# Electromagnetic Emission

# F C C  M E A S U R E M E N T  R E P O R T

## CERTIFICATION OF COMPLIANCE

### FCC Part 15 Certification Measurement

| | | |
|---|---|---|
| **PRODUCT** | : | RADAR DETECTOR |
| **MODEL/Serial No.** | : | RL100 / Proto-type |
| **FCC ID** | : | W75-M1K-Y12 |
| **BRAND NAME** | : | K40 |
| **APPLICANT** | : | ATTOWAVE CO., LTD.<br>1005, 10F Leader's Tower, 60-15 Gasan-dong,<br>Gumchun-gu, Seoul, 153-801 Korea<br>Attn. : Hyun Joo, Cho / Director |
| **MANUFACTURER** | : | ATTOWAVE CO., LTD.<br>1005, 10F Leader's Tower, 60-15 Gasan-dong,<br>Gumchun-gu, Seoul, 153-801 Korea |
| **FCC CLASSIFICATION** | : | Unintentional Radiators<br>CRD - Part 15 Radar Detector |
| **RULE PART(S)** | : | FCC Part 15 Subpart B |
| **FCC PROCEDURE** | : | ANSI C63.4-2003 |
| **TEST REPORT No.** | : | ETLE100324.01 |
| **DATES OF TEST** | : | March 26, 2010 |
| **REPORT ISSUE DATE** | : | April 02, 2010 |
| **TEST LABORATORY** | : | ETL Inc. (FCC Designation Number : KR0022) |

This RADAR DETECTOR, Model RL100 has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B:
I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is 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.

Yo Han, Park / Chief Engineer

**ETL Inc.**
**#371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea**
**Tel: 82-2-858-0786 Fax: 82-2-858-0788**

# Table of Contents





**Head Office:** # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# FCC MEASUREMENT 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)*

## General Information

| | |
|---|---|
| **Applicant Name** | **: ATTOWAVE CO., LTD.** |
| **Address** | **: 1005, 10F Leader's Tower, 60-15 Gasan-dong, Gumchun-gu, Seoul, 153-801 Korea.** |
| **Attention** | **: Hyun Joo, Cho / Director** |

- **EUT Type :** RADAR DETECTOR
- **Model Number :** RL100
- **FCC ID :** W75-M1K-Y12
- **S/N :** Proto-type
- **Frequency Range :** NONE
- **FCC Rule Part(s) :** FCC Part 15 Subpart B
- **Test Procedure :** ANSI C63.4-2003
- **FCC Classification :** Unintentional Radiators
  CRD - Part 15 Radar Detector
- **Dates of Tests :** March 26, 2010
- **Place of Tests :** ETL Inc. Testing Lab.

  Radiated Emission test;
  #499-1, Sagot-ri, Seosin-myeon, Hwaseong-si,
  Gyeonggi-do, 445-882, Korea

  Conducted Emission test;
  ETL Inc. Testing Lab.
  371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
- **Test Report No. :** ETLE100324.01



**Head Office:** # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC Designation Number : KR0022).

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 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the ATTOWAVE CO., LTD. Model: RL100



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 2. PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the RADAR DETECTOR (model: RL100).

## 2.2 General Specification

| | | |
|---|---|---|
| General | | |
| Dimensions | 29.3 mm (H) x 69.0 mm (W) x 115.0 mm (L) | |
| Power Requirement | 12 V to 16 VDC, 250 mA, negative ground | |
| Temperature Range | Operating | -20 ℃ to +80 ℃ |
| | Storage | -30 ℃ to +100 ℃ |
| Laser | | |
| Receiver Type | Pulsed laser signal receiver | |
| Detector Type | Digital signal processor pulse width discriminator | |
| Optical sensor | Dual convex condenser lens and high speed photo diode detector, 800 nanometers (nm) ~ 1 100 nanometers (nm) | |
| Radar | | |
| Receiver Type | Dual conversion super-heterodyne | |
| Antenna Type | Linear polarized, self-contained | |
| Detector Type | Scanning frequency discriminator | |
| Frequency of Operation | X Band: 10.525 GHz ±50 MHz | |
| | K Band: 24.150 GHz ±100 MHz | |
| | Ka Band (Super-wide): 34.700 GHz ±1 300 MHz | |



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 3. DESCRIPTION OF TESTS

## 3.1 Radiated Emission Measurement

Radiated emission measurements were made in accordance with section 12,"Measurement of unintentional radiators other than ITE" of ANSI C63.4-2003. The measurements were performed over the frequency range of 11.7 GHz to 12.2 GHz using antenna as the input transducer to a spectrum analyzer. The measurements were made with the detector set for "peak" within a bandwidth of 1 MHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determined the frequency producing the maximum emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from Above 1 GHz; linearly polarized double ridge horn antennas were used. Final measurements were made open site at 3 m. A search was made of spectrum from 11.7 GHz to 12.2 GHz the measurements indicate that the unit meets the FCC requirements. Measurements in the 11.7 GHz to 12.2 GHz band were made with a Standard Gain Horn. The measurements in the 11.7 GHz to 12.2 GHz band represent the ambient noise levels. The attached plots were made with peak detector with the analyzer in a maximum hold for 2 minutes. The test equipment was laced on a wooden turn-table. 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 pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8 m high nonmetallic 1 m x 1.5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission.

