

# FCC PART 15B TEST REPORT

For

**Shanghai HowayGIS Co., Ltd**

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**FCC ID: 2AAZD-TGT1-S3**

|                                                                                                                                                                                                                                                  |                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                           | <b>Product Type:</b><br>High Precision Mobile GNSS Receiver |
| <b>Test Engineer:</b> Annie Xuan                                                                                                                                                                                                                 | <i>Annie Xuan</i>                                           |
| <b>Report Number:</b> RKSA180614001-00A                                                                                                                                                                                                          |                                                             |
| <b>Report Date:</b> 2018-08-23                                                                                                                                                                                                                   |                                                             |
| <b>Reviewed By:</b> Ray Wang<br>EMC Leader                                                                                                                                                                                                       | <i>Ray Wang</i>                                             |
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## GENERAL INFORMATION

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

|                  |                                                     |
|------------------|-----------------------------------------------------|
| Applicant        | Shanghai HowayGIS Co., Ltd                          |
| Test Model       | TG-T1                                               |
| Series Model     | TG-T2, TG-T3, X2                                    |
| Model Difference | Model Name                                          |
| Product          | High Precision Mobile GNSS Receiver                 |
| Rate Voltage     | DC 7.2V from Battery and DC 12V charging by Adapter |
| Dimension        | 137mm(L)*72mm(W)*50.4mm(H)                          |

#### Adapter Information:

Model: A122-1201000ID

Input: AC100-240V 50/60Hz 0.4A

Output: DC12V,1000mA

*\*All measurement and test data in this report was gathered from production sample serial number: 20180614001.  
(Assigned by the BACL. The EUT supplied by the applicant was received on 2018-06-14)*

### Objective

This report is prepared on behalf of Shanghai HowayGIS Co., Ltd in accordance with Part 2-Subpart J, and Part 15-Subparts A and B of the Federal Communication Commission's rules.

The objective of the manufacturer is to determine the compliance of EUT with FCC Part 15, Class B digital device.

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

FCC Part 15.247 DTS and Part 15.247 DSS submissions with FCC ID: 2AAZD-TGT1-S3.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, 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. (Kunshan). 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. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

## SYSTEM TEST CONFIGURATION

### Justification

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

*Test mode: Data transmission & GPS on*

### EUT Exercise Software

Notebook and EUT data transmission by “U-Center.exe”.  
Mobile Phone and EUT to communication by APP “GNSS viewer. APP”

### Special Accessories

No special accessory was used.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

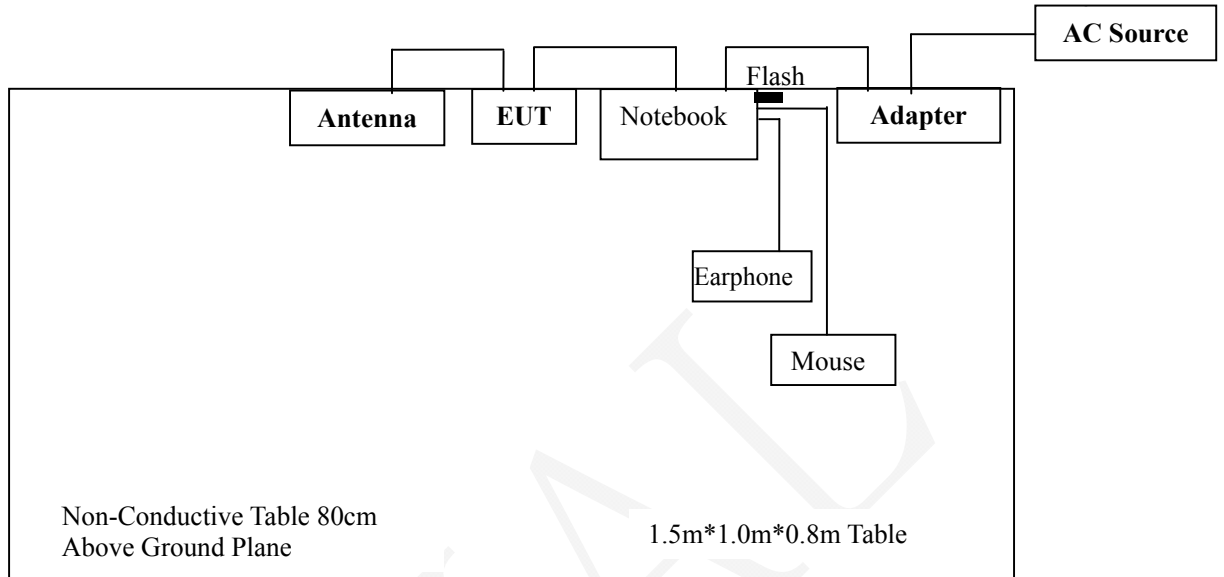
| Manufacturer                           | Description | Model       | Serial Number   |
|----------------------------------------|-------------|-------------|-----------------|
| DELL                                   | Notebook    | E6410       | 3094742521      |
| DELL                                   | Adapter     | DA130PE1-00 | /               |
| Logitech                               | Mouse       | M-U0026     | HS529HB         |
| Lenovo                                 | Flash       | T180        | 0A1266865200521 |
| Shanghai HowayGIS<br>Infotech Co., Ltd | Antenna     | /           | /               |
| /                                      | Earphone    | /           | /               |

