPrime Model Name: EM7455
Sample 1	EUT with Antenna 1
Sample 2	EUT with Antenna 2
EUT supports Radios application	WCDMA/HSPA/LTE
EUT Stage	Production Unit

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



## 1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
<b>Tx Frequency</b>	814.7 ~ 823.3 MHz
<b>Rx Frequency</b>	859.7 ~ 868.3 MHz
<b>Bandwidth</b>	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz
<b>Type of Modulation</b>	QPSK / 16QAM

**Remark:** This test report recorded only product characteristics and test results of PCS Licensed Transmitter (PCB).

## 1.5 Modification of EUT

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

## 1.6 Testing Site

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 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. TEL: +886-3-327-3456 FAX: +886-3-328-4978
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	03CH07-HY

## 1.7 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 / EIA-603-D-2010
- 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

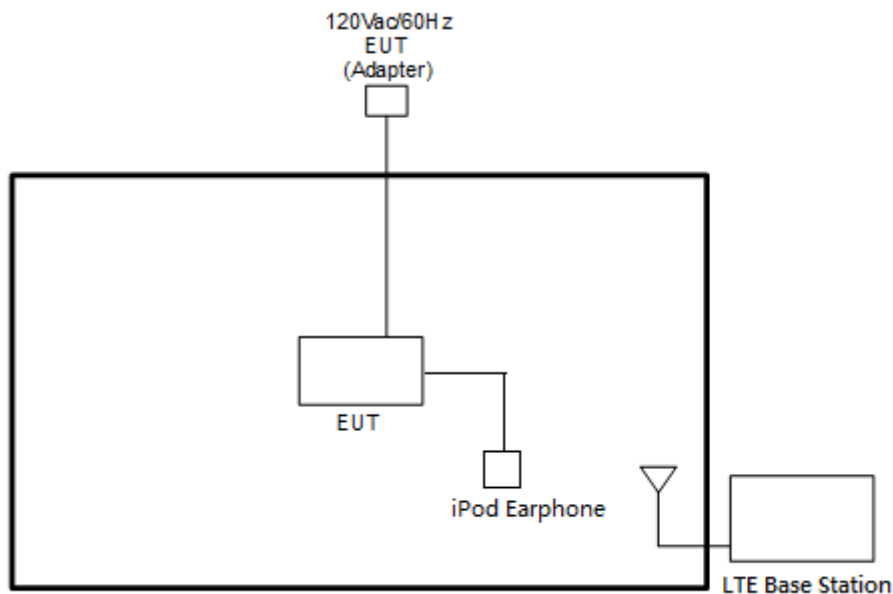
### 2.1 Test Mode

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
Radiated Spurious Emission	26	v	v	v	v	v	-	v		v			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.														

### 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.	LTE Base Station	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 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 Field Strength of Spurious Radiation Measurement**

##### **3.1.1 Description of Field Strength of Spurious Radiated Measurement**

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-C-2004. 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.

##### **3.1.2 Measuring Instruments**

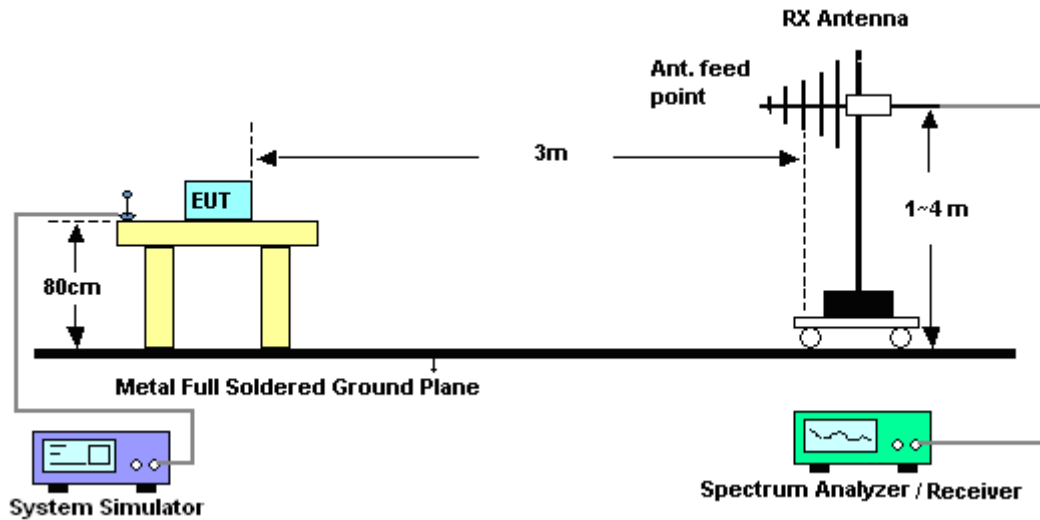
The measuring equipment is listed in the section 4 of this test report.