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



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 4. TEST CONDITION

## 4.1 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 and which tends to maximize its emission level in a typical application.

## 4.2 EUT operation

- The EUT was connected as user's guide. And during the test executed EUT is operating on the following:

| Operating Mode |
|---|
| Stand-by mode |
| X Band: 10.525 GHz ±50 MHz |
| K Band: 24.150 GHz ±100 MHz |
| Ka Band (Super-wide): 34.700 GHz ±1 300 MHz |
| Laser: 800 nm ~ 1 100 nm |

## 4.3 Support Equipment Used

| Description | Model Name | Serial No. | Manufacturer |
|---|---|---|---|
| - | - | - | - |

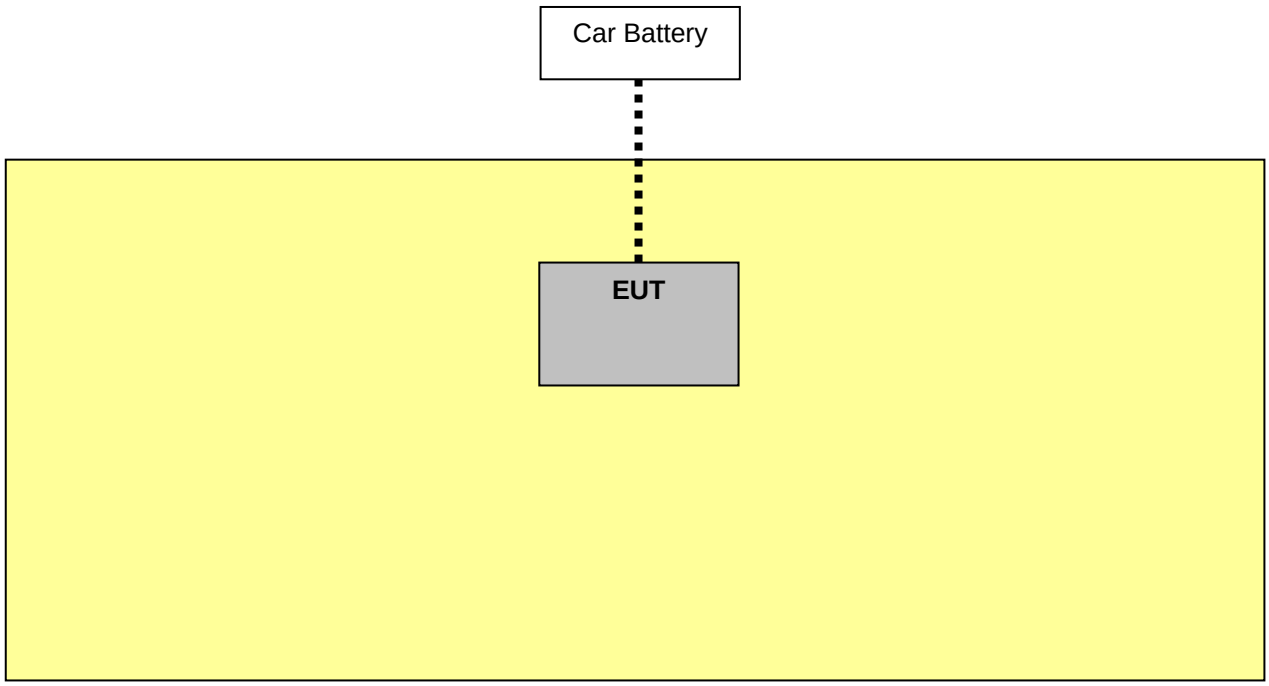
## 4.4 Type of Cables Used

| Device from | Device to | Type of I/O port | Length[m] | Type of shield |
|---|---|---|---|---|
| EUT | Car Battery | DC Input | 1.2 | Shielded |



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

## 4.5 The setup drawing(s)




——————— : Data Line

▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ : DC Power Line

——————— : AC Power Line



**Head Office:** # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 5. TEST RESULTS

## 5.1 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 | Measurement Required | Result |
|---|---|---|
| 15.109(h) | Radiated Emission Measurement | **Passed by 24.60 dB** |

The data collected shows that the **ATTOWAVE CO., LTD. / RADAR DETECTOR / RL100** complied with technical requirements of above rules part 15.109(h).

The equipment is modified anything, mechanical or circuits to improve EMI status during a measurement. EMI suppression device(s) was added and/or modified during testing.



