



# FCC RF Test Report

**APPLICANT** : LC Future Center Limited Taiwan Branch  
**EQUIPMENT** : Notebook  
**BRAND NAME** : Lenovo  
**MODEL NAME** : TP00086A  
**FCC ID** : 2AJN7-TP00086AUC  
**STANDARD** : FCC 47 CFR Part 2, and 90(S)  
**CLASSIFICATION** : PCS Licensed Transmitter (PCB)

Equipment: AirPrime EM7455 and Intel 8260NGW tested inside of Lenovo Notebook.

This is a variant report which is only valid together with the original test report. The product was received on Nov. 18, 2016 and testing was completed on Dec. 12, 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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### APPENDIX A. TEST RESULTS OF RADIATED TEST

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## REVISION HISTORY



## SUMMARY OF TEST RESULT

| Report Section | FCC Rule           | Description                          | Limit                               | Result | Remark                                     |
|----------------|--------------------|--------------------------------------|-------------------------------------|--------|--|
| 3.1            | §2.1053<br>§90.691 | Field Strength of Spurious Radiation | $< 43+10\log_{10}(P[\text{Watts}])$ | PASS   | Under limit<br>27.55 dB at<br>4896.000 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-TP00086AUC   |
| Sample 1                        | EUT with Antenna 1   |
| Sample 2                        | EUT with Antenna 2   |
| Integrated WWAN Module          | Manufacturer: Sierra Wireless<br>Brand Name: AirPrime<br>Model Name: EM7455                      |
| Integrated WLAN Module          | Brand Name: Intel<br>Model Name: 8260NGW   |
| EUT supports Radios application | WCDMA/HSPA/LTE<br>WLAN 11a/b/g/n HT20/HT40<br>WLAN 11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE |
| EUT Stage                       | Production Unit  |

**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. This is a variant report by TP00086A (FCC ID: 2AJN7-TP00086A) change WLAN module from Intel 8265NGW to Intel 8260NGW. WWAN RSE spot check has been performed on 2AJN7-TP00086AUC (model: TP00086A). Other test cases were performed on original report which can be referred to Sporton Report Number FW6N0822. Based on the original report, only worst case was verified.



## 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

Sportun 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,<br>Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| <b>Test Site No.</b>      | <b>Sportun 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

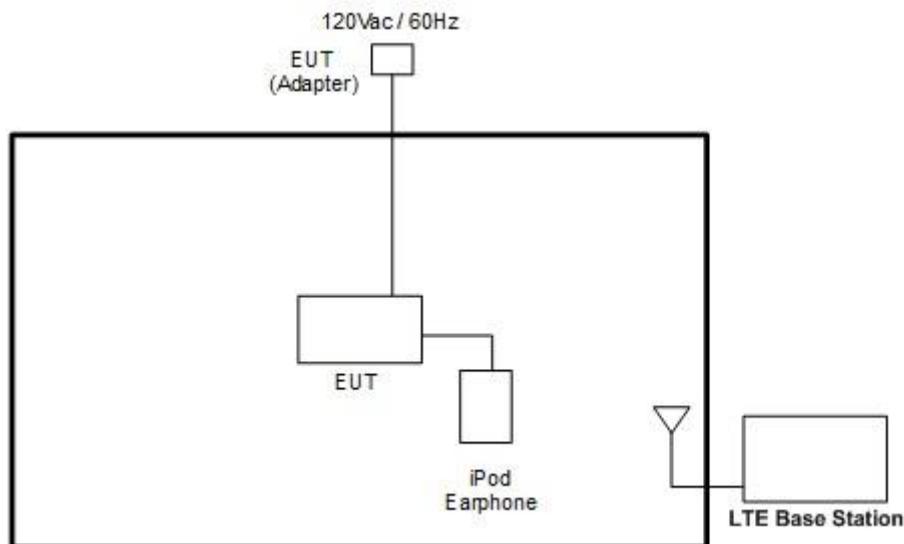
### 2.1 Test Mode

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            |   |   |
| Note                       | <ol style="list-style-type: none"><li>The mark "v" means that this configuration is chosen for testing</li><li>The mark "-" means that this bandwidth is not supported.</li><li>All the test cases were performed with Sample 1.</li><li>LTE Band26 transmit frequency for part22 rule is 824MHz-849MHz, for part90 rule is 824MHz-849MHz. 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.</li></ol> |                 |   |   |    |    |    |            |       |      |      |      |              |   |   |