##### **3.1.3 Test Procedures**

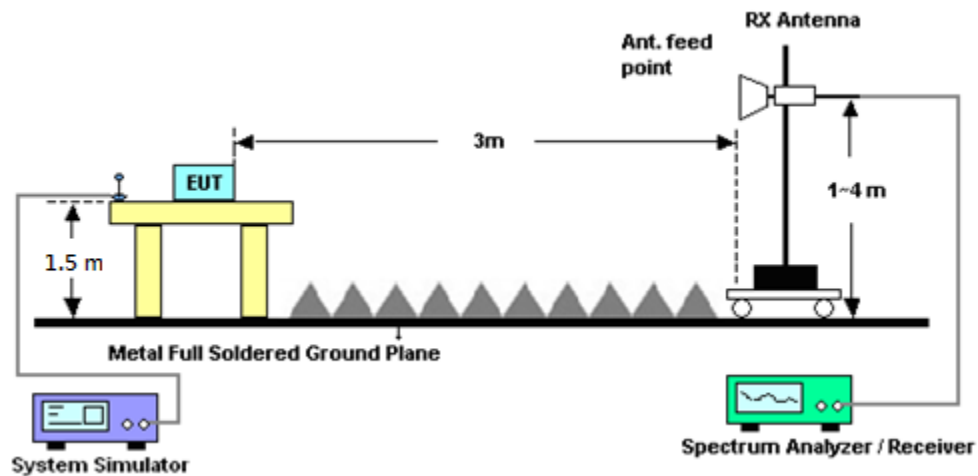
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position 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)  
 $= P(W) - [43 + 10 \log(P)] \text{ (dB)}$   
 $= [30 + 10 \log(P)] \text{ (dBm)} - [43 + 10 \log(P)] \text{ (dB)}$   
 $= -13 \text{ dBm}.$

### 3.1.4 Test Setup

For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



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

Please refer to Appendix A.



## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D&008 00N1D01N- 06	35419&03	30MHz to 1GHz	Jan. 13, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Jan. 12, 2017	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Aug. 18, 2017	Radiation (03CH07-HY)
EMI Test Receiver	Keysight	N9038A(MX E)	MY5413008 5	20Hz ~ 8.4GHz	Oct. 26, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Oct. 25, 2017	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00 101800-30- 10P	1590075	1GHz ~ 18GHz	Apr. 15, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Apr. 14, 2017	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	Mar. 18, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Mar. 17, 2017	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY5347011 8	10Hz~44GHz	Feb. 27, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Feb. 26, 2017	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Nov. 17, 2016 ~ Nov. 25, 2016	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Nov. 17, 2016 ~ Nov. 25, 2016	N/A	Radiation (03CH07-HY)
Preamplifier	MITEQ	JS44-18004 000-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Jun. 13, 2017	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA91702 51	18GHz ~ 40GHz	Oct. 07, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Oct. 06, 2017	Radiation (03CH07-HY)
Horn Antenna	ESCO	3117	00066584	1GHz~18GHz	Sep. 02, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	Sep. 01, 2017	Radiation (03CH07-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	May 19, 2016	Nov. 17, 2016 ~ Nov. 25, 2016	May 18, 2017	Radiation (03CH07-HY)

## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.05
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.44
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### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.95
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## Appendix A. Test Results of Radiated Test

### Part 90S LTE Band 26

Part 90S 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	1628	-70.20	-13	-57.20	-57.89	-72.02	0.97	4.94	H
	2442	-67.00	-13	-54.00	-60.11	-68.8	1.27	5.23	H
	3256	-66.01	-13	-53.01	-61.2	-69.26	1.53	6.93	H
	1628	-70.77	-13	-57.77	-58.94	-72.59	0.97	4.94	V
	2442	-66.54	-13	-53.54	-60.09	-68.34	1.27	5.23	V
	3256	-65.41	-13	-52.41	-61	-68.66	1.53	6.93	V
Middle	1637	-66.96	-13	-53.96	-54.65	-68.75	0.97	4.92	H
	2455	-66.84	-13	-53.84	-60.03	-68.68	1.28	5.27	H
	3273	-65.95	-13	-52.95	-61.21	-69.27	1.53	7.00	H
	1637	-68.44	-13	-55.44	-56.61	-70.23	0.97	4.92	V
	2455	-65.98	-13	-52.98	-59.61	-67.82	1.28	5.27	V
	3273	-65.60	-13	-52.60	-61.23	-68.92	1.53	7.00	V
Highest	1645	-68.55	-13	-55.55	-56.39	-70.32	0.98	4.89	H
	2468	-66.60	-13	-53.60	-59.79	-68.47	1.28	5.30	H
	3290	-65.98	-13	-52.98	-61.31	-69.37	1.54	7.08	H
	1645	-68.12	-13	-55.12	-56.43	-69.89	0.98	4.89	V
	2468	-66.48	-13	-53.48	-60.11	-68.35	1.28	5.30	V
	3290	-65.84	-13	-52.84	-61.5	-69.23	1.54	7.08	V

