

# FCC PART 15C TEST REPORT

For

## Shenzhen Autel Intelligent Tech. Co., Ltd.

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Nanshan, Shenzhen, China

**FCC ID: WQ83017315433**

|                                                                                                                                                                                                                                                                                                                 |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                                                                                          | <b>Product Type:</b><br>TPMS Sensor |
| <b>Test Engineer:</b> Rocky Kang                                                                                                                                                                                                                                                                                | <i>Rocky Kang</i>                   |
| <b>Report Number:</b> RSZ131213002-00                                                                                                                                                                                                                                                                           |                                     |
| <b>Report Date:</b> 2014-01-02                                                                                                                                                                                                                                                                                  |                                     |
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**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Shenzhen Autel Intelligent Tech. Co., Ltd.*'s product, model number: *MaxiTPMS-PAD (FCC ID: WQ83017315433)* or the "EUT" in this report was a TPMS Sensor, *named as MaxiTPMS-PAD by applicant*, which was measured approximately: 10.3 cm (L) x 10.0 cm (W) x 2.7 cm (H), rated input voltage: DC 5V from USB port.

*\* All measurement and test data in this report was gathered from production sample serial number: 1312066 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2013-12-13.*

### Objective

This report is prepared on behalf of *Shenzhen Autel Intelligent Tech. Co., Ltd.* in accordance with Part 2-Subpart J, and Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207 and 15.209 rules.

### Related Submittal(s)/Grant(s)

No related submittal(s)

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

### EUT Exercise Software

MaxiTPMS-Pad provided by manufacturer.

### Special Accessories

The special accessories were provided by BACL.

### Equipment Modifications

No modification was made to the EUT tested.

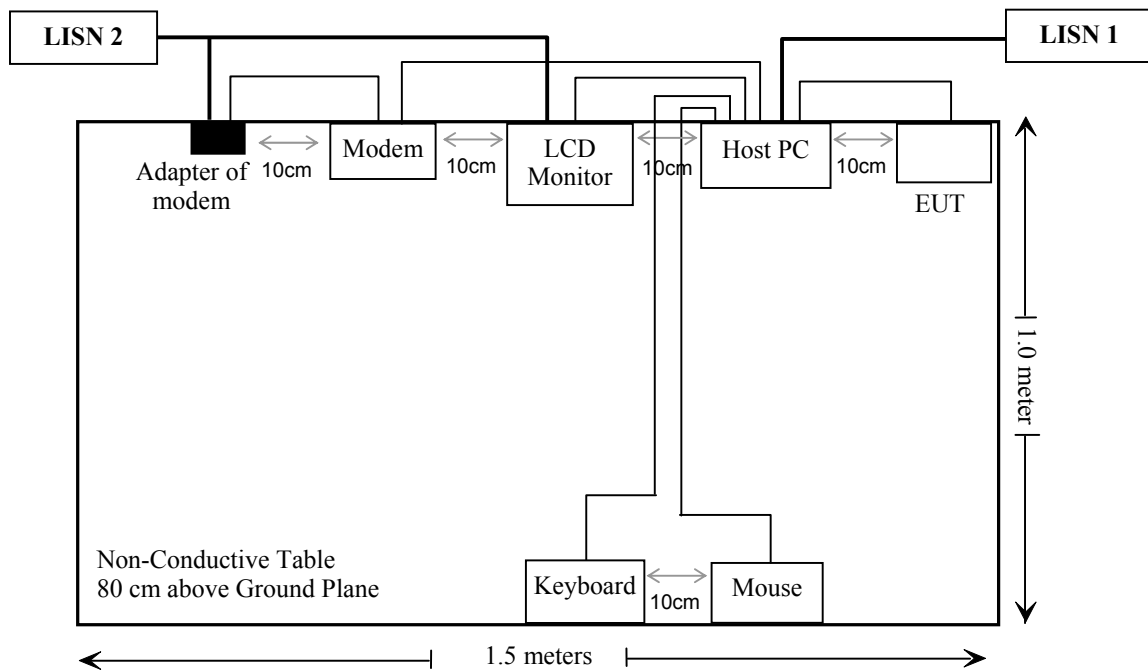
### Support Equipment List and Details

| Manufacturer | Description | Model    | Serial Number            |
|--------------|-------------|----------|--------------------------|
| IBM          | PC          | 166      | L3AG6TG                  |
| DELL         | LCD Monitor | ST2420Lb | CN-OXOK27-74261-2AF-090U |
| DELL         | Keyboard    | L100     | CNORH656658907BL05DC     |
| DELL         | Mouse       | MOC5UO   | G1900NKD                 |
| SAST         | Modem       | AEM-2100 | 0293                     |