### External I/O Cable

| Cable Description      | Length (m) | From/Port        | To        |
|------------------------|------------|------------------|-----------|
| Antenna Cable          | 3.0        | EUT              | Antenna   |
| Mouse USB Cable        | 1.0        | Notebook         | Mouse     |
| 9pin Fisher Plug cable | 1.2        | 9pin Fisher Plug | EUT       |
| RS232 turn USB cable   | 1.0        | 9pin Fisher Plug | Notebook  |
| Power Cable            | 1.0        | Adapter          | AC Source |

## Configuration of Radiation Test Setup

*Test mode*



**SUMMARY OF TEST RESULTS**

| FCC Rules | Description of Test | Results    |
|-----------|---------------------|------------|
| §15.107   | Conducted Emissions | Compliance |
| §15.109   | Radiated Emissions  | Compliance |

## FCC §15.107 –CONDUCTED EMISSIONS

### Applicable Standard

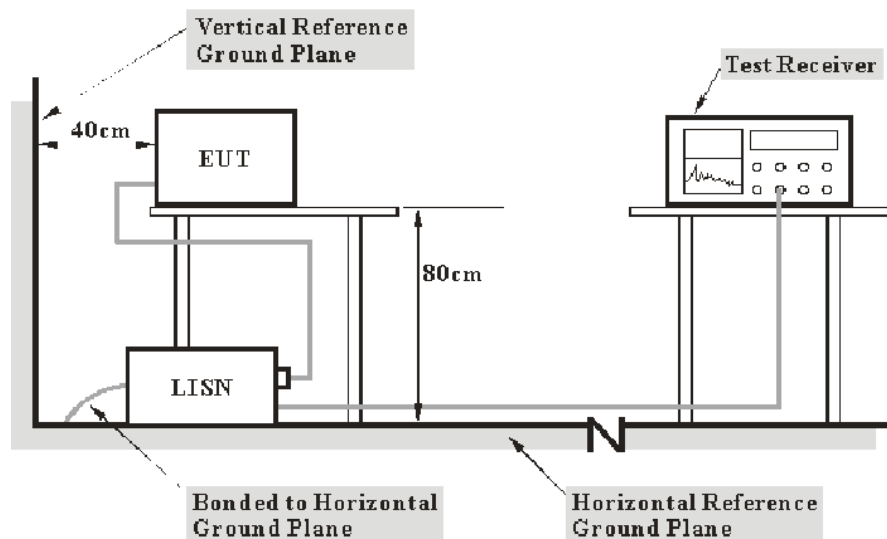
According to FCC§15.107

### Measurement Uncertainty

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

| Item |              | Measurement Uncertainty | $U_{\text{cispr}}$ |
|------|--------------|-------------------------|--------------------|
| AMN  | 150kHz~30MHz | 3.19 dB                 | 3.4 dB             |

### 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 measurement procedure of EUT setup is according with ANSI C63.4-2014. The related limit was specified in FCC Part 15.107 Class B.

