

# TEST REPORT

of

## FCC Part 15 Subpart C §15.249

### FCC ID : WEK-SKR-01

Equipment Under Test : Screen Keeper Wireless Tag  
Model Name : SKR-01  
Serial No. : N/A  
Applicant : Semilink Inc.  
Manufacturer : Semilink Inc.  
Date of Test(s) : 2010.06.08 ~ 2010.06.22  
Date of Issue : 2010.06.28

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date

2010.06.28

Duke Ko

Approved By:



Date

2010.06.28

Charles Kim

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## 1. General information

### 1.1 Testing laboratory

SGS Testing Korea Co., Ltd.

Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

[www.electrolab.kr.sgs.com](http://www.electrolab.kr.sgs.com)

Telephone : +82 +31 428 5700

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### 1.2 Details of applicant

Applicant : Semilink Inc.

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Gyeonggi-do, Korea 431-070

Contact Person : Caley Kim

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### 1.3. Description of EUT

|                      |                            |
|----------------------|----------------------------|
| Kind of Product      | Screen Keeper Wireless Tag |
| Model Name           | SKR-01                     |
| Serial Number        | N/A                        |
| Power Supply         | DC 3 V (Lithium Battery)   |
| Frequency Range      | 2 402 ~ 2 480 MHz          |
| Modulation Technique | GFSK                       |
| Number of Channels   | 79                         |
| Antenna Type         | Fixed Type                 |
| Antenna Gain         | -4.72 dB i                 |

### 1.4 Details of modification

-N/A

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## 1.5. Test equipment list

| Equipment        | Manufacturer                  | Model                                | Cal Due.      |
|------------------|-------------------------------|--------------------------------------|---------------|
| Signal Generator | Agilent                       | E4438C                               | Mar 31, 2011  |
| Power Meter      | Agilent                       | E4416A                               | Mar. 31, 2011 |
| Power Sensor     | Agilent                       | E9327A                               | Apr. 01, 2011 |
| Attenuator       | Agilent                       | 8495B                                | Apr. 02, 2011 |
| High Pass Filter | Wainwright                    | WHK3.0/18G-10SS                      | Sep. 29, 2010 |
| DC power Supply  | Agilent                       | U8002A                               | Jan. 06, 2011 |
| Preamplifier     | H.P.                          | 8447F                                | Jul. 02, 2010 |
| Preamplifier     | Agilent                       | 8449B                                | Mar. 31, 2011 |
| Test Receiver    | R & S                         | ESU26                                | Apr. 08, 2011 |
| Bilog Antenna    | SCHWARZBECK<br>MESSELEKTRONIK | VULB9163                             | Jul. 22, 2010 |
| Horn Antenna     | Rohde & Schwarz               | HF 906                               | Oct. 08, 2011 |
| Antenna Master   | EMCO                          | 1050                                 | N.C.R         |
| Turn Table       | Daeil EMC                     | DI-1500                              | N.C.R         |
| Anechoic Chamber | SY Corporation                | L x W x H<br>(9.6 m x 6.4 m x 6.6 m) | Jan. 27, 2011 |

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## 1.6. Summary of test results

The EUT has been tested according to the following specifications:

| Applied Standard : FCC Part15, Subpart C      |  |          |
|---|--|----------|
| Standard Section                              | Test Item  | Result   |
| 15.209(a)<br>15.249(a)<br>15.249(d)<br>15.205 | Fundamental, Spurious emission and edge band radiated emission | Complied |

