Electromagnetic Emission
FCC MEASUREMENT REPORT
FCC PART 15 SUBPART B
FOR Single Superheterodyne Receiver

PRODUCT	:	**Keyless Entry receiver**
MODEL/TYPE NO	:	**OKA-310R**
FCC ID	:	**OSLOKA-310R**
TRADE NAME	:	**Omron**
APPLICANT	:	**Omron Automotive Electronics Korea Co, Ltd 481-2, Kasan-Dong, Kumchun-Ku, Seoul, 153-023, South Korea Attn. : Young-Jea, Seo / General Manager**
FCC CLASSIFICATION	:	**DYY- Communication receiver used w/Pt 15 Transmitter**
FCC RULE PART(S)	:	**FCC Part 15 Subpart B Section 15.101**
FCC PROCEDURE	:	**Certification**
DATES OF TEST	:	**February 27, 2004**
DATES OF ISSUE	:	**February 28, 2004**
TEST REPORT No.	:	**BWS-04-EF-0015**
TEST LAB.	:	**BWS Tech., Inc. (Registration No. : 553281)**

This Keyless Entry Receiver has been tested in accordance with the measurement procedures specified in ANSI C63.4-2000 at the BWS TECH/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B Section15.101
I attest to the accuracy of data. All measurement herein was performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Lee Young-Soo
Chief of Laboratory Division
BWS TECH Inc.

BWS TECH Inc.
www.bws.co.kr
294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, 464-080, Korea
TEL: +82 31 762 0124 FAX: +82 31 762 0126

TABLE OF CONTENTS

FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

Applicant

Company Name	:	Omron Automotive Electronics Korea Co, Ltd
Company Address	:	481-2, Kasan-Dong, Kumchun-Ku, Seoul, 153-023, South Korea
Phone/Fax	:	Phone : +82-2-850-5747Fax : +82-2-850-5808

Manufacturer

Company Name	:	Omron Automotive Electronics Korea Co, Ltd
Company Address	:	481-2, Kasan-Dong, Kumchun-Ku, Seoul, 153-023, South Korea
Phone/Fax	:	Phone : +82-2-850-5747Fax : +82-2-850-5808

● **EUT Type**	:	Keyless Entry Receiver
● **Model Number**	:	OKA-310R
● **FCC Identifier**	:	OSLOKA-310R
● **S/N**	:	Prototype
● **Receiving Freq.**	:	313.85 MHz
● **Channel**	:	1 ch
● **Modulation Method**	:	FSK
● **FCC Rule Part(s)**	:	Part 15 Subpart B Section 15.101
● **Test Procedure**	:	ANSI C63.4-2000
● **Dates of Tests**	:	February 27, 2004
● **Place of Tests**	:	BWS TECH Inc. EMC Testing Lab (FCC Registration Number : 553281) 294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, 464-080, Korea TEL: +82 31 762 0124 FAX: +82 31 762 0126
● **Test Report No.**	:	BWS-04-EF-0015

2. Description of Test Facility

The measurement for radiated emission test were practiced at the open area test site of BWS TECH Inc. Measurement for conducted emission test were practiced at the semi EMC Anechoic Chamber test site of BWS TECH Inc. facility located at 294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2000 and CISPR Publication 16. The BWS TECH measurement facility has been filed to the Commission with the FCC for 3 and 10-meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission (Registration Number : 553281).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-2000) was used in determining radiated emissions from the Omron Automotive Electronics Korea Co, Ltd. Keyless Entry Receiver Model : OKA-310R.

3. Product Information

3.1 Equipment Description

The Equipment Under Test (EUT) is receiver by the Omron Automotive Electronics Korea Co, Ltd Keyless Entry Receiver model: OKA-310R (FCC ID: OSLOKA-310R).
The RECEIVER is fixed inside the vehicle. It works intermittently to prevent the battery exhaustion. When the receiver detects the synchronous code, it runs continuously to receive the signals completely. After receiving the signal, the receiver decides which operation will be performed.

3.2 General Specification

- Receiving Frequency	313.85 MHz
- Frequency generation	Crystal resonator 4MHz
- Modulation Scheme	FM(superheterodyne)
- Bandwidth	±200KHz
- Operating Temperature	-40℃ ~ +105℃
- Power Requirement	DC 12V, 50mA CAR Battery(DC 12V)
- Operating guidance	LOCK in door, UNLOCK in door , Open the TRUNK , alarm the horn
- Size	140mm(L) x 113mm(W) x 62mm(H)

4. Description of Tests

4.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2000. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table, which is placed 40cm away from the vertical wall, and 1.5m away from the sidewall of the chamber room. Two LISNs are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the another Koritsu LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling (serpentine fashion) to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the R3261A Spectrum Analyzer to determine the frequency producing the max. Emission from the EUT. The frequency producing the max. Level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

4.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 3-meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configurations, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using biconilog antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies, which were selected as bottom, middle, and top frequency in the operating band. Emission level from the EUT with various configurations was examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconical and log periodic, Horn antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer (for above 25GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20dB/decade) as per section 15.31(f).