### 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

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

All final 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  | 834115/007    | 2017-11-12       | 2018-11-11           |
| ROHDE&SCHWARZ   | LISN              | ENV216  | 3560655016    | 2017-11-12       | 2018-11-11           |
| BACL            | BACL-EMC          | V1.0    | CE001         | --               | --                   |
| MICRO-COAX      | Coaxial Cable     | Cable-6 | 006           | 2017-09-08       | 2018-09-07           |

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

### Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Amplitude} = \text{Meter Reading} + \text{VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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 7 dB below the limit. The equation for margin calculation is as follows:

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

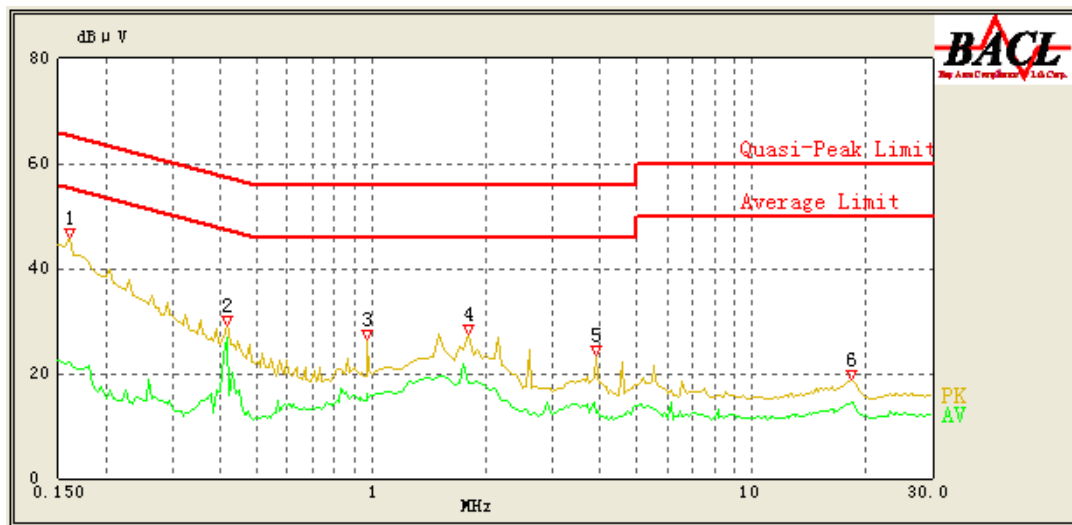
**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24°C      |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

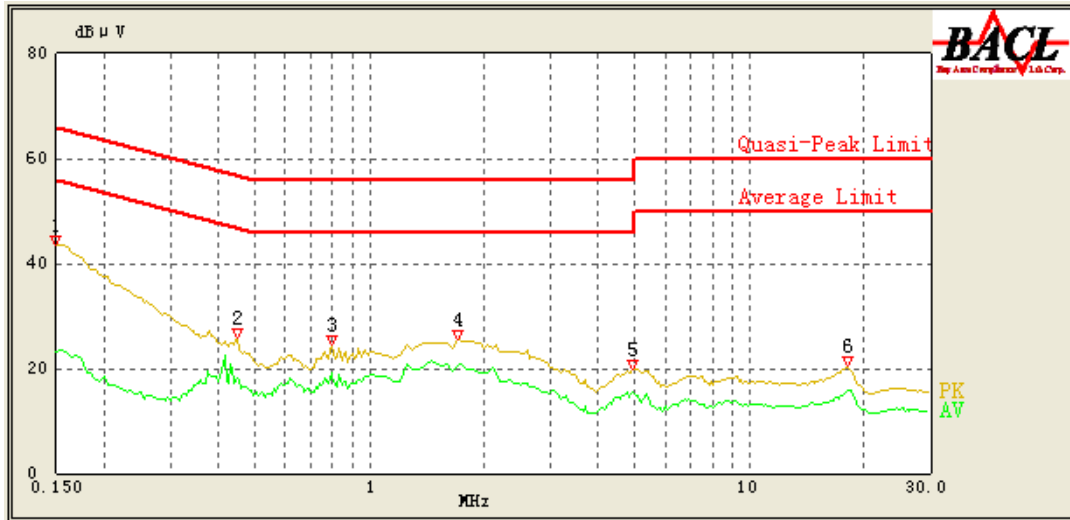
The testing was performed by Annie Xuan on 2018-08-07