**Head Office:** # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

## 5.2 Radiated Emissions Measurement

| | |
|---|---|
| EUT | RADAR DETECTOR / RL100 (S/N: Proto-type) |
| Limit apply to | FCC Part 15.109(h) |
| Test Date | March 26, 2010 |
| Operating Condition | Operating on the following Bands (X, K, Ka, Laser bands) |
| Result | Passed by 24.60 dB |

### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: Peak mode (Bandwidth: 1 MHz)

| Frequency [MHz] | Reading [dB($\mu$V)] | Polarization (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | AMP [dB] | Result [dB($\mu$V/m)] | Limit [dB($\mu$V/m)] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 11 820.00 | 2.10 | V | 39.00 | 19.80 | 31.50 | 29.40 | 54.00 | 24.60 |

NOTES:

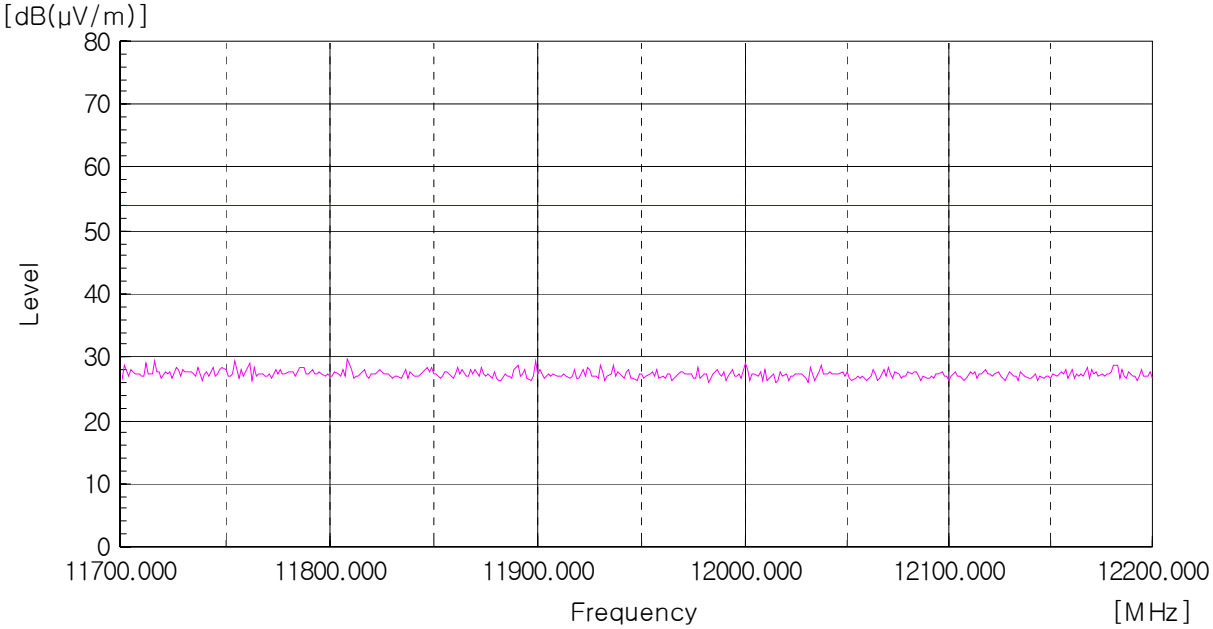
1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss - AMP**
3. **Margin value = Limit - Result**
4. **The measurement was performed for the frequency range 11.7 GHz - 12.2 GHz according to FCC Part 15.109(h).**

Test Engineer: Kug Kyoung, Yoon



**Head Office:** # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

## Plot data (Radiated Emissions Measurement of 11.7 GHz - 12.2 GHz)






Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

# 6. SAMPLE CALCULATION

## Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and Minus AMP.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AMP

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AMP = Amp Factor

$dB(\mu V) = 20 \log_{10} (\mu V)$
$dB\mu V = dBm + 107$

Example : @ 11 820.00 MHz

Limit = 54.00 dB(㎶/m)

Reading = 2.10 dB(㎶)

Antenna Factor + Cable Loss – AMP = 39.00 + 19.80 – 31.50 = 27.30 dB(㎶/m)

Total = 29.40 dB(㎶/m)

Margin = 54.00 – 29.40 = 24.60 dB

= 24.60 dB below Limit



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

## 7. List of test equipments used for measurements

| Test Equipment | | Model | Mfg. | Serial No. | Cal. Due Date |
|---|---|---|---|---|---|
| ☒ | Spectrum Analyzer | E7405A | H.P | US41160290 | 10.09.18 |
| ☒ | Preamplifier | 8348A | H.P | 3307A02865 | 10.09.17 |
| ☒ | Horn Antenna | BBHA 9120D | Schwarzbeck | 227 | 11.03.16 |
| ☒ | Turn-Table | MFT-120S | Max-Full Antenna Corp | - | N/A |
| ☒ | Antenna Master | MFA-440E | Max-Full Antenna Corp | - | N/A |



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788