Photographs of the worst-case emission test setup can be seen in Appendix A.

5. Test Condition

5.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner, which tends to maximize its emission level in a typical application.

Conducted Emission Test

It needs not to test requirement, because the EUT supplies from a DC battery.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/2000 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were measured at 3-meter open field test site. To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes.

5.2 EUT operation

EUT was tested according to the following operation modes provided by the specifications given by the manufacturer, and reported the worst emissions

5.4 Peripherals / Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

Type of Peripheral Equipment Used:

Description	Model Name	Serial No.	Manufacturer	FCC ID
EUT	OKA-310R	N/A	Omron	-
POWER SUPPLY				-
TEST LOAD	-	-	Omron	-

Type of Cables Used:

Device from	Device to	Type of Cable	Length(m)	Type of shield
NA	-	-	-	-

6. TEST RESULTS

6.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

	FCC Rule Parts	Measurement Required	Limit	Result
6.2	15.107	Conducted Emissions	Class B	NA
6.3	15.109	Radiated Emission	Class B	Pass

The data collected shows that the Omron Automotive Electronics Korea Co, Ltd Keyless Entry Receiver OKA-310R complies with technical requirements of the Part 15.231 of the FCC Rules.

Note : Modification to EUT

The device tested is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

6.2 Conducted Emissions [§15.107]

It needs not to test requirement, because the EUT supplies from a DC battery.

6.3 Radiated Emissions [§15.109]

EUT : Keyless Entry Receiver
Test Date : February 27, 2004
Operating Condition : The EUT was operated at transmitting condition continuously during the test.
Environment Condition : Humidity Level : 35 %RH, Temperature : 16℃

Test Method:

The sample was placed 0.8m above the ground plane on the open filed test site. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations.

Tabulated Radiated Emission Test Data

Frequency (MHz)	Level (dBuV)	Antenna Pplarity (H/V)	Factor & Loss (dB)	Duty Cycal Factor (dB)	Level (dBuV/m)	Level (uV/m)	Limit (uV/m)	Limit (dBuV/m)	Margin (dB)
There were no emission data higher than 20dB below the limit during the radiated emission measurement.									

NOTES :

1. H : Horizontal polarization , V : Vertical polarization
2.Emission Level = Reading + Antenna factor + Cable loss-preamplifier gain
3.Measurement was performed at operating channels.

*Tested by **Kim Jin-Seok***

7. Sample Calculation and Other Information

7.1 Sample Calculations

$$dB\mu V = 20 \log 10 (\mu V/m)$$

$$\mu V = 10^{(dB\mu V/20)}$$

7.2. Measurement Uncertainty

Measurement uncertainty of RFI Voltage Measurement test was estimated at ±3.51 dB(k=2)
Measurement uncertainty of RFI Field Strength Measurement test was estimated at ±4.34dB (k=2)

8. TEST EQUIPMENTS LIST

The listing below denotes the test equipments utilized for the test(s).

Test Equipment	Manufacture Model Number	Serial Number	Calibration Due date
Signal Analyzer	PMM PMM9000	3100570602	09/09/04
EMC Analyzer	HP E7403A	US39150108	02/27/04
Spectrum Analyzer	ADVANTEST R3261C	61720002	08/14/04
Amplifier (0.1MHz-1.3GHz)	HP 8447E	2945A02712	08/14/04
Biconical Antenna	PMM BC01	0020J70501	01/16/05
Log Periodic Antenna	PMM LC01	0020J70501	01/16/05
Plotter	HP 7475A	007475A	N/A
Shield Room 7m x 4m x 4m	SEMITECH	000815	N/A
Turn Table	JAEMC JAC-2	N/A	N/A
Antenna Mast	Dae-il EMC JAC-1	N/A	N/A
Artificial Mains Network	PMM L3-25	1110K70403	10/02/04
Artificial Mains Network	FCC FCC-LISN-50-50-2-02	03074	10/07/04
Antenna Turntable Controller	JAEMC JAC-2	N/A	N/A
HORN ANTENNA	SCHWARZBECK BBHA 9120 D	N/A	2004-06-20