

FCC Part 15 EMI TEST REPORT

Part I - 125kHz

E.U.T. : Access Controller

Model : AR-888

FCC ID : 2ACLEAR-888

for

APPLICANT : SOYAL TECHNOLOGY CO., LTD.

ADDRESS : 11F, No.368, Gongjian Rd., Xizhi Dist, New
Taipei City 221, Taiwan, R.O.C

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN

NO. 34. LIN 5. DINGFU VIL., LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.

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Report Number : 15-08-RBF-039-04

TEST REPORT CERTIFICATION

Applicant : SOYAL TECHNOLOGY CO., LTD.
11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221,
Taiwan, R.O.C

Manufacture : SOYAL TECHNOLOGY CO., LTD.
11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221,
Taiwan, R.O.C

Description of Device :
a) Type of EUT : Access Controller
b) Trade Name : SOYAL
c) Model No. : AR-888
d) Power Supply : DC 12V

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2009, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Summary of Tests

| Test | Results |
|--------------------|-------------|
| Radiated Emission | Pass |
| Conducted Emission | N/A |

Date Test Item Received : Aug. 29, 2015
Date Test Campaign Completed : Oct. 16, 2015
Date of Issue : Nov. 20, 2015

Test Engineer : Brian Huang
(Brian Huang, Engineer)

Approve & Authorized : S. S. Liou
S. S. Liou, Section Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : Access Controller
- b) Trade Name : SOYAL
- c) Model No. : AR-888
- d) Power Supply : DC 12V

1.2 Characteristics of Device

Access Controller working on frequency 125kHz and 13.56MHz.

1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.10-2009. Other required measurements were illustrated in separate sections of this test report for details.

Measurement Software

| Software | Version | Note |
|----------|-------------------|-------------------------|
| e3 | Version 6.100618b | Radiated Emission Test |
| e3 | Version 6.100421 | Conducted Emission Test |

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.

This site is FCC 2.948 listed and accepted in a letter dated Jan. 29, 2014.

Registration Number: 90589

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency MHz | Quasi Peak dB μ V | Average dB μ V |
|------------------|--------------------------|-----------------------|
| 0.15 - 0.5 | 66-56* | 56-46* |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

* Decreases with the logarithm of the frequency

(2) Radiated Emission Requirement

For intentional device, according to §15.209(a), except as provided elsewhere in this Subpart, the emission from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (μ V/m) | Distance (Meters) |
|--------------------|--------------------------------|----------------------|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

(3) Antenna Requirement

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 with the device.

2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

| MHz | MHz | MHz | GHz |
|-------------------|-----------------------|---------------|-------------|
| 0.090 - 0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495 - 0.505 ** | 16.69475 - 16.69525 | 608-614 | 5.35-5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475 - 156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2655-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3360-4400 | Above 38.6 |
| 13.36-13.41 | | | |

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation.

All measurements were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

| Device | Manufacture | Model / FCC ID. | Description |
|---------------------|-------------------------------|---------------------|-------------------------------|
| Access Controller * | SOYAL TECHNOLOGY CO., LTD. | AR-888/ 2ACLEAR-888 | 1.5m Unshielded DC Power Line |

Remark “*” means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For intentional radiators, the radiated emission shall comply with §15.209(a).

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below 30 MHz and 30 MHz~1000MHz respectively.
2. For radiated emission measurements, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on an open test site.
3. For radiated emission measurements, set the spectrum analyzer on a 100 kHz resolution bandwidth for each frequency measured in step 2.
4. For emission frequencies measured in 30 MHz~1000MHz, the search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.
8. For emission frequencies measured below 30 MHz, the search antenna is to be set in horizontal and vertical polarized orientation respectively. Rotate the loop antenna when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna rotation again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Figure 1 : Frequencies measured below 30 MHz configuration