## 1.7. Test report revision

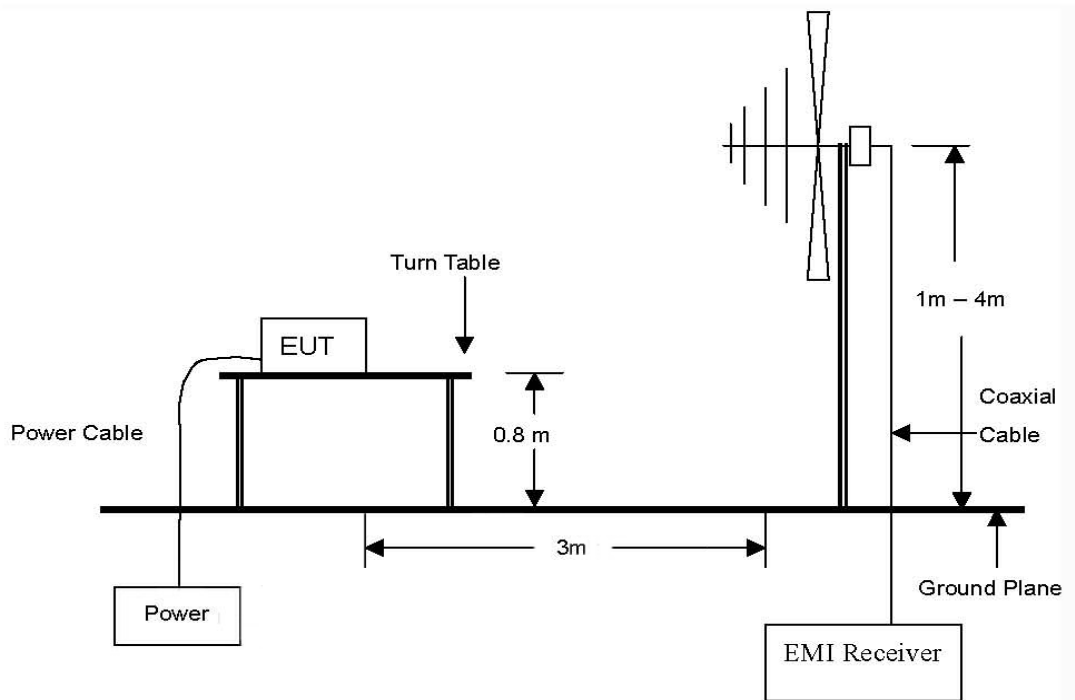
| Revision | Report number        | Description |
|----------|----------------------|-------------|
| 0        | F690501/RF-RTL003935 | Initial     |

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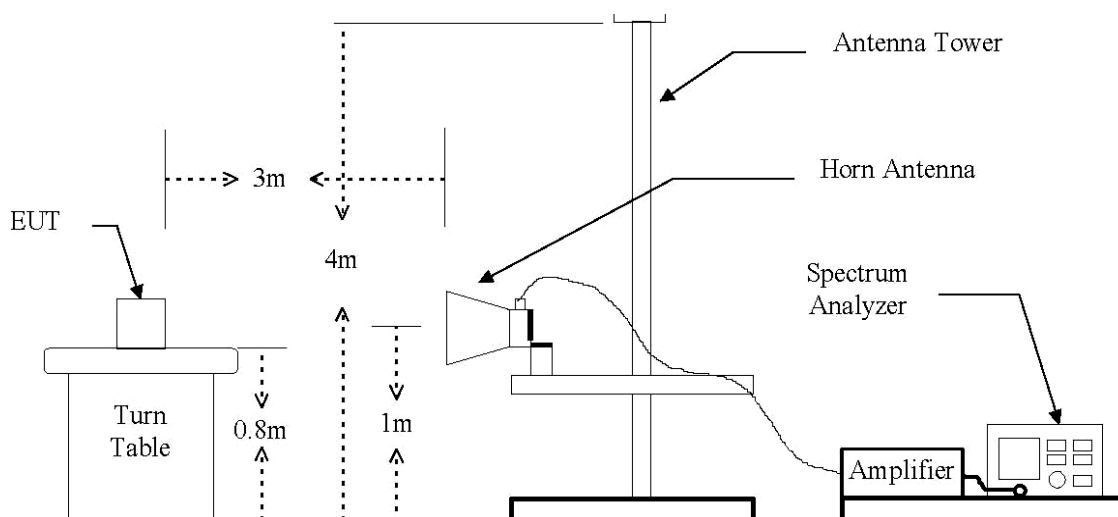
## 2. Fundamental, Spurious emission and edge band radiated emission

### 2.1. Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz Emissions.



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## 2.2. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Note :

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

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### 2.3. Limit

In the section 15.249(a) :

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental<br>(mV/m) | Field strength of harmonics<br>( $\mu$ V/m) |
|-----------------------|---|---|
| 902 ~ 928 MHz         | 50                                      | 500   |
| 2 400 ~ 2 483.5 MHz   | 50                                      | 500   |
| 5 725 ~ 5 875 MHz     | 50                                      | 500   |
| 24.0 ~ 24.25 GHz      | 250                                     | 2 500                                       |

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Fundamental frequency<br>(MHz) | Field strength<br>( $\mu$ V/m) | Measurement distance<br>(m) |
|--------------------------------|--------------------------------|-----------------------------|
| 30 ~ 88                        | 100*                           | 3                           |
| 88 ~ 216                       | 150*                           | 3                           |
| 216 ~960                       | 200*                           | 3                           |
| Above 960                      | 500                            | 3                           |

Remark:

Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

In the above emission table, the tighter limit applies at the band edges.

| Fundamental frequency<br>(MHz) | Field strength<br>( $\mu$ V/m at 3 meter) | Field strength<br>(dB $\mu$ V/m at 3 meter) |
|--------------------------------|---|---|
| 30 ~ 88                        | 100                                       | 40  |
| 88 ~ 216                       | 150                                       | 43.5  |
| 216 ~960                       | 200                                       | 46  |
| Above 960                      | 500                                       | 54  |

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## 2.4. Test result

Ambient temperature : (23 ± 2) °C  
Relative humidity : 46 % R.H.