Test mode

Line:



| No. | Frequency (MHz) | Corrected Amplitude (dBμV) | Correction (dB) | Limit (dBμV) | Margin (dB) | Detector (PK/AV/QP) |
|-----|-----------------|----------------------------|-----------------|--------------|-------------|---------------------|
| 1   | 0.160           | 45.68                      | 16.05           | 65.71        | 20.03       | QP                  |
|     | 0.160           | 22.02                      | 16.05           | 55.71        | 33.69       | AV                  |
| 2   | 0.415           | 29.10                      | 16.06           | 58.43        | 29.33       | QP                  |
|     | 0.415           | 26.79                      | 16.06           | 48.43        | 21.64       | AV                  |
| 3   | 0.975           | 26.60                      | 15.89           | 56.00        | 29.40       | QP                  |
|     | 0.975           | 16.17                      | 15.89           | 46.00        | 29.83       | AV                  |
| 4   | 1.800           | 27.63                      | 15.86           | 56.00        | 28.37       | QP                  |
|     | 1.800           | 18.26                      | 15.86           | 46.00        | 27.74       | AV                  |
| 5   | 3.900           | 23.54                      | 15.85           | 56.00        | 32.46       | QP                  |
|     | 3.900           | 12.41                      | 15.85           | 46.00        | 33.59       | AV                  |
| 6   | 18.350          | 18.76                      | 16.36           | 60.00        | 41.24       | QP                  |
|     | 18.350          | 14.46                      | 16.36           | 50.00        | 35.54       | AV                  |

**Neutral**

| No. | Frequency (MHz) | Corrected Amplitude (dBμV) | Correction (dB) | Limit (dBμV) | Margin (dB) | Detector (PK/AV/QP) |
|-----|-----------------|----------------------------|-----------------|--------------|-------------|---------------------|
| 1   | 0.150           | 43.53                      | 16.06           | 66.00        | 22.47       | QP                  |
|     | 0.150           | 23.21                      | 16.06           | 56.00        | 32.79       | AV                  |
| 2   | 0.450           | 25.72                      | 16.10           | 57.43        | 31.71       | QP                  |
|     | 0.450           | 18.17                      | 16.10           | 47.43        | 29.26       | AV                  |
| 3   | 0.795           | 24.34                      | 15.97           | 56.00        | 31.66       | QP                  |
|     | 0.795           | 19.27                      | 15.97           | 46.00        | 26.73       | AV                  |
| 4   | 1.700           | 25.51                      | 15.92           | 56.00        | 30.49       | QP                  |
|     | 1.700           | 20.51                      | 15.92           | 46.00        | 25.49       | AV                  |
| 5   | 4.950           | 19.96                      | 15.87           | 56.00        | 36.04       | QP                  |
|     | 4.950           | 15.57                      | 15.87           | 46.00        | 30.43       | AV                  |
| 6   | 18.150          | 20.45                      | 16.10           | 60.00        | 39.55       | QP                  |
|     | 18.250          | 15.96                      | 16.11           | 50.00        | 34.04       | AV                  |

