

FCC TEST REPORT

FCC ID : RS7SK-108

Applicant : **Turnbull Miracle Design and Engineering Group Ltd**
4310 B Street NW, Auburn, Washington 98001

Equipment Under Test (EUT) :

Product description : The Wireless Locator

Model No. : SK-108

Standards : FCC 15 Paragraph 15.109, Paragraph 15.231

Date of Test : January 13, 2004

Test Engineer : Jimmy Lee

Reviewed By : **Philo Zhong**

PERPARED BY:
Shenzhen Huatongwei International Inspection Co., Ltd
Keji S, 12th, Road, Hi-tech Industrial Park, Shenzhen, Guangdong, China

FCC Registration Number: 662850

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3 Test Summary

Test	Test Requirement	Test Method	Class / Severity	Result
Radiated Emission (30MHz to 1GHz)	FCC PART 15: 2002	ANSI C63.4: 1992	Class B	PASS
Conducted Emission (150KHz to 30MHz)	FCC PART 15: 2002	ANSI C63.4: 1992	Class B	N/A

4 General Information

4.1 Client Information

Applicant: **Turnbull Miracle Design and Engineering Group Ltd**
Address of Applicant: 4310 B Street NW,Auburn,Washington 98001

4.2 General Description of E.U.T.

Product description: The Wireless Locator
Model No.: SK-108

4.3 Details of E.U.T.

Power Supply: 3.0VDC BATTERY

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

The customer requested FCC tests for a The Wireless Locator. The standards used were FCC 15 Paragraph 15.109 and Paragraph 15.231.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC – Registration No.: 662850**

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 662850, November 17, 2003.

4.7 Test Location

All Emissions tests were performed at:-Shenzhen Huatongwei International Inspection Co., Ltd. at Keji S, 12th, Road, Hi-tech Industrial Park, Shenzhen, Guangdong, China.

5 Equipment Used during Test

Conducted Emission Test						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due date
1	Shielding Room	Frankonia	12 x 4 x 4 m ³	EMC0103	N/A	N/A
2	LISN	Schaffner Chase	MNZ050D11	1421	06-11-2003	05-11-2004
3	EMI Test Receiver	Rohde & Schwarz	ESCS30	100038	18-11-2003	17-11-2004
Radiated Emission Test						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due date
1	3m Semi- Anechoic Chamber	ETS	N/A	N/A	05-11-2003	04-11-2004
2	EMI Test Receiver	ROHDE & SCHWARZ	ESI 26	100009	12-11-2003	12-11-2004
3	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100038	18-11-2003	17-11-2004
4	EMI Test Software	ROHDE & SCHWARZ	ES-K1	N/A	N/A	N/A
5	Bilog Type Antenna	ETS	2075	2346	02-12-2003	01-12-2004
5	Ultra-Broadband Antenna	ROHDE & SCHWARZ	HL562	100015	02-12-2003	01-12-2004
Common Used Equipment						
Item	Test Equipment	Manufacturer	Model No.	Series No.	Cal. Date	Due date
1	Temperature, Humidity & Barometer	OREGON SCIENTIFIC	BA-888	EMC0001 to EMC0004	25-07-2003	25-07-2004
2	DMM	FLUKE	73	70681569 or 70671122	23-07-2003	23-07-2004

6 Conducted Emission Test

Product:	The Wireless Locator / SK-108
Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	-----
Frequency Range:	150kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 Test Equipment