### 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 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.

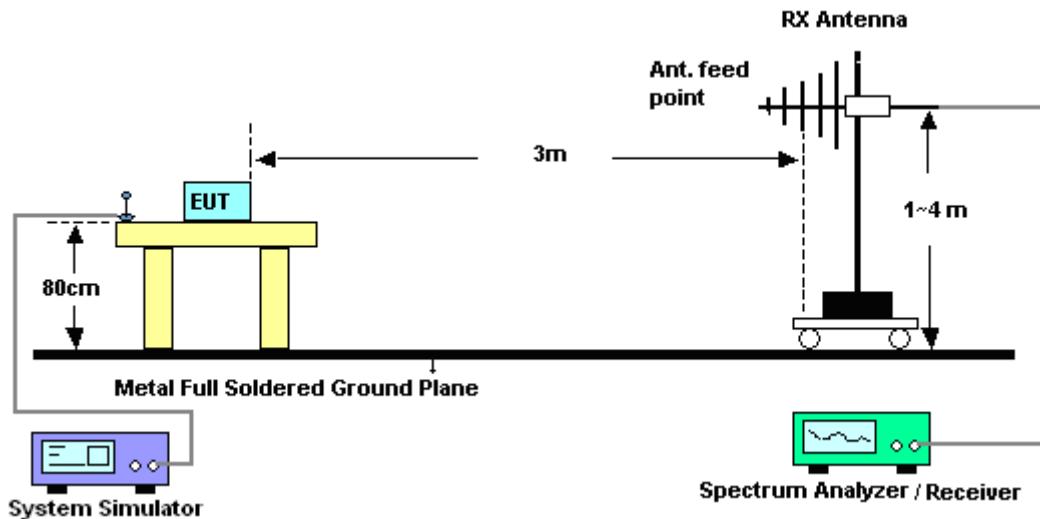
##### 3.1.3 Test Procedures

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

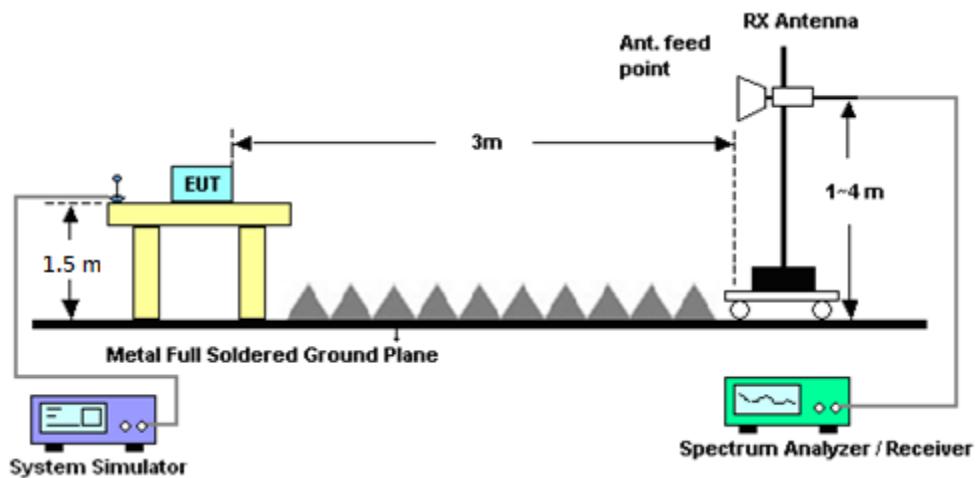
$$\begin{aligned} &= P(W) - [43 + 10\log(P)] \text{ (dB)} \\ &= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)} \\ &= -13 \text{ dBm.} \end{aligned}$$