### External I/O Cable

| Cable Description                 | Length (m) | From/Port | To          |
|-----------------------------------|------------|-----------|-------------|
| Shielding Detachable USB Cable    | 1.5        | Host PC   | Mouse       |
| Shielding Detachable Serial Cable | 1.2        | Host PC   | Modem       |
| Shielding Detachable K/B Cable    | 1.5        | Host PC   | Keyboard    |
| Shielding Detachable VGA Cable    | 1.2        | Host PC   | LCD Monitor |
| Unshielding Detachable USB Cable  | 1.0        | EUT       | Host PC     |

# Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| FCC Rules       | Description of Test | Result     |
|-----------------|---------------------|------------|
| §15.203         | Antenna Requirement | Compliance |
| §15.207(a)      | Conducted Emissions | Compliance |
| 15.205, §15.209 | Radiated Emissions  | Compliance |

## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

### **Antenna Connector Construction**

The EUT has a PCB antenna arrangement, which was permanently attached; fulfill the requirement of this section. Please refer to EUT photos.

**Result:** Compliant

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC §15.207

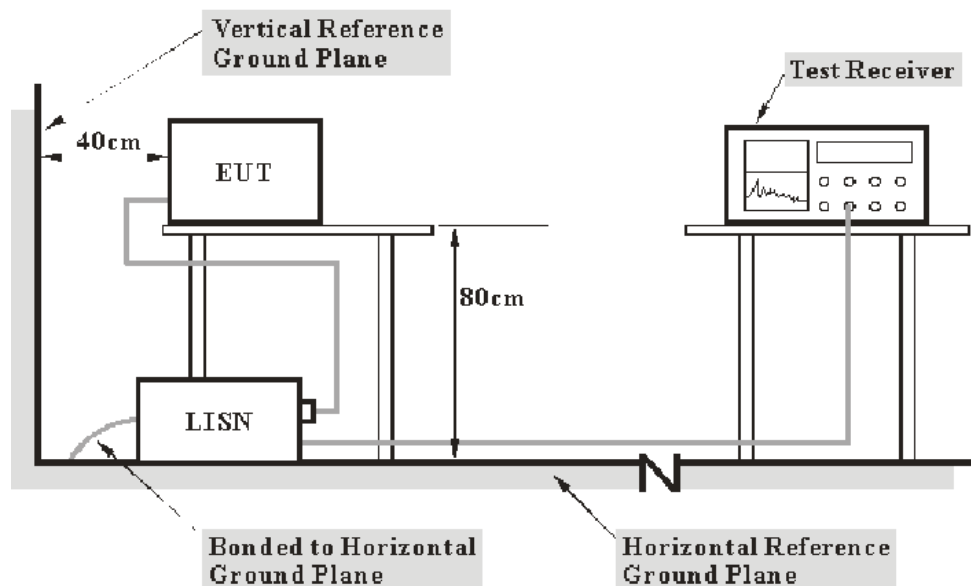
### Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements may be receiver reading, attenuation of the connection between AMN/ISN and receiver, AMN/ISN voltage division factor, AMN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

| Port     | Measurement uncertainty                |
|----------|----------------------------------------|
| AC Mains | 3.26 dB (k=2, 95% level of confidence) |
| CAT 3    | 3.70 dB (k=2, 95% level of confidence) |
| CAT 5    | 3.86 dB (k=2, 95% level of confidence) |
| CAT 6    | 4.64 dB (k=2, 95% level of confidence) |

### EUT Setup



- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The host PC was connected to a 120 VAC/60 Hz power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range  | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz  |

### Test Procedure

During the conducted emission test, the host PC was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