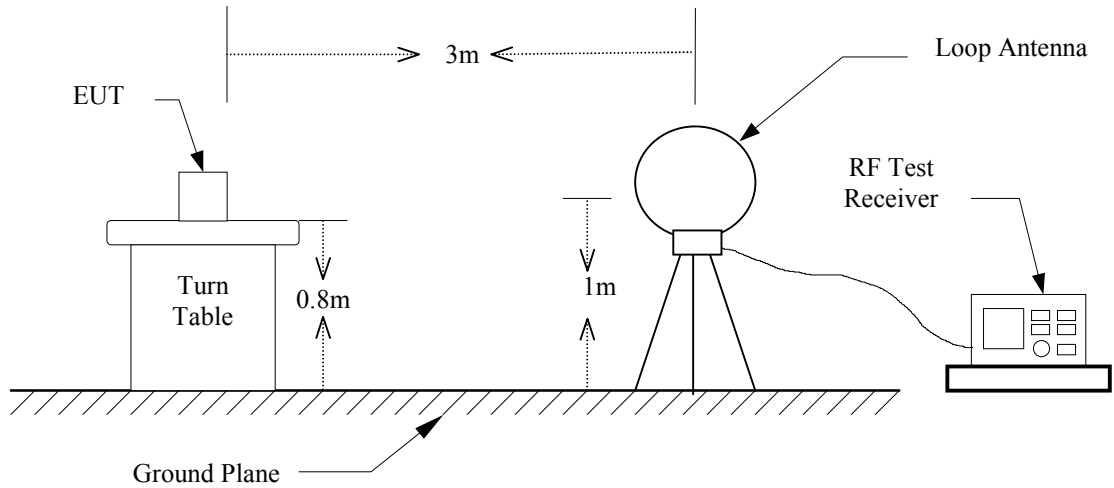
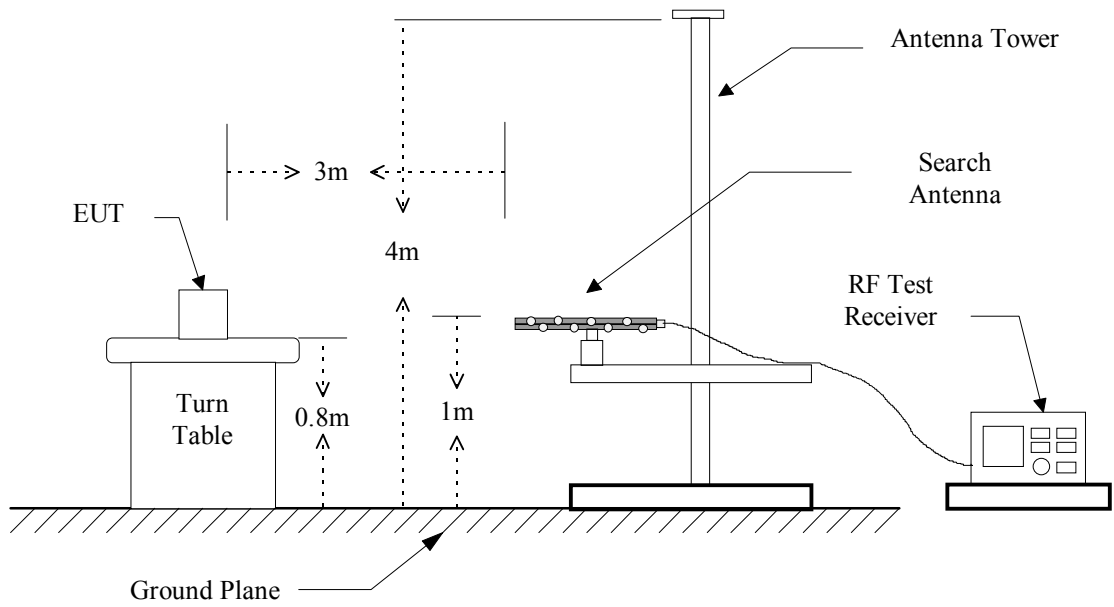