### 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&00800 N1D01N-06 | 35419&03    | 30MHz to 1GHz   | Jan. 13, 2016    | Dec. 12, 2016 | Jan. 12, 2017 | Radiation (03CH07-HY) |
| Double Ridge Horn Antenna | ESCO            | 3117                      | 00075962    | 1GHz ~ 18GHz    | Aug. 19, 2016    | Dec. 12, 2016 | Aug. 18, 2017 | Radiation (03CH07-HY) |
| EMI Test Receiver         | Keysight        | N9038A(MXE)               | MY54130085  | 20Hz ~ 8.4GHz   | Oct. 26, 2016    | Dec. 12, 2016 | Oct. 25, 2017 | Radiation (03CH07-HY) |
| Preamplifier              | MITEQ           | AMF-7D-0010 1800-30-10P   | 1590075     | 1GHz ~ 18GHz    | Apr. 15, 2016    | Dec. 12, 2016 | Apr. 14, 2017 | Radiation (03CH07-HY) |
| Preamplifier              | COM-POWER       | PA-103A                   | 161241      | 10MHz-1GHz      | Mar. 18, 2016    | Dec. 12, 2016 | Mar. 17, 2017 | Radiation (03CH07-HY) |
| Spectrum Analyzer         | Agilent         | N9010A                    | MY53470118  | 10Hz~44GHz      | Feb. 27, 2016    | Dec. 12, 2016 | Feb. 26, 2017 | Radiation (03CH07-HY) |
| Antenna Mast              | Max-Full        | MFA520BS                  | N/A         | 1m~4m           | N/A              | Dec. 12, 2016 | N/A           | Radiation (03CH07-HY) |
| Turn Table                | ChainTek        | Chaintek 3000             | N/A         | 0~360 Degree    | N/A              | Dec. 12, 2016 | N/A           | Radiation (03CH07-HY) |
| Preamplifier              | MITEQ           | JS44-1800400 0-33-8P      | 1840917     | 18GHz ~ 40GHz   | Jun. 14, 2016    | Dec. 12, 2016 | Jun. 13, 2017 | Radiation (03CH07-HY) |
| SHF-EHF Horn Antenna      | SCHWARZBECK     | BBHA 9170                 | BBHA9170251 | 18GHz ~ 40GHz   | Oct. 07, 2016    | Dec. 12, 2016 | Oct. 06, 2017 | Radiation (03CH07-HY) |
| Horn Antenna              | ESCO            | 3117                      | 00066584    | 1GHz~18GHz      | Sep. 02, 2016    | Dec. 12, 2016 | Sep. 01, 2017 | Radiation (03CH07-HY) |
| Signal Generator          | Rohde & Schwarz | SMF100A                   | 101107      | 100kHz~40GHz    | May 19, 2016     | Dec. 12, 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)) | 5.7 |
|---|-----|

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

|   |     |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.5 |
|---|-----|

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

|   |     |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.2 |
|---|-----|



## **Appendix A. Test Results of Radiated Test**



## Part 90S LTE Band 26

| Part 90S 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                              | 1632              | -65.69       | -13           | -52.69            | -53.14            | -67.5              | 0.97                 | 4.93                  | H                  |
|                                     | 2448              | -58.36       | -13           | -45.36            | -51.25            | -60.18             | 1.27                 | 5.24                  | H                  |
|                                     | 4896              | -40.55       | -13           | -27.55            | -39.63            | -45.61             | 2.28                 | 9.49                  | H                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | H                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | H                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | H                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | H                  |
|                                     | 1632              | -63.62       | -13           | -50.62            | -51.49            | -65.43             | 0.97                 | 4.93                  | V                  |
|                                     | 2448              | -53.48       | -13           | -40.48            | -46.78            | -55.3              | 1.27                 | 5.24                  | V                  |
|                                     | 4896              | -64.27       | -13           | -51.27            | -63.14            | -69.33             | 2.28                 | 9.49                  | V                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | V                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | V                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | V                  |
|                                     |                   |              |               |                   |                   |                    |                      |                       | V                  |



## Appendix C. Antenna Information

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