TEST REPORT

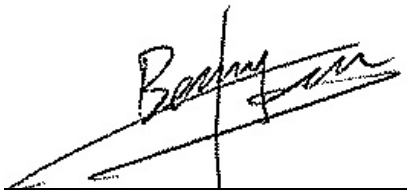
Report No.: HK09081188-1

Root Four Imagination Inc.

Application
For
Certification
(Original Grant)
(FCC ID: VVT-LS02)
(IC: 7496A-LS02)

Transceiver

Prepared and Checked by:



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Approved by:

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Date: October 16, 2009

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GENERAL INFORMATION

Root Four Imagination Inc.
BRAND NAME: Safe Driver (Sensor), MODEL: LS02

FCC ID: VVT-LS02
IC: 7496A-LS02

Grantee:	Root Four Imagination Inc.
Grantee Address:	80 Castors Dr., Mount Pearl, NL Canada A1N 5K5.
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Manufacturer:	Root Four Imagination Inc.
Manufacturer Address:	80 Castors Dr., Mount Pearl, NL Canada A1N 5K5.
Brand Name:	Safe Driver
Model:	LS02
Type of EUT:	Transceiver
Description of EUT:	Safe Driver (Sensor)
Serial Number:	N/A
FCC ID / IC:	VVT-LS02 / 7496A-LS02
Date of Sample Submitted:	August 27, 2009
Date of Test:	October 13, 2009
Report No.:	HK09081188-1
Report Date:	October 16, 2009
Environmental Conidtions:	Temperature: +10 to 40°C Humidity: 10 to 90%

SUMMARY OF TEST RESULT

Root Four Imagination Inc.
BRAND NAME: Safe Driver (Sensor), MODEL: LS02

FCC ID: VVT-LS02
IC: 7496A-LS02

TEST SPECIFICATION	REFERENCE	RESULTS
Maximum Peak Output Power	15.247(b), (c) / RSS-210 A8.4	N/A
Hopping Channel Carrier Frequencies Separation	15.247(e) / RSS-210 A8.1	N/A
20dB Bandwidth of the Hopping Channel	15.247(a) / RSS-210 A8.1	N/A
Number of Hopping Frequencies	15.247(e) / RSS-210 A8.1	N/A
Average Time of Occupancy of Hopping Frequency	15.247(e) / RSS-210 A8.1	N/A
Anteann Conducted Spurious Emissions	15.247(d) / RSS-210 A8.5	N/A
Radiated Spurious Emissions	15.247(d) / RSS-210 A8.5	N/A
RF Exposure Compliance	15.247(i) / RSS-Gen 5.5	N/A
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 7.2.2	N/A
Transmitter Field Strength	15.227 / RSS-310 3.8	N/A
Transmitter Field Strength	15.229 / RSS-210 A2.7	N/A
Transmitter Field Strength, Bandwidth and Timing Requirement	15.231(a) / RSS-210 A1.1.1	N/A
Transmitter Field Strength, Bandwidth and Timing Requirement	15.231(e) / RSS-210 A1.1.5	Pass
Transmitter Field Strength and Bandwidth Requirement	15.239 / RSS-210 A2.8	N/A
Transmitter Field Strength and Bandwidth Requirement	15.249 / RSS-210 A2.9	N/A
Transmitter Field Strength and Bandwidth Requirement	15.235 / RSS-310 3.9	N/A
Receiver	RSS-210 2.3	Pass
Digital Device Conducted Emissions	15.107 / ICES-003	N/A

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the pervisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

Table of Contents

1.0 General Description

1.1 Product Description

The Equipment Under Test (EUT) is a RF Transceiver, model: LS02 operating at 433.92MHz. The EUT is powered by 12VDC. LS02 is a Safe Driving Monitor Sensor. It is used with the Key Fob model: LK02. LS02 is connected to the OBD II socket in vehicle and collect the vehicle data through it. After a HandShake with LK02, it will send the data to LK02 for display every 30 seconds. And the duration of each transmission is 31.4ms.

Antenna Type : Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

Certification procedure of the corresponding transceiver for this transceiver (with FCC ID: VVT-LK02) is being processed as the same time of this application. The receiver portion of this transceiver has been authorized by Verification procedure.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003). All radiated measurements were performed in an Open Area Test Site. Preliminary scans were performed in the Open Area Test Site only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Justification Section"** of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been placed on file with the FCC and IC.

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2003).

The device was powered from 12VDC (1x12 V "Lead-acid battery).

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was connected with the test fixture and placed in the center of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit enters test mode, it transmits the RF signal continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Equipment Modification

Any modifications installed previous to testing by Root Four Imagination Inc. will be incorporated in each production model sold/leased in the United States and Canada.

No modifications were installed by Intertek Testing Services Hong Kong Ltd.