Figure 2 : Frequencies measured in 30 MHz~1000MHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|----------------------|-----------------|-----------|------------------|----------------|
| Loop Antenna | EMCO | 6512 | 2015/08/13 | 2016/08/12 |
| EMI Test Receiver | Rohde & Schwarz | ESVS30 | 2015/06/03 | 2016/06/02 |
| EMI Test Receiver | Rohde & Schwarz | ESL | 2015/03/26 | 2016/03/25 |
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2015/07/06 | 2016/07/05 |
| Bi-Log Antenna | ETC | MCTD 2786 | 2015/07/01 | 2016/06/30 |
| Log-periodic Antenna | EMCO | 3146 | 2015/06/04 | 2016/06/03 |
| Biconical Antenna | EMCO | 3110B | 2015/05/29 | 2016/05/28 |
| Amplifier | HP | 8447D | 2015/08/10 | 2016/08/09 |

Measuring instrument setup in measured frequency band when specified detector function is used :

| Frequency Band | Instrument | Detector | IF Bandwidth |
|------------------|-------------------|----------|------------------------------|
| 9 kHz ~ 150 kHz | EMI Test Receiver | QP | 200 Hz |
| | EMI Test Receiver | PK/AV | 200 Hz |
| 150 kHz ~ 30 MHz | EMI Test Receiver | QP | 9 kHz |
| | EMI Test Receiver | PK/AV | 9 kHz |
| 30 ~ 1000 MHz | EMI Test Receiver | QP | 120 kHz |
| | Spectrum Analyzer | PK | RBW: 100 kHz VBW: 100 kHz |

4.4 Radiated Emission Data

4.4.1 RF Portion

Operation Mode : TX
Fundamental Frequency : 0.125 MHz

Test Date : Oct. 16, 2015 Temperature : 28 °C Humidity : 56 %

A. Fundamental

| Frequency (MHz) | Ant Pol (H/V) | Reading (dBuV) | | Corr. Factor (dB) | Result @3m (dBuV/m) | | Limit @3m (dBuV/m) | | Margin Peak (dB) | Margin Ave (dB) |
|--------------------|---------------------|-------------------|------|-------------------------|------------------------|------|-----------------------|-------|------------------------|-----------------------|
| | | Peak | Ave | | Peak | Ave | Peak | Ave | | |
| 0.125 | V | 42.4 | 40.2 | 38.9 | 81.3 | 79.1 | 125.7 | 105.7 | -44.4 | -26.6 |

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “****” means that the average measurements are not necessary because the peak values of all emissions were below the average limit.
3. Limit for 125kHz at 300m distances is 19.2 uV/m or 25.7 dB μ V/m. The equivalent limit at 3m distances is 105.7 dB μ V/m.
4. The expanded uncertainty of the radiated emission tests is 3.53 dB.