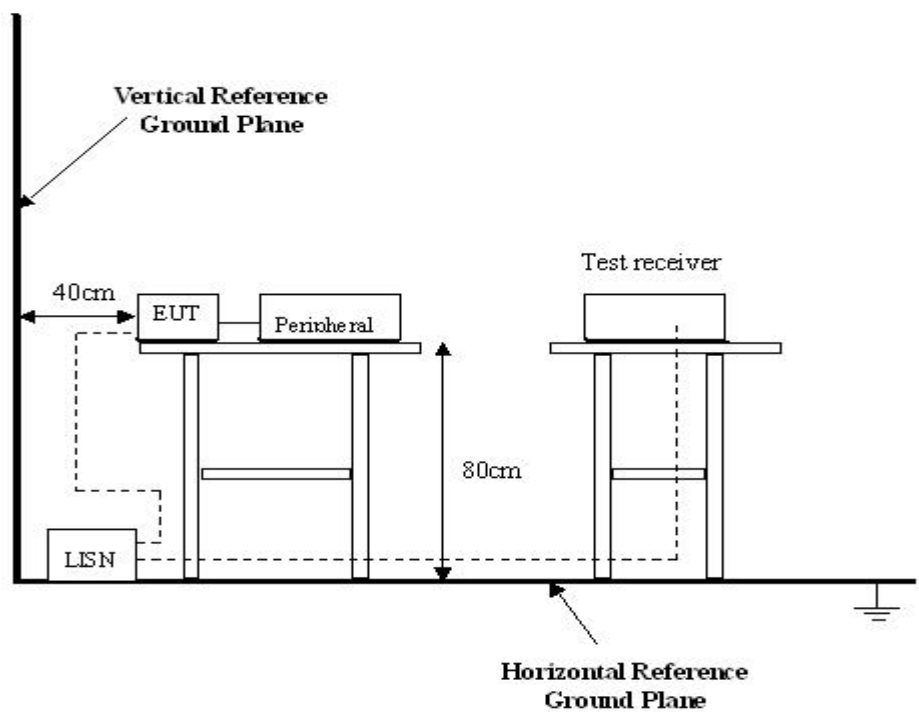
Please refer to Section 5 this report.

6.2 Test Procedure

1. The EUT was tested according to ANSI C63.4. The frequency spectrum from 150kHz to 30MHz was investigated.
2. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.3 Conducted Test Setup

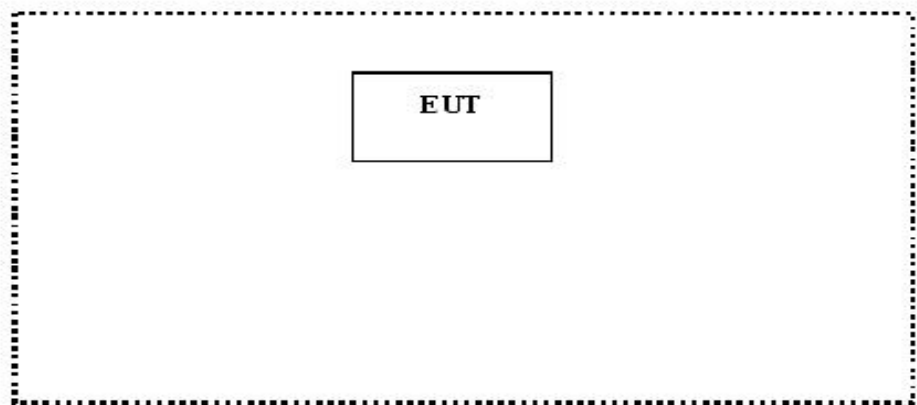
The conducted emission tests were performed using the setup accordance with the ANSI C63.4, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



6.4 EUT Operating Condition

Operating condition is according to ANSI C63.4.

- A. Setup the EUT and simulators as shown on follow.
- B. Enable RF signal and confirm EUT active.
- C. Modulate output capacity of EUT up to specification.



6.5 Conducted Emission Limits

66-56 dB μ V/m between 0.15MHz & 0.5MHz

56 dB μ V/m between 0.5MHz & 5MHz

60 dB μ V/m between 5MHz & 30MHz

Note: In the above limits, the tighter limit applies at the band edges.

6.6 Conducted Emission Test Result

Owing to the DC operation of EUT, this test is not performed.

7 Radiation Emission Test

Product:	The Wireless Locator / SK-108
Test Requirement:	FCC Part15 Paragraph 15.109 and Paragraph 15.231
Test Method:	Based on FCC Part15 Paragraph 15.109 and Paragraph 15.231
Test Date:	January 13, 2003
Frequency Range:	30MHz to 4GHz
Measurement Distance:	3m
Detector:	Peak for pre-scan (120kHz resolution bandwidth) Quasi-Peak if maximised peak within 6dB of limit

7.1 Test Equipment

Please refer to Section 5 this report.