2.5 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

OBD II socket test fixture. (Provided by applicant)

3.0 **Emission Results**

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG - AV

where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF

where FS = Field Strength in dBµV/m
RR = RA - AG - AV in dBµV
LF = CF + AF in dB

Assume a receiver reading of 52.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 52.0 dBµV/m
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
AV = 5.0 dB
RR = 18.0 dBµV
LF = 9.0 dB
FS = RR + LF
FS = 18 + 9 = 27 dBµV/m

Level in µV/m = Common Antilogarithm [(27 dBµV/m)/20] = 22.4 µV/m

3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 3472.096 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by -12.0 dB (Tx)
-0.5 dB (Rx)

3.4 Conducted Emission Configuration Photograph

Not Applicable.

3.5 Conducted Emission Data

Not Applicable.

Applicant: Root Four Imagination Inc. Date of Test: October 13, 2009
Model: LS02
Worst-Case Operating Mode: TX mode

Table 1

Radiated Emissions
Pursuant to FCC Part 15 Section 15.231(e) Requirement

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp (dB)	Antenna factor (dB)	Average Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
H	434.012	66.3	16	25.0	15.6	59.7	72.9	-13.1
H	868.024	30.6	16	31.0	15.6	30.0	52.9	-22.8
H	1302.036	51.3	33	26.1	15.6	28.8	54.0	-25.2
H	1736.048	50.8	33	27.2	15.6	29.4	54.0	-24.6
H	2170.060	54.7	33	29.4	15.6	35.5	54.0	-18.5
H	2604.072	59.2	33	30.4	15.6	41.0	54.0	-13.0
H	3038.084	49.9	33	31.9	15.6	33.2	54.0	-20.8
H	3472.096	58.7	33	31.9	15.6	42.0	54.0	-12.0
H	3906.108	53.7	33	33.3	15.6	38.4	54.0	-15.6
H	4340.120	50.3	33	34.8	15.6	36.5	54.0	-17.5

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

Applicant: Root Four Imagination Inc. Date of Test: October 13, 2009
Model: LS02
Worst-Case Operating Mode: RX mode

Table 2

Radiated Emissions
Pursuant to RSS-210 2.3 Requirement

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
H	160.000	43.0	16	16.0	43.0	43.5	-0.5
H	240.000	39.0	16	19.0	42.0	46.0	-4.0
H	384.012	31.0	16	24.0	39.0	46.0	-7.0
H	435.312	27.8	16	26.0	37.8	46.0	-8.2
H	720.000	24.5	16	30.0	38.5	46.0	-7.5
H	768.024	23.8	16	31.0	38.8	46.0	-7.2
H	870.624	26.0	16	32.0	42.0	46.0	-4.0
H	960.000	21.0	16	33.0	38.0	46.0	-8.0
H	1152.036	44.9	33	26.1	38.0	54.0	-16.0
H	1305.936	43.7	33	26.1	36.8	54.0	-17.2
H	1536.048	45.7	33	27.2	39.9	54.0	-14.1
H	1741.248	45.8	33	27.2	40.0	54.0	-14.0
H	1920.060	45.2	33	27.2	39.4	54.0	-14.6

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

4.0 Equipment Photographs

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 Product Labelling

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 Technical Specifications

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States and Canada.

8.0 Miscellaneous Information

The miscellaneous information includes details of the test procedure and measured bandwidth / calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

8.1 Measured Bandwidth

For electronic filing, the plot shows the fundamental emission when modulated is saved with filename: bw.pdf. From the plot, the bandwidth is observed to be 520kHz, at 20dBc where the bandwidth limit is 1085kHz.

8.2 Discussion Pulse Desensitivity

Pulse desnesitivity is not applicable for this device. The effective period (Teff) is approximately 300μs for a ditital “1” bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 100kHz, so the pulse densensitivity factor is 0dB.

8.3 Calculation of Average Factor

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 100ms

Effective period of the cycle = 16.64ms

DC = 0.1664

Therefore, the averaging factor is found by 20log 0.1664 = -15.6dB.

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2003. A typical or an unmodulated CW signal at the operating frequency of the EUT has been supplied to the EUT for all measurements. Such a signal is supplied by a signal generator and an antenna in close proximity to the EUT. The signal level is sufficient to stabilize the local oscillator of the EUT.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.4 - 2003.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

9.0 Confidentiality Request

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 Equipment List

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	Log Periodic Antenna
Registration No.	EW-0014	EW-0954	EW-0446
Manufacturer	R&S	EMCO	EMCO
Model No.	ESVS30	3104C	3146
Calibration Date	Jun. 01, 2009	Sep. 30, 2008	Oct. 02, 2008
Calibration Due Date	Jun. 01, 2010	Mar. 30, 2010	Apr. 02, 2010

Equipment	Spectrum Analyzer	Double Ridged Guide Antenna	Spectrum Analyzer
Registration No.	EW-2188	EW-1015	EW-2249
Manufacturer	AGILENTTECH	EMCO	ROHDESCHWARZ
Model No.	E4407B	3115	FSP30
Calibration Date	Dec. 18, 2008	Jul. 28, 2008	Jun. 25, 2009
Calibration Due Date	Dec. 18, 2009	Jan. 28, 2010	Jun. 25, 2010