### 2.4.1. Below 1 GHz

| Radiated Emissions |                      |             | Ant  | Correction Factors |               | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|---------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP + CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| Below 1 000.000    | Not Detected         | -           | -    | -                  | -             | -                     | -                    | -           |

#### Remark

1. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.(Worst case is XZ-plane)
2. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.

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## 2.4.2. Above 1 GHz

### A. Low Channel (2 402 MHz)

| Radiated Emissions |                      |             | Ant  | Correction Factors |         | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| 2 402.000          | 50.75                | Peak        | V    | 28.07              | 4.87    | 83.69                 | 114.00               | 30.31       |
| *2 390.000         | 23.17                | Peak        | V    | 28.09              | 4.84    | 56.10                 | 74.00                | 17.90       |
| *2 390.000         | 11.84                | Average     | V    | 28.09              | 4.84    | 44.77                 | 54.00                | 9.23        |

| Radiated Emissions |                      |             | Ant  | Correction Factors |             | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| Above 2 500.000    | Not Detected         | -           | -    | -                  | -           | -                     | -                    | -           |

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## B. Middle Channel (2 439 MHz)

| Radiated Emissions |                      |             | Ant  | Correction Factors |         | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| 2 439.000          | 50.12                | Peak        | V    | 28.00              | 4.82    | 82.94                 | 114.00               | 31.06       |

| Radiated Emissions |                      |             | Ant  | Correction Factors |             | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| Above 2 500.000    | Not Detected         | -           | -    | -                  | -           | -                     | -                    | -           |

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## C. High Channel (2 480 MHz)

| Radiated Emissions |                      |             | Ant  | Correction Factors |         | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| 2 480.000          | 48.69                | Peak        | V    | 28.08              | 4.78    | 81.55                 | 114.00               | 32.45       |
| *2 483.500         | 25.47                | Peak        | V    | 28.09              | 4.78    | 58.34                 | 74.00                | 15.66       |
| *2 483.500         | 11.82                | Average     | V    | 28.09              | 4.78    | 44.69                 | 54.00                | 9.31        |

| Radiated Emissions |                      |             | Ant  | Correction Factors |             | Total                 | FCC Limit            |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| Above 2 500.000    | Not Detected         | -           | -    | -                  | -           | -                     | -                    | -           |

## Remarks ;

1. “\*” means the restricted band.
2. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes. (Worst case is XZ-plane)
3. Measuring frequencies from 1 GHz to the 10<sup>th</sup> harmonic of highest fundamental Frequency.
4. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
5. Average test would be performed if the peak result were greater than the average limit.
6. Actual = Reading + AF - Amp Gain + CL

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### 3. RF Exposure Evaluation

#### 3.1. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

##### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency Range<br>(MHz)                              | Electric Field<br>Strength(V/m) | Magnetic Field<br>Strength<br>(A/m) | Power Density<br>(mW/cm <sup>2</sup> ) | Average Time     |
|---|---------------------------------|-------------------------------------|--|------------------|
| (A) Limits for Occupational /Control Exposures        |                                 |                                     |  |                  |
| 300 – 1 500   | --                              | --                                  | F/300                                  | 6                |
| 1 500 – 100 000                                       | --                              | --                                  | 5                                      | 6                |
| (B) Limits for General Population/Uncontrol Exposures |                                 |                                     |  |                  |
| 300 – 1 500   | --                              | --                                  | F/1500                                 | 6                |
| <b><u>1 500 – 100 000</u></b>                         | --                              | --                                  | <b><u>1</u></b>                        | <b><u>30</u></b> |

##### 3.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where  $P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi$  = 3.1416

$R$  = distance between observation point and center of the radiator in cm

$P_d$  the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

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### 3.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data  
Test Mode : Normal Operation

### 3.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

| Channel | Channel Frequency (MHz) | Output Average Power to Antenna (dB m) | Antenna Gain (dB i) | Power Density at 20 cm (mW/cm <sup>2</sup> ) | LIMITS (mW/cm <sup>2</sup> ) |
|---------|-------------------------|--|---------------------|--|------------------------------|
| Low     | 2 402                   | -4.18                                  | -4.72               | 0.000 03                                     | 1                            |
| Middle  | 2 439                   | -5.43                                  | -4.72               | 0.000 02                                     | 1                            |
| High    | 2 480                   | -6.36                                  | -4.72               | 0.000 02                                     | 1                            |

Note :

- The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm<sup>2</sup> .

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