7.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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.

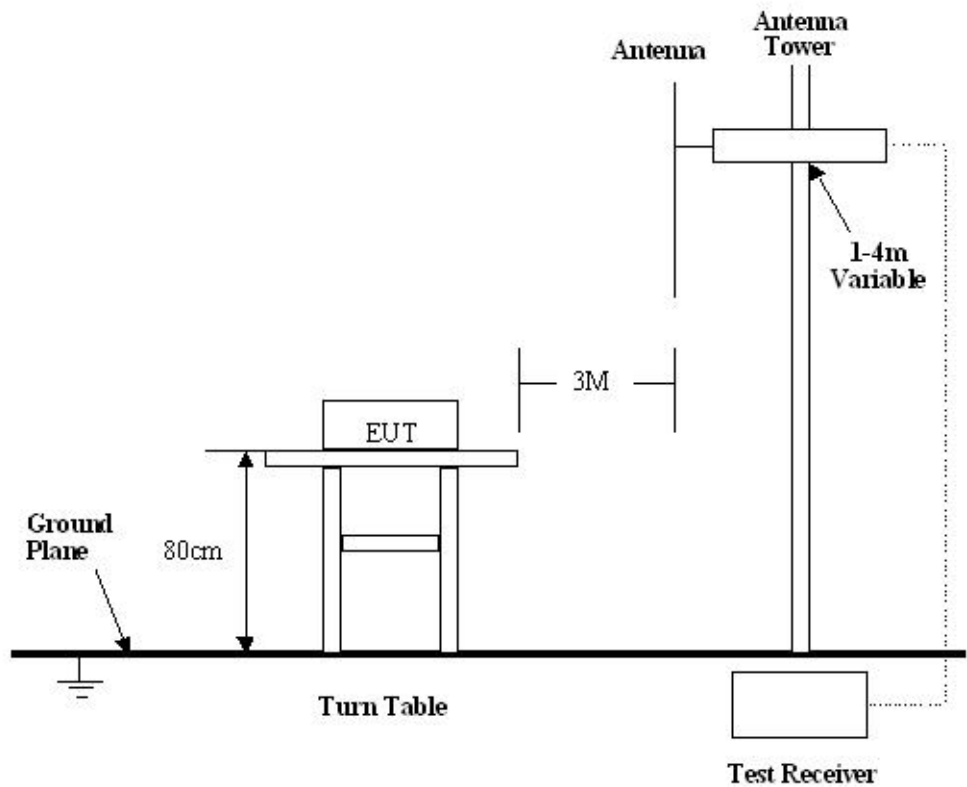
Based on ANSI C63.4, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at SZHTW is +4.0 dB.

7.3 Test Procedure

1. For the radiated emissions test, since the EUT does not have a power source, there was no connection to AC outlets.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
3. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB μ V of specification limits), and are distinguished with a "Qp" in the data table.
4. The EUT was under normal mode during the final qualification test and the configuration was used to represent the worst case results.

7.4 Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4, The specification used in this report was the FCC Part15 Paragraph 15.109 and Paragraph 15.231 limits.



7.5 Spectrum Analyzer Setup

According to FCC Part15 Paragraph 15.109 and Paragraph 15.231 Rules, the system was tested to 4000 MHz.

Start Frequency	30 MHz
Stop Frequency	4000 MHz
Sweep Speed	Auto
IF Bandwidth	100 kHz
Video Bandwidth	1 MHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode.....	Normal
Resolution Bandwidth	1MHz

7.6 Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

7.7 Summary of Test Results

According to the data in section 7.10, the EUT complied with the FCC Part15 Paragraph 15.109 and Paragraph 15.231 standards.

7.8 EUT Operating Condition

Same as section 6.4 of this report.