## FCC §15.109 - RADIATED EMISSIONS

### Applicable Standard

FCC §15.109

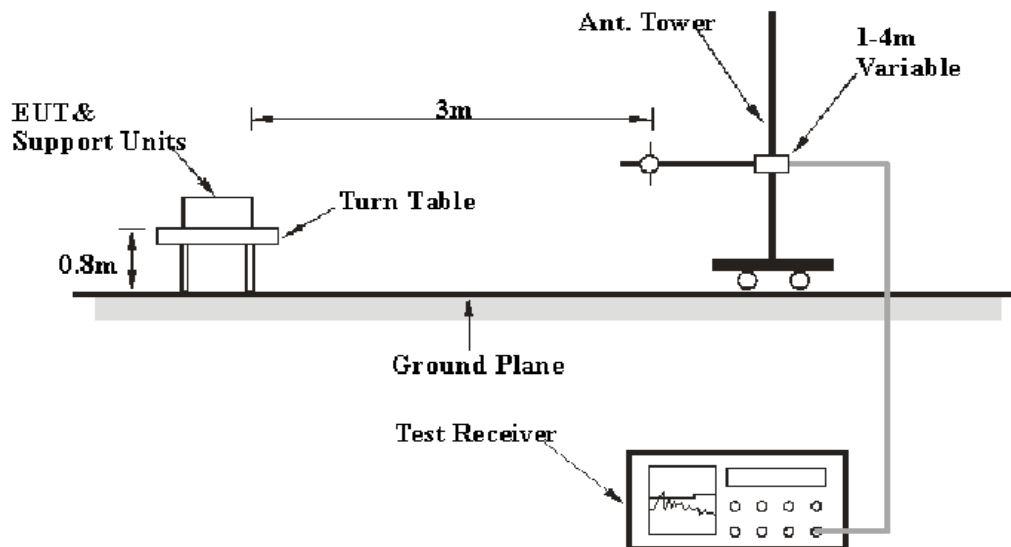
### Measurement Uncertainty

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.

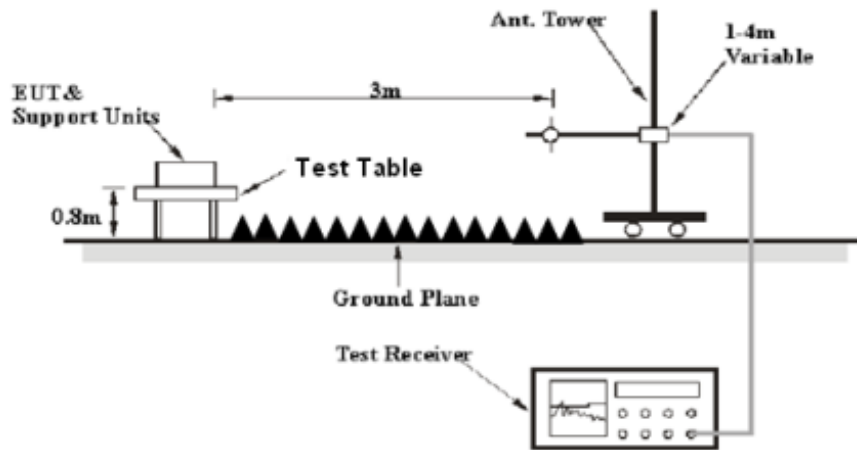
| Item              |               | Measurement Uncertainty | $U_{\text{cispr}}$ |
|-------------------|---------------|-------------------------|--------------------|
| Radiated Emission | 30MHz~1GHz    | 6.11dB                  | 6.3 dB             |
|                   | 1GHz~6GHz     | 4.45dB                  | 5.2 dB             |
|                   | 6 GHz ~18 GHz | 5.23dB                  | 5.5 dB             |

### EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2014. The specification used was the FCC Part 15.109 Class B limits.

The spacing between the peripherals was 10 cm.

### EMI Test Receiver Setup

The system was investigated from 30 MHz to 18 GHz.

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

| Frequency Range  | RBW     | Video B/W | IF B/W | Detector |
|------------------|---------|-----------|--------|----------|
| 30MHz – 1000 MHz | 120 kHz | 300 kHz   | 120kHz | QP       |
| Above 1 GHz      | 1MHz    | 3 MHz     | /      | Peak     |
|                  | 1MHz    | 3 MHz     | 1MHz   | AVG      |

### Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz, Peak and average detection mode above 1 GHz.