### Test Equipment List and Details

| Manufacturer    | Description       | Model  | Serial Number          | Calibration Date | Calibration Due Date |
|-----------------|-------------------|--------|------------------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCS30 | 100176                 | 2013-06-17       | 2014-06-17           |
| Rohde & Schwarz | LISN              | ENV216 | 3560.6650.12-101613-Yb | 2013-05-07       | 2014-05-07           |
| Rohde & Schwarz | Transient Limiter | ESH3Z2 | DE25985                | 2013-10-15       | 2014-10-15           |
| Rohde & Schwarz | CE Test software  | EMC 32 | V8.53                  | -                | -                    |

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

### Test Results Summary

According to the recorded data in following table, with the worst margin reading of:

**11.2 dB at 13.166000 MHz in the Neutral conducted mode**

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

in BACL,  $U_{(Lm)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

**Test Data****Environmental Conditions**

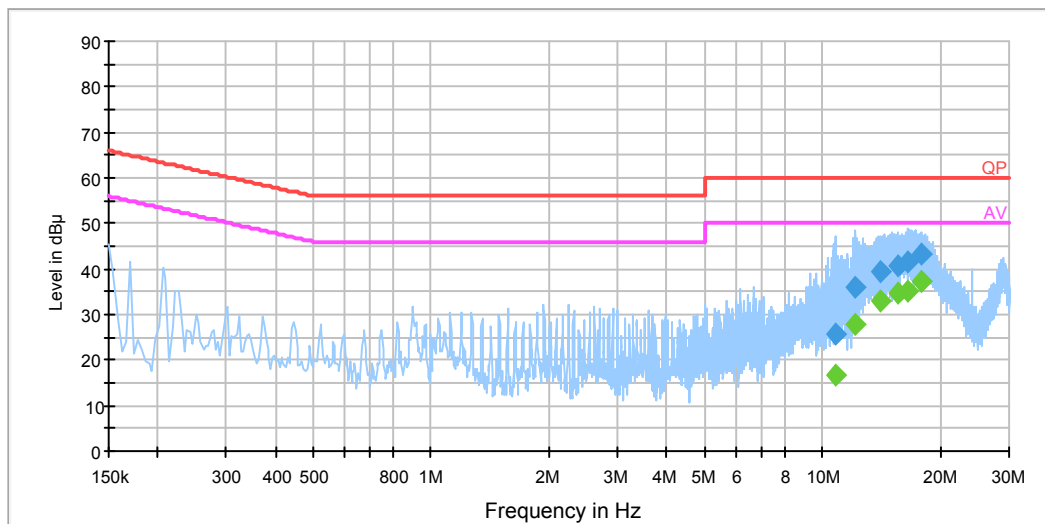
|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 20 °C     |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

The testing was performed by Rocky Kang on 2013-12-30.