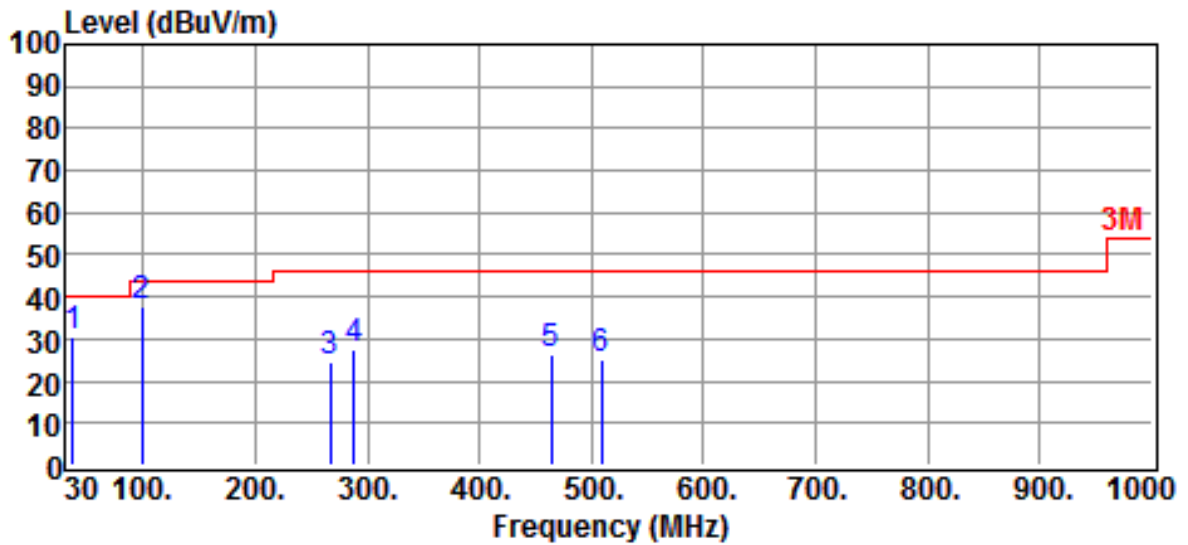
B. Harmonics

| Frequency (MHz) | Ant Pol (H/V) | Reading (dB μ V) | | Corr. Factor (dB) | Result @3m (dB μ V/m) | | Limit @3m (dB μ V/m) | | Margin (dB) |
|--------------------|---------------------|-------------------------|-----|-------------------------|------------------------------|-----|-----------------------------|-------|----------------|
| | | Peak | Ave | | Peak | Ave | Peak | Ave | |
| 0.250 | --- | --- | --- | 58.6 | --- | --- | 39.65 | 19.65 | --- |
| 0.375 | --- | --- | --- | 54.9 | --- | --- | 36.12 | 16.12 | --- |
| 0.500 | --- | --- | --- | 52.4 | --- | --- | 33.62 | --- | --- |
| 0.625 | --- | --- | --- | 51.1 | --- | --- | 31.69 | --- | --- |
| 0.750 | --- | --- | --- | 49.7 | --- | --- | 30.10 | --- | --- |
| 0.875 | --- | --- | --- | 48.3 | --- | --- | 28.76 | --- | --- |
| 1.000 | --- | --- | --- | 46.9 | --- | --- | 27.60 | --- | --- |
| 1.125 | --- | --- | --- | 46.5 | --- | --- | 26.58 | --- | --- |
| 1.250 | --- | --- | --- | 46.1 | --- | --- | 25.67 | --- | --- |

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emission level is too low to be measured.
3. Mark “*” means that the emission level is measured with a Quasi-Peak function.
4. Remark “****” means that the average measurements are not necessary because the peak values of all emissions were below the average limit.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.2 Other Emission