7.9 Radiated Emissions Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

Calculation of Field Strength Limits 15.23.1(e)

Fundamental field strength limits for the band 260-470MHz: $\mu\text{V/m}$ at 3 meters=

$16.6667(\text{F}) - 2833.3333 = 16.6667 * 315 - 2833.3333 = 2416.775 \mu\text{V/m}$

2416.775 $\mu\text{V/m}$ corresponds with 67.6 dB $\mu\text{V/m}$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

i.e. 47.6 dB $\mu\text{V/m}$

A. FCC Part 15 subpart C Paragraph 15.231 Limit

Fundamental Frequency(MHZ)	Field Strength of Fundamental	
	$\mu\text{V/m}$	dB $\mu\text{V/m}$
260-470	2416.775	87.6

- Note:**
- (1) RF Voltage(dBuV)=20 log RF Voltage(μV)
 - (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
 - (3) The emission limit in this paragraph is based on measurement instrumentation employing an average detector. Measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

B. Frequencies in restricted band are complied to limit on Paragraph 15.109

Frequency(MHZ)	Distance(m)	Field strength(dBuV/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note: (1) $\text{RF Voltage(dBuV)} = 20 \log \text{RF Voltage(uV)}$
(2) In the Above Table, the tighter limit applies at the band edges.
(3) Distance refers to the distance in meters between the measuring instrument antenna.

7.10 Radiated Emissions Test Result

Formula of conversion factors: the field strength at 3m was established by adding
The meter reading of the spectrum analyser (which is set to read in units of dBuV)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stated in terms of dB. The gain of the pressetor was accounted
For in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading +ACF=FS

33 20dBuV+10.36dB=30.36dBuV/m @3m

A. Fundamental Radiated Emission Data

Test Item: Fundamental Radiated Emission Data
Test Voltage: DC 3V (Power by Battery)
Test Mode: Normal
Temperature: 24 °C
Humidity: 52%RH
Test Result: PASS

Test Frequency (MHz)	Peak (dBuV/m)		Limits (dBuV/m)	Margin (dB)	
	Vertical	Horizontal		Vertical	Horizontal
315.200	54.0	65.3	87.6	33.6	22.3

Test Frequency (MHz)	Average (dBuV/m)		Limits (dBuV/m)	Margin (dB)	
	Vertical	Horizontal		Vertical	Horizontal
315.200	30.8	40.6	67.6	36.8	27.0

Note: (1) All Reading are Peak Value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) The average measurement was not performed when the peak measured data under the limit of average detection.

B. General Radiated Emission Data

Test Item: General Radiated Emission Data
Test Voltage: DC 3V (Power by Battery)
Test Mode: Normal
Temperature: 24 °C
Humidity: 52%RH
Test Result: PASS

Frequency (MHz)	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°C)
630.400	Vertical	41.1	46.0	4.9	1.5	90
945.600	Vertical	36.6	46.0	9.4	1.0	45
1260.920	Vertical	48.5	54.0	5.5	1.8	180
630.400	Horizontal	25.6	46.0	20.4	2.0	270
945.600	Horizontal	36.9	46.0	9.1	1.5	45
1260.920	Horizontal	43.6	54.0	10.4	1.0	180

Note: (1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.

(2) Emission Level = Reading Level + Probe Factor + Cable Loss.

8 Periodic Operation

15.23.1(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

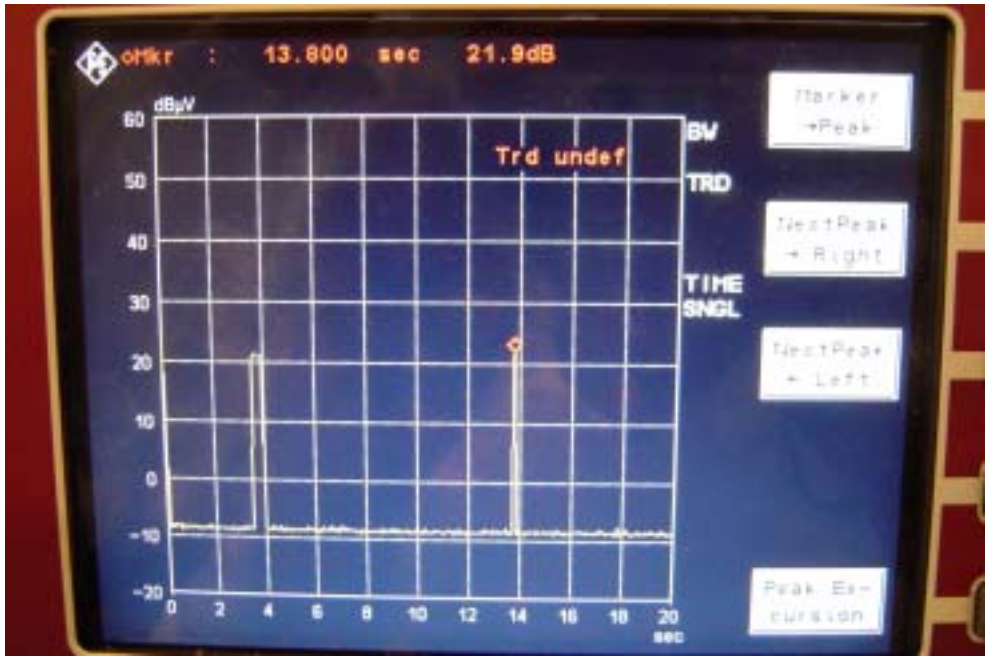
Fundamental Field Strength of Field Strength of
Frequency Fundamental Spurious Emission
(MHz) (microvolts/meter) (microvolts/meter)