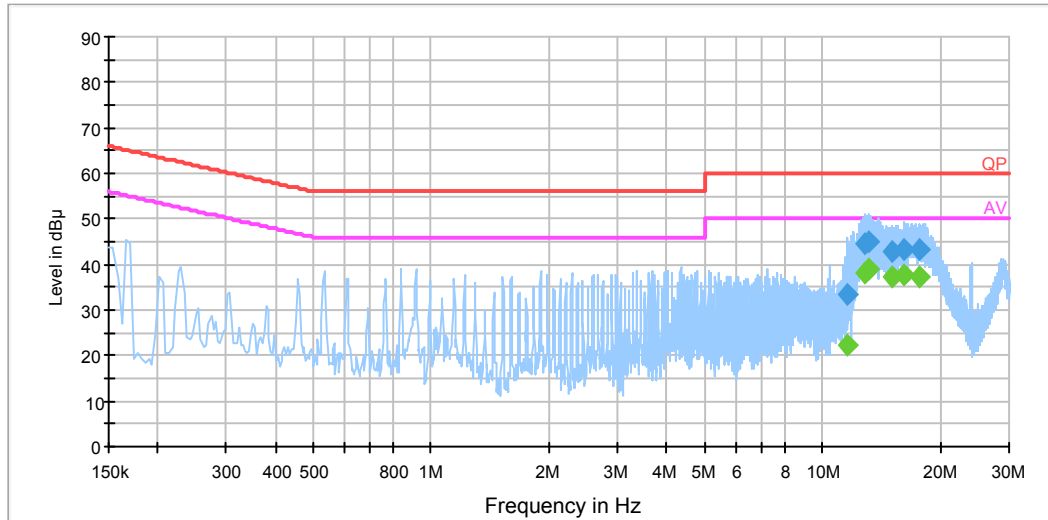
Test mode: Transmitting

**AC 120V/60 Hz, Line**

EMI Auto Test L



| Frequency (MHz) | Corrected Amplitude (dBμV) | Corrected Factor (dB) | Limit (dBμV) | Margin (dB) | Remark (PK/QP/Ave) |
|-----------------|----------------------------|-----------------------|--------------|-------------|--------------------|
| 10.822000       | 25.6                       | 19.7                  | 60.0         | 34.4        | QP                 |
| 10.822000       | 16.6                       | 19.7                  | 50.0         | 33.4        | Ave.               |
| 12.122000       | 35.9                       | 19.7                  | 60.0         | 24.1        | QP                 |
| 12.122000       | 28.0                       | 19.7                  | 50.0         | 22.0        | Ave.               |
| 14.094000       | 39.2                       | 19.8                  | 60.0         | 20.8        | QP                 |
| 14.094000       | 32.8                       | 19.8                  | 50.0         | 17.2        | Ave.               |
| 15.614000       | 40.6                       | 19.8                  | 60.0         | 19.4        | QP                 |
| 15.614000       | 34.6                       | 19.8                  | 50.0         | 15.4        | Ave.               |
| 16.578000       | 41.4                       | 19.8                  | 60.0         | 18.6        | QP                 |
| 16.578000       | 35.3                       | 19.8                  | 50.0         | 14.7        | Ave.               |
| 17.818000       | 43.4                       | 19.9                  | 60.0         | 16.6        | QP                 |
| 17.818000       | 37.3                       | 19.9                  | 50.0         | 12.7        | Ave.               |

**AC 120V/60 Hz, Neutral****EMI Auto Test N**

| Frequency (MHz) | Corrected Amplitude (dBμV) | Corrected Factor (dB) | Limit (dBμV) | Margin (dB) | Remark (PK/QP/Ave) |
|-----------------|----------------------------|-----------------------|--------------|-------------|--------------------|
| 11.522000       | 33.3                       | 19.8                  | 60.0         | 26.7        | QP                 |
| 11.522000       | 22.5                       | 19.8                  | 50.0         | 27.5        | Ave.               |
| 12.826000       | 44.4                       | 19.8                  | 60.0         | 15.6        | QP                 |
| 12.826000       | 38.0                       | 19.8                  | 50.0         | 12.0        | Ave.               |
| 13.166000       | 45.1                       | 19.8                  | 60.0         | 14.9        | QP                 |
| 13.166000       | 38.8                       | 19.8                  | 50.0         | 11.2        | Ave.               |
| 15.090000       | 42.9                       | 19.9                  | 60.0         | 17.1        | QP                 |
| 15.090000       | 37.4                       | 19.9                  | 50.0         | 12.6        | Ave.               |
| 16.186000       | 43.3                       | 19.9                  | 60.0         | 16.7        | QP                 |
| 16.186000       | 37.9                       | 19.9                  | 50.0         | 12.1        | Ave.               |
| 17.662000       | 43.2                       | 20.0                  | 60.0         | 16.8        | QP                 |
| 17.662000       | 37.5                       | 20.0                  | 50.0         | 12.5        | Ave.               |

**Note:**

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation  
The corrected factor has been input into the transducer of the test software.
- 2) Corrected Amplitude = Reading + Correction Factor + Transient Limiter
- 3) Margin = Limit – Corrected Amplitude