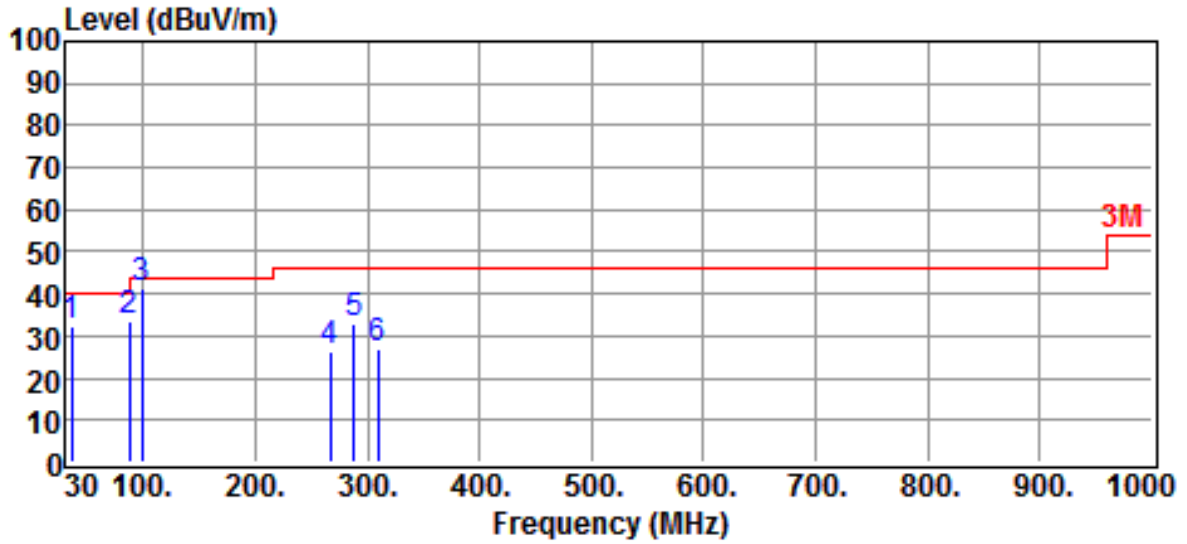


| | | | |
|--------------|--------------------|-----------|-------------|
| Site | :OPEN SITE | Date | :2015-10-16 |
| Limit | :3M | Ant. Pol. | :HORIZONTAL |
| EUT | :Access Controller | Model | :AR-888 |
| Power Rating | :DC 12V | Temp. | :28°C |
| Engineer | :Brian Huang | Humi. | :56 % |
| Test Mode | : | | |

| Freq MHz | Reading dB μ V | Correction Factor dB | Result dB μ V/m | Limits dB μ V/m | Over limit dB | Detector |
|-------------|-----------------------|----------------------------|------------------------|------------------------|------------------|----------|
| 37.7600 | 17.2 | 13.1 | 30.3 | 40.0 | -9.7 | QP |
| 98.8700 | 28.2 | 9.8 | 38.0 | 43.5 | -5.5 | QP |
| 266.6800 | 6.5 | 18.2 | 24.7 | 46.0 | -21.3 | QP |
| 288.0200 | 7.4 | 20.0 | 27.4 | 46.0 | -18.6 | QP |
| 463.5900 | 8.6 | 17.5 | 26.1 | 46.0 | -19.9 | QP |
| 509.1800 | 6.9 | 18.5 | 25.4 | 46.0 | -20.6 | QP |

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result



| | | | |
|--------------|--------------------|-----------|-------------|
| Site | :OPEN SITE | Date | :2015-10-16 |
| Limit | :3M | Ant. Pol. | :VERTICAL |
| EUT | :Access Controller | Model | :AR-888 |
| Power Rating | :DC 12V | Temp. | :28°C |
| Engineer | :Brian Huang | Humi. | :56 % |
| Test Mode | : | | |

| Freq MHz | Reading dB μ V | Correction Factor dB | Result dB μ V/m | Limits dB μ V/m | Over limit dB | Detector |
|-------------|-----------------------|----------------------------|------------------------|------------------------|------------------|----------|
| 35.8200 | 18.9 | 13.5 | 32.4 | 40.0 | -7.6 | QP |
| 87.2300 | 24.4 | 9.3 | 33.7 | 40.0 | -6.3 | QP |
| 98.8700 | 31.6 | 9.8 | 41.4 | 43.5 | -2.1 | QP |
| 266.6800 | 7.9 | 18.2 | 26.1 | 46.0 | -19.9 | QP |
| 288.0200 | 12.7 | 20.0 | 32.7 | 46.0 | -13.3 | QP |
| 309.3600 | 7.3 | 19.7 | 27.0 | 46.0 | -19.0 | QP |

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\mathbf{Result = Reading + Corrected Factor}$$

where Corrected Factor

$$= \text{Antenna FACTOR} + \text{Cable Loss} - \text{Amplifier Gain}$$

4.6 Photos of Radiation Measuring Setup





5 CONDUCTED EMISSION MEASUREMENT

5.1 Description

This EUT is excused from investigation of conducted emission, for it is powered by DC battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

6 ANTENNA REQUIREMENT

6.1 Standard Applicable

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 with the device.

6.2 Antenna Construction

The antenna is permanently attached on PCB, no consideration of replacement. Please refer to construction Photos of Exhibit B for details.