40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 150 **
174 - 260	1,500 150	
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $uV/m \text{ at } 3 \text{ meters} = 22.72727(F) - 2454.545$; for the band 260-470 MHz, $uV/m \text{ at } 3 \text{ meters} = 16.6667(F) - 2833.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.



9 Band Edge

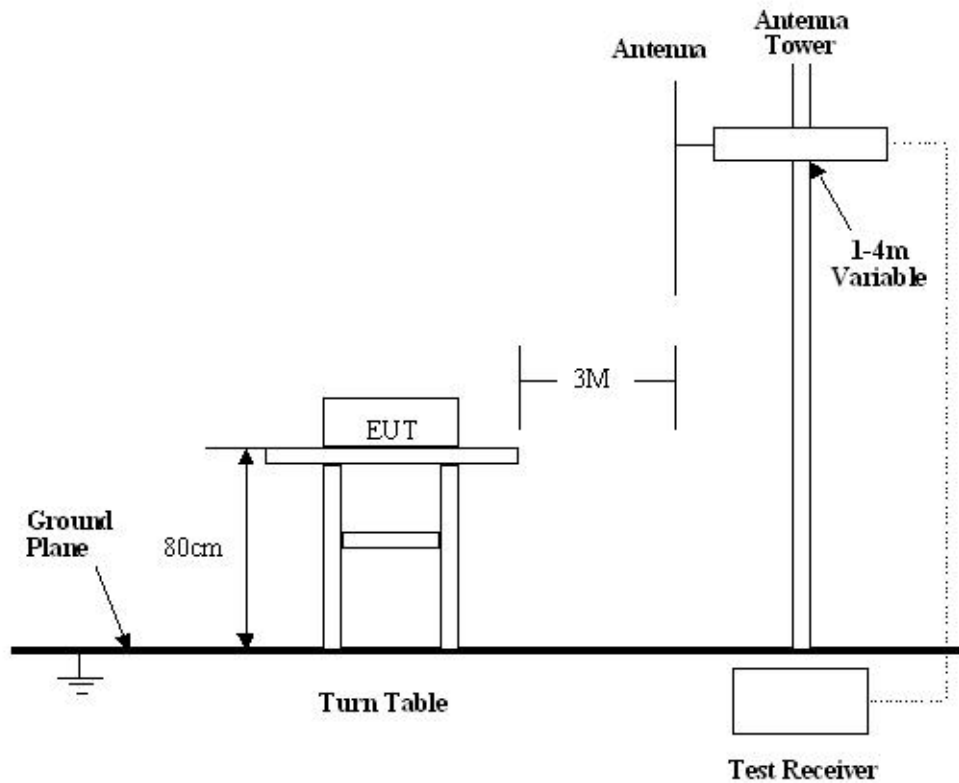
9.1 Test Equipment

Please refer to Section 5 this report.