## **FCC§15.205 & §15.209 - FIELD STRENGTH AND RADIATED EMISSIONS**

### **Applicable Standard**

FCC§15.205, §15.209

### **Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is 5.91 dB for 30MHz-1GHz.

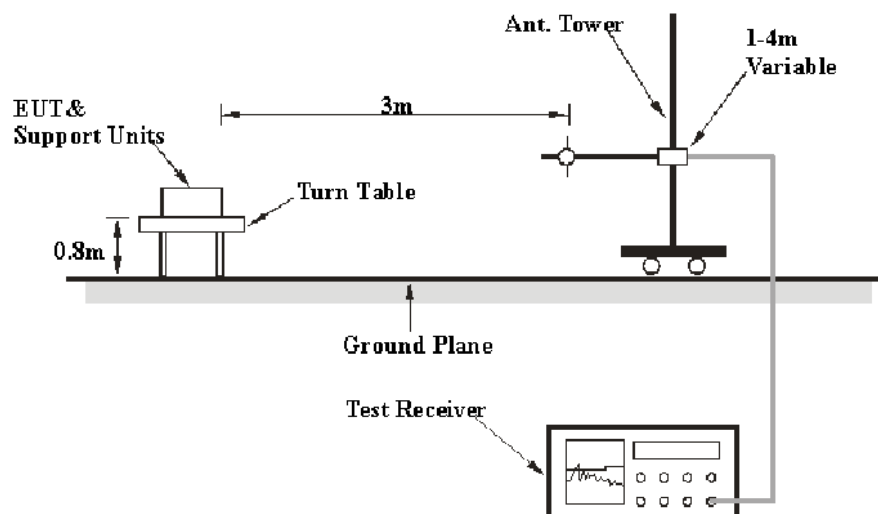
### **Test Equipment Setup**

The spectrum analyzer or receiver is set as:

| Frequency Range   | RBW     | Video B/W | IF B/W | Detector |
|-------------------|---------|-----------|--------|----------|
| 9 kHz – 30 MHz    | 10 kHz  | 30 kHz    | 9 kHz  | QP       |
| 30 MHz – 1000 MHz | 100 kHz | 300 kHz   | 120kHz | QP       |

Note: The frequency bands 9-90 kHz and 110-490 kHz, the testing are use an average detector.

### **EUT Setup**



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2009 The specification used was the FCC 15.209 and 15.205 limits.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

| Manufacturer    | Description          | Model  | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|----------------------|--------|---------------|------------------|----------------------|
| HP              | Amplifier            | 8447E  | 1937A01046    | 2013-09-30       | 2014-09-30           |
| Rohde & Schwarz | EMI Test Receiver    | ESCI   | 101122        | 2013-09-17       | 2014-09-17           |
| Sunol Sciences  | Broadband Antenna    | JB1    | A040904-2     | 2011-11-28       | 2014-11-27           |
| ETS             | Passive Loop Antenna | 6512   | 00029604      | 2011-11-30       | 2014-11-29           |
| Rohde & Schwarz | CE Test software     | EMC 32 | V9.10         | -                | -                    |

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 20 °C     |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

*The testing was performed by Rocky Kang on 2013-12-31.*

*EUT operation mode: Transmitting*

**1) Field Strength of Radiated Emissions, up to 30MHz**

| Frequency (kHz) | Reading Amplitude (dBuV) | Detector (PK/QP/Ave.) | Direction (Degree) | Height (m) | Antenna Factor (dB/m) | Cable Loss (dB) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------------------|-----------------------|--------------------|------------|-----------------------|-----------------|-----------------|----------------|-------------|
| 125.0           | 36.85                    | Ave.                  | 180                | 1.5        | 59.8                  | 0.1             | 96.75           | 105.67         | 8.92        |
| 369.6           | 28.51                    | Ave.                  | 180                | 1.5        | 56.8                  | 0.1             | 85.41           | 96.25          | 10.84       |

**2) Spurious Emission, up to 1000MHz:**

| Frequency (MHz) | Corrected Amplitude (dBμV/m) | Antenna height (m) | Antenna Polarity | Turntable position (degree) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------------------|--------------------|------------------|-----------------------------|------------------------|----------------|-------------|
| 40.67           | 34.54                        | 1.3                | H                | 196                         | -13.8                  | 40             | 5.46        |
| 67.79           | 32.73                        | 1.2                | H                | 178                         | -19.4                  | 40             | 7.27        |
| 216.97          | 34.24                        | 1.0                | V                | 163                         | -14.3                  | 46             | 11.76       |
| 665.96          | 33.32                        | 1.1                | H                | 89                          | -7.6                   | 46             | 12.68       |

**\*\*\*\*\* END OF REPORT \*\*\*\*\***