**Test Equipment List and Details**

| Manufacturer      | Description        | Model          | Serial Number | Calibration Date | Calibration Due Date |
|-------------------|--------------------|----------------|---------------|------------------|----------------------|
| Sonoma Instrument | Amplifier          | 310N           | 171205        | 2017-08-14       | 2018-08-13           |
| Rohde & Schwarz   | EMI Test Receiver  | ESCI           | 100195        | 2017-11-12       | 2018-11-11           |
| Sunol Sciences    | Broadband Antenna  | JB3            | A090314-2     | 2016-01-09       | 2019-01-08           |
| ETS               | Horn Antenna       | 3115           | 9207-3900     | 2017-07-15       | 2020-07-14           |
| Rohde & Schwarz   | Signal Analyzer    | ESU40          | 100207        | 2017-08-27       | 2018-08-26           |
| Champrotek        | Chamber            | Chamber A      | T-KSEMC049    | -                | -                    |
| Champrotek        | Chamber            | Chamber B      | T-KSEMC080    | -                | -                    |
| R&S               | Auto test Software | EMC32          | 100361        | -                | -                    |
| Narda             | Pre-amplifier      | AFS42-00101800 | 2001270       | 2017-12-12       | 2018-12-11           |
| MICRO-COAX        | Coaxial Cable      | Cable-8        | 008           | 2017-08-15       | 2018-08-14           |
| MICRO-COAX        | Coaxial Cable      | Cable-9        | 009           | 2017-08-15       | 2018-08-14           |
| MICRO-COAX        | Coaxial Cable      | Cable-10       | 010           | 2017-08-15       | 2018-08-14           |
| MICRO-COAX        | Coaxial Cable      | Cable-4        | 004           | 2017-12-12       | 2018-12-11           |
| MICRO-COAX        | Coaxial Cable      | Cable-5        | 005           | 2017-12-12       | 2018-12-11           |

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

**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:

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

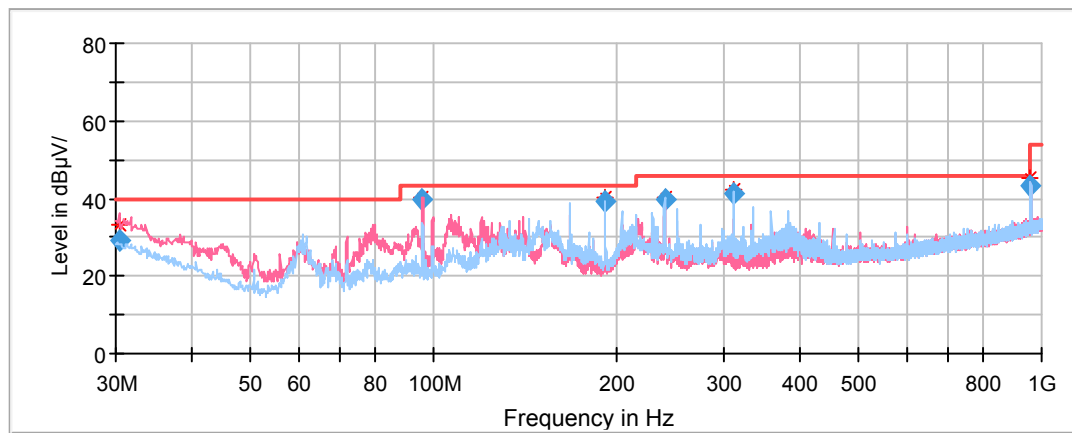
The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

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

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

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 20.2 °C   |
| <b>Relative Humidity:</b> | 56 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