9.2 Test Procedure

1. The EUT was tested according to ANSI C63.4. The radiated test was performed at Shenzhen Huatongwei International Inspection Co., Ltd. This lab has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 662850, November 17, 2003.
2. The EUT, peripherals were put on the turntable which table size is 1mX1.5m, table high 0.8m. All set up is according to ANSI C63.4.
3. The frequency spectrum from 30MHz to 1GHz was investigated. All reading from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120KHz. All reading are above 1GHz, peak values with a resolution bandwidth of 1MHz. Measurements were made at 3 meters.
4. The antenna high were varied from 1m to 4m high to find the maximum emission for each frequency.
5. Maximizing procedure was performed on the highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak reading was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "QP" in the data table.
6. The antenna polarization: Vertical polarization and horizontal polarization.

9.3 Radiated Test Setup



9.4 EUT Operation

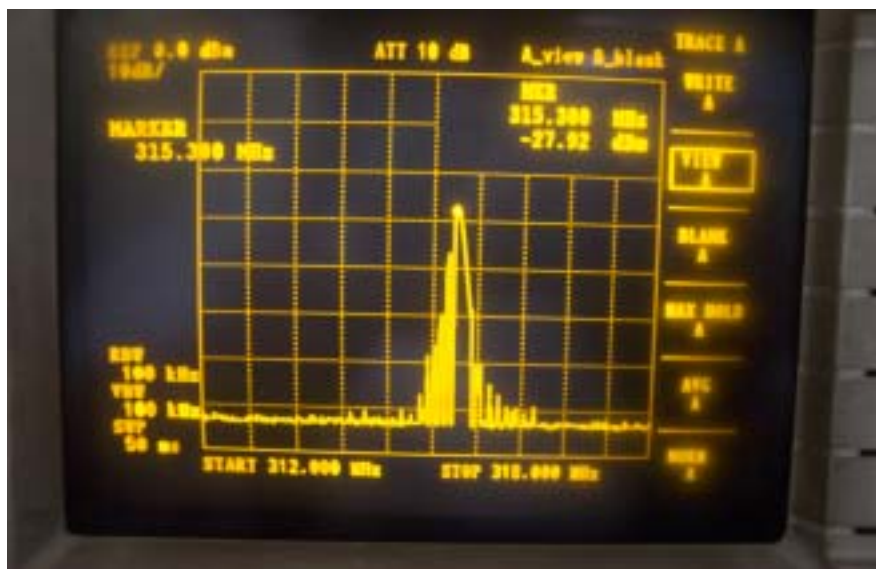
Same as section 6.4 of this report.

9.5 Band Edge Limit

Attenuation below the general limits specified in section 15.231 (e) is not required .In addition, radiated emissions which fall in the restricted bands, as defined in Section15.231(e), must also comply with the radiated emission limits specified in Section15.231(e).

9.6 Band Edge Test Result

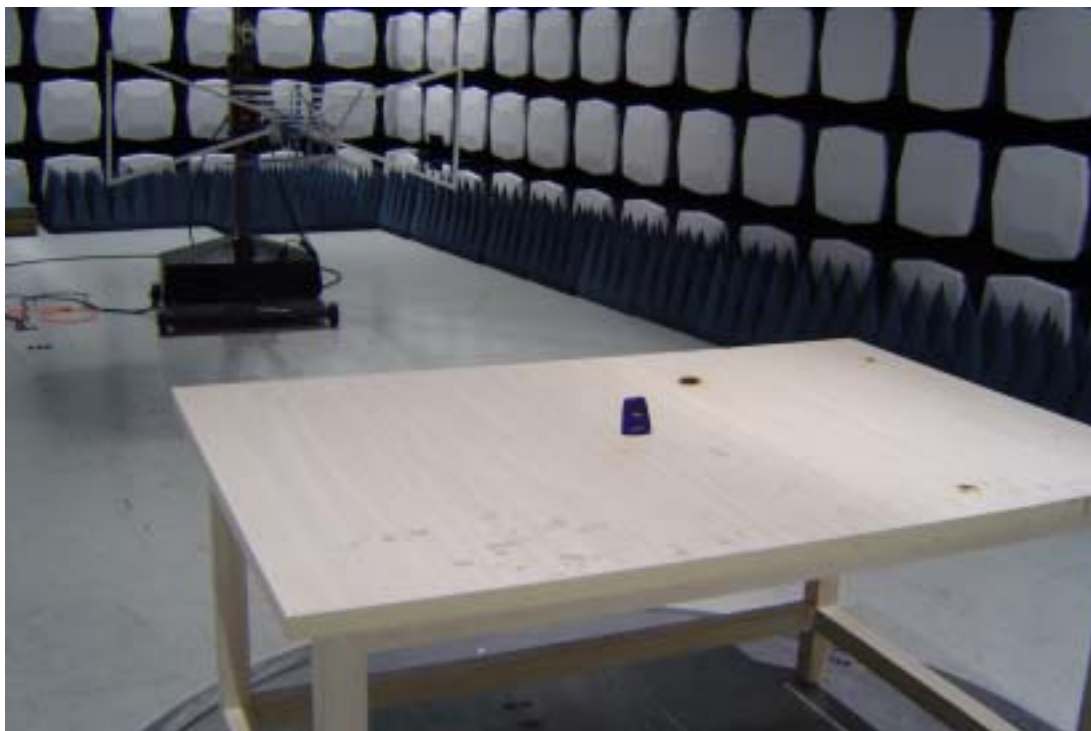
Product: The Wireless Locator / SK-108
Test Item: Band Edge Test
Test Voltage: DC 3V (Power by Battery)
Test Mode: Normal
Temperature: 24 °C
Humidity: 52%RH