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



Part 90S LTE Band 26 / 3MHz / 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	1628	-70.76	-13	-57.76	-58.45	-72.58	0.97	4.94	H
	2442	-67.08	-13	-54.08	-60.19	-68.88	1.27	5.23	H
	3256	-66.24	-13	-53.24	-61.43	-69.49	1.53	6.93	H
	1628	-70.53	-13	-57.53	-58.7	-72.35	0.97	4.94	V
	2442	-66.52	-13	-53.52	-60.07	-68.32	1.27	5.23	V
	3256	-65.63	-13	-52.63	-61.22	-68.88	1.53	6.93	V
Middle	1635	-68.58	-13	-55.58	-56.27	-70.38	0.97	4.92	H
	2453	-66.40	-13	-53.40	-59.51	-68.23	1.28	5.26	H
	3270	-65.98	-13	-52.98	-61.24	-69.29	1.53	6.99	H
	1635	-69.94	-13	-56.94	-58.11	-71.74	0.97	4.92	V
	2453	-66.47	-13	-53.47	-60.02	-68.3	1.28	5.26	V
	3270	-65.59	-13	-52.59	-61.22	-68.9	1.53	6.99	V
Highest	1642	-68.77	-13	-55.77	-56.61	-70.55	0.98	4.90	H
	2463	-66.57	-13	-53.57	-59.76	-68.43	1.28	5.29	H
	3284	-65.83	-13	-52.83	-61.09	-69.19	1.54	7.05	H
	1642	-68.45	-13	-55.45	-56.76	-70.23	0.98	4.90	V
	2463	-66.54	-13	-53.54	-60.17	-68.4	1.28	5.29	V
	3284	-65.37	-13	-52.37	-61	-68.73	1.54	7.05	V

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



Part 90S LTE Band 26 / 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	1628	-70.81	-13	-57.81	-58.51	-72.63	0.97	4.94	H
	2442	-66.81	-13	-53.81	-59.92	-68.61	1.27	5.23	H
	3256	-66.04	-13	-53.04	-61.23	-69.29	1.53	6.93	H
	1628	-70.34	-13	-57.34	-58.51	-72.16	0.97	4.94	V
	2442	-66.52	-13	-53.52	-60.07	-68.32	1.27	5.23	V
	3256	-65.66	-13	-52.66	-61.25	-68.91	1.53	6.93	V
Middle	1633	-67.93	-13	-54.93	-55.62	-69.74	0.97	4.93	H
	2450	-66.81	-13	-53.81	-59.92	-68.63	1.28	5.25	H
	3266	-65.95	-13	-52.95	-61.14	-69.24	1.53	6.97	H
	1633	-69.71	-13	-56.71	-57.88	-71.52	0.97	4.93	V
	2450	-66.50	-13	-53.50	-60.05	-68.32	1.28	5.25	V
	3266	-65.66	-13	-52.66	-61.25	-68.95	1.53	6.97	V
Highest	1638	-67.78	-13	-54.78	-55.62	-69.57	0.97	4.91	H
	2457	-66.76	-13	-53.76	-59.95	-68.6	1.28	5.27	H
	3276	-65.76	-13	-52.76	-61.02	-69.09	1.53	7.01	H
	1638	-68.49	-13	-55.49	-56.8	-70.28	0.97	4.91	V
	2457	-66.19	-13	-53.19	-59.82	-68.03	1.28	5.27	V
	3276	-65.66	-13	-52.66	-61.29	-68.99	1.53	7.01	V

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





LTE Band 26 / 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	1628	-68.70	-13	-55.70	-56.39	-70.52	0.97	4.94	H
	2442	-66.67	-13	-53.67	-59.78	-68.47	1.27	5.23	H
	3256	-65.73	-13	-52.73	-60.92	-68.98	1.53	6.93	H
	1628	-70.10	-13	-57.10	-58.27	-71.92	0.97	4.94	V
	2442	-66.36	-13	-53.36	-59.91	-68.16	1.27	5.23	V
	3256	-65.37	-13	-52.37	-60.96	-68.62	1.53	6.93	V

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



Part 90S LTE Band 26 / 15MHz / 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	1628	-69.50	-13	-56.50	-57.19	-71.32	0.97	4.94	H
	2442	-67.06	-13	-54.06	-60.17	-68.86	1.27	5.23	H
	3256	-65.87	-13	-52.87	-61.06	-69.12	1.53	6.93	H
	1628	-70.54	-13	-57.54	-58.71	-72.36	0.97	4.94	V
	2442	-66.69	-13	-53.69	-60.24	-68.49	1.27	5.23	V
	3256	-65.70	-13	-52.70	-61.29	-68.95	1.53	6.93	V

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

## Appendix C. Antenna Information

EM7455				3G & LTE
Antenna 1	Manufacturer	Amphenol	Peak gain	2.97
	P/N	LX-7845-16-000-C	Type	PIFA
Antenna 2	Manufacturer	Speedwire	Peak gain	2.94
	P/N	F.0G.ZV-0006-001-00	Type	PIFA