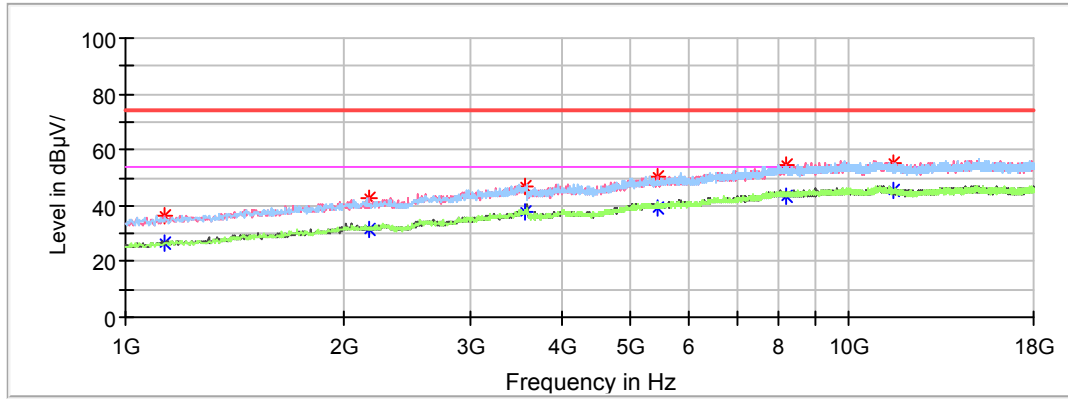
The testing was performed by Annie Xuan on 2018-08-09.

**30MHz ~ 1GHz**

| Frequency (MHz) | Quasi Peak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|---------------------|----------------|-------------|-------------|-----|---------------|--------------|
| 30.433354       | 29.38               | 40.00          | 10.62       | 101.0       | V   | 13.0          | -4.2         |
| 95.897550       | 39.87               | 43.50          | 3.63        | 101.0       | V   | 146.0         | -16.0        |
| 191.817100      | 39.34               | 43.50          | 4.16        | 101.0       | H   | 165.0         | -12.8        |
| 239.764600      | 39.86               | 46.00          | 6.14        | 199.0       | H   | 35.0          | -12.1        |
| 311.687150      | 41.36               | 46.00          | 4.64        | 101.0       | H   | 207.0         | -10.2        |
| 959.923350      | 43.15               | 46.00          | 2.85        | 101.0       | V   | 136.0         | 1.5          |

**Above 1 GHz:**

Full Spectrum



| Frequency (MHz) | Max Peak (dBμV/m) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|-------------------|------------------|----------------|-------------|-------------|-----|---------------|--------------|
| 1129.200000     | ---               | 26.79            | 54.00          | 27.21       | 200.0       | V   | 199.0         | -3.5         |
| 1129.200000     | 36.25             | ---              | 74.00          | 37.75       | 200.0       | V   | 199.0         | -3.5         |
| 2169.600000     | ---               | 31.46            | 54.00          | 22.54       | 100.0       | V   | 156.0         | 2.4          |
| 2169.600000     | 42.50             | ---              | 74.00          | 31.50       | 100.0       | V   | 156.0         | 2.4          |
| 3570.400000     | ---               | 37.76            | 54.00          | 16.24       | 200.0       | V   | 97.0          | 7.5          |
| 3570.400000     | 46.57             | ---              | 74.00          | 27.43       | 100.0       | V   | 2.0           | 7.5          |
| 5437.000000     | ---               | 39.45            | 54.00          | 14.55       | 100.0       | V   | 195.0         | 12.3         |
| 5437.000000     | 50.33             | ---              | 74.00          | 23.67       | 100.0       | V   | 195.0         | 12.3         |
| 8180.800000     | ---               | 43.33            | 54.00          | 10.67       | 100.0       | V   | 246.0         | 17.2         |
| 8180.800000     | 54.59             | ---              | 74.00          | 19.41       | 100.0       | V   | 246.0         | 17.2         |
| 11499.200000    | ---               | 45.70            | 54.00          | 8.30        | 100.0       | V   | 36.0          | 18.3         |
| 11499.200000    | 55.50             | ---              | 74.00          | 18.50       | 200.0       | V   | 109.0         | 18.3         |

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