Note: (1) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209.
(2) The average measurement was not performed when the peak measured data under the limit of average detection.

10 Photographs of Testing

10.1 Radiation Emission Test View



11 Photographs - Constructional Details

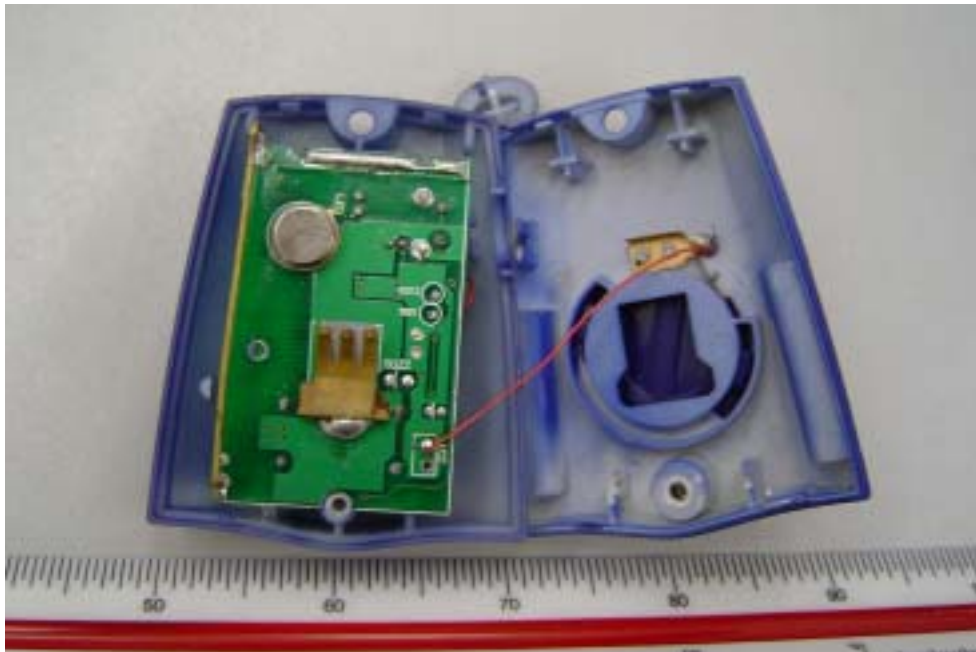
11.1 EUT - Front View



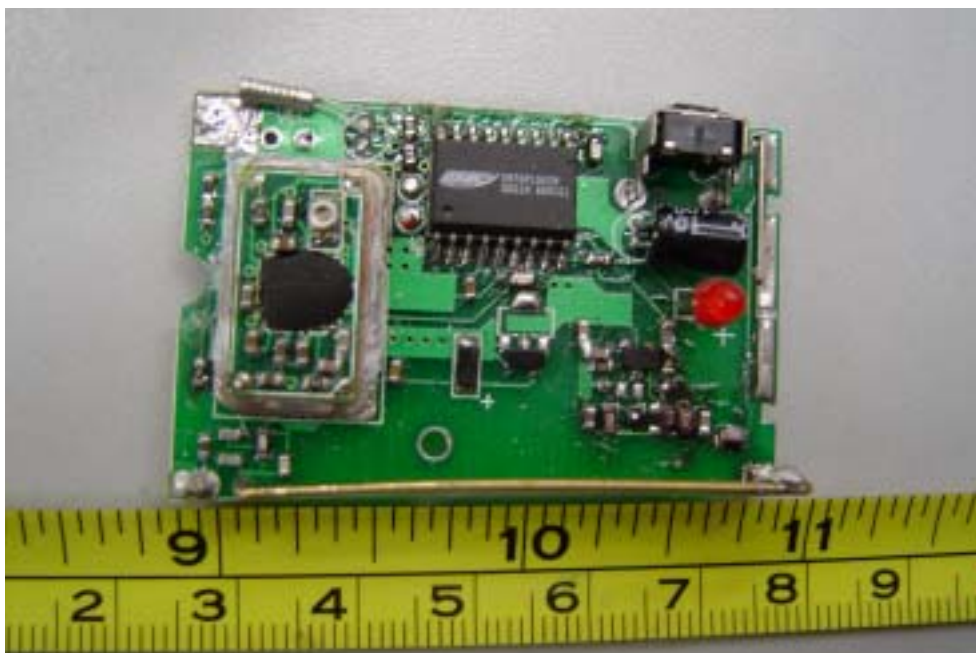
11.2 EUT - Back View



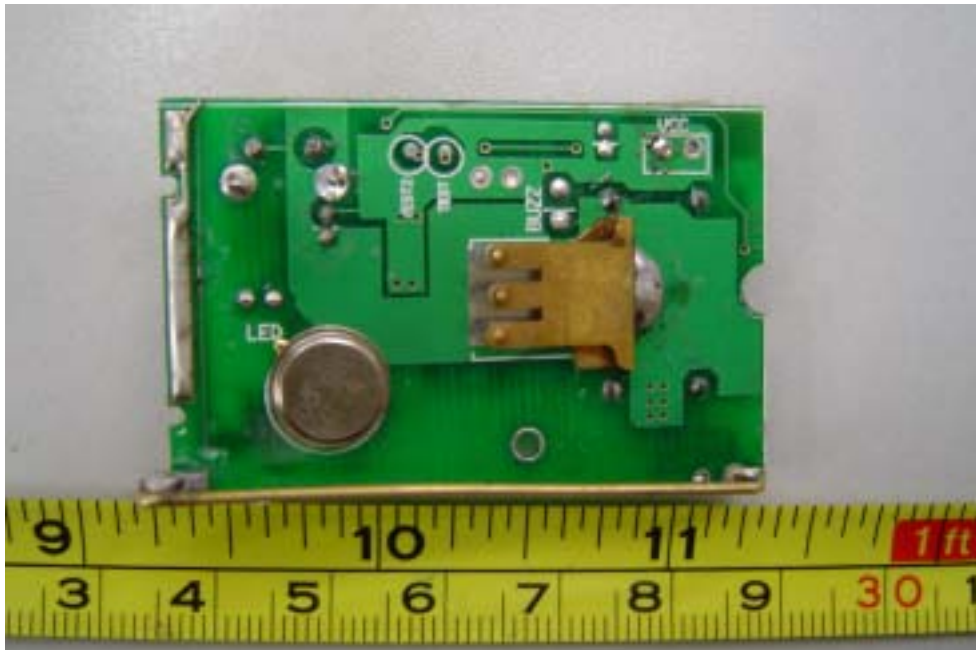
11.3 EUT – Component View



11.4 PCB - Component View



11.5 PCB - Solder View



12 FCC ID Label

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 accpt any interference received, including interference that may cause undesired operation

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT
EUT Bottom View/proposed FCC Mark Location

