

# RADIO PERFORMANCE TEST REPORT

**Test Report No.** : OT-201-RWD-034  
**AGR No.** : A195A-131  
**Applicant** : LAON Technology  
**Address** : #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu,  
Seongnam-Si, Gyeonggi-Do, Korea  
**Manufacturer** : LAON Technology  
**Address** : #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu,  
Seongnam-Si, Gyeonggi-Do, Korea  
**Type of Equipment** : Wireless Audio RF Module  
**FCC ID.** : 2AU4Y-LAON-INTERCOM  
**Model Name** : KUM1000-MA0-03  
**Serial number** : N/A  
**Total page of Report** : 10 pages (including this page)  
**Date of Incoming** : June 10, 2019  
**Date of issue** : January 29, 2020

## SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART E Section 15.407**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Ha-Ram Lee / Assistant Manager  
ONETECH Corp.

Approved by:



Jae-Ho Lee / Chief Engineer  
ONETECH Corp.

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### REVISION HISTORY

| Rev. No. | Issued Report No. | Issued Date      | Revisions              | Effect Section                                |
|----------|-------------------|------------------|------------------------|-----------------------------------------------|
| 0        | OT-19O-RWD-022    | October 11, 2019 | Initial Issue          | All                                           |
| 1        | OT-201-RWD-034    | January 29, 2020 | Added Client mode test | 5. Calculated MPE Safe Distance (Client mode) |

## 1. VERIFICATION OF COMPLIANCE

Applicant : LAON Technology  
Address : #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu, Seongnam-Si, Gyeonggi-Do, Korea  
Contact Person : Kwon Hyukjin / General Manager  
Telephone No. : 82-70-8766-9396  
FCC ID : 2AU4Y-LAON-INTERCOM  
Model Name : KUM1000-MA0-03  
Brand Name : N/A  
Serial Number : N/A

|                                                         |                                                                                     |
|---------------------------------------------------------|-------------------------------------------------------------------------------------|
| EQUIPMENT CLASS                                         | NII – Unlicensed National Information Infrastructure(UNII)                          |
| E.U.T. DESCRIPTION                                      | Wireless Audio RF Module                                                            |
| THIS REPORT CONCERNS                                    | Original Grant                                                                      |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                                                                   |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                                                                      |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | Certification                                                                       |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART E Section 15.407<br>KDB 789033 D01 General UNII Test Procedures |
| Modifications on the Equipment to Achieve<br>Compliance | None                                                                                |
| Final Test was Conducted On                             | 3 m, Semi Anechoic Chamber                                                          |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The LAON Technology, Model KUM1000-MA0-03 (referred to as the EUT in this report) is a Wireless Audio RF Module.

Product specification information described herein was obtained from product data sheet or user's manual.

|                                                    |                                       |                            |                                                       |                            |           |
|----------------------------------------------------|---------------------------------------|----------------------------|-------------------------------------------------------|----------------------------|-----------|
| DEVICE TYPE                                        | Wireless Audio RF Module              |                            |                                                       |                            |           |
| FREQUENCY RANGE                                    | WLAN<br>5 GHz Band<br>(802.11n(HT20)) | U-NII 1                    | Master                                                | 5 150 MHz ~ 5 250 MHz Band |           |
|                                                    |                                       |                            | Client                                                | 5 150 MHz ~ 5 250 MHz Band |           |
|                                                    |                                       | U-NII 3                    | Master                                                | 5 725 MHz ~ 5 825 MHz Band |           |
|                                                    |                                       |                            | Client                                                | 5 725 MHz ~ 5 825 MHz Band |           |
| MAX. RF OUTPUT POWER                               | WLAN<br>5 GHz Band<br>(802.11n(HT20)) | U-NII 1                    | Master                                                | 18.81 dBm                  |           |
|                                                    |                                       |                            | Client                                                | 18.53 dBm                  |           |
|                                                    |                                       | U-NII 3                    | Master                                                | 19.19 dBm                  |           |
|                                                    |                                       |                            | Client                                                | 18.44 dBm                  |           |
| MODULATION TYPE                                    |                                       |                            | OFDM Modulation(BPSK/QPSK/16QAM/64QAM)                |                            |           |
| ANTENNA TYPE                                       | Antenna 1 (Basic)                     |                            | Dipole Antenna [Model name: AE-T2450/5500DP5-RSMA]    |                            |           |
|                                                    | Antenna 2 (Additional)                |                            | PCB Antenna [Model name: AEi-2450/5500P-IPEX35]       |                            |           |
|                                                    | Antenna 3 (Additional)                |                            | PCB Antenna [Model name: AEi-5500DP5-IPEX100[Bottom]] |                            |           |
|                                                    | Antenna 4 (Additional)                |                            | PCB Antenna [Model name: AEi-RO-5500DP4-IPEX160]      |                            |           |
|                                                    | Antenna 5 (Additional)                |                            | PCB Antenna [Model name: AEi-RO-5500DP4-IPEX250]      |                            |           |
| ANTENNA GAIN                                       | Antenna 1                             |                            | WLAN<br>5 GHz<br>Band                                 | 5 150 MHz ~ 5 250 MHz Band | 4.299 dBi |
|                                                    |                                       |                            |                                                       | 5 725 MHz ~ 5 825 MHz Band | 5.634 dBi |
|                                                    | Antenna 2                             |                            |                                                       | 5 150 MHz ~ 5 250 MHz Band | 3.967 dBi |
|                                                    |                                       |                            |                                                       | 5 725 MHz ~ 5 825 MHz Band | 1.119 dBi |
|                                                    | Antenna 3                             |                            |                                                       | 5 150 MHz ~ 5 250 MHz Band | 1.169 dBi |
|                                                    |                                       |                            |                                                       | 5 725 MHz ~ 5 825 MHz Band | 4.358 dBi |
|                                                    | Antenna 4                             |                            |                                                       | 5 150 MHz ~ 5 250 MHz Band | 3.719 dBi |
|                                                    |                                       |                            |                                                       | 5 725 MHz ~ 5 825 MHz Band | 6.861 dBi |
|                                                    | Antenna 5                             |                            |                                                       | 5 150 MHz ~ 5 250 MHz Band | 4.290 dBi |
|                                                    |                                       | 5 725 MHz ~ 5 825 MHz Band | 5.904 dBi                                             |                            |           |
| List of each Osc. or crystal Freq.(Freq. >= 1 MHz) |                                       |                            | 40 MHz                                                |                            |           |
| RATED SUPPLY VOLTAGE                               |                                       |                            | DC 3.3 V                                              |                            |           |

Note. - This EUT operates only in 802.11n (HT20) mode.

- This EUT operates one port and the other port is Diversity Port.
- This EUT operates master mode or client mode.

**2.2 Alternative type(s)/model(s); also covered by this test report.**

-. None

**3. EUT MODIFICATIONS**

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500 \text{ mW/cm}^2$  for the frequency range between 300 MHz and 1 500 MHz and  $1.0 \text{ mW/cm}^2$  for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a  $1 \text{ mW/cm}^2$  exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

$S$  = Power density in  $\text{mW/cm}^2$ ,  $Z$  = Impedance of free space,  $377 \Omega$

$E$  = Electric field strength in  $\text{V/m}$ ,  $G$  = Numeric antenna gain, and  $d$  = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using  $P (\text{mW}) = P (\text{W}) / 1 000$ ,  $d (\text{cm}) = 0.01 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

$d$  = distance in cm,  $P$  = Power in mW,  $G$  = Numeric antenna gain, and  $S$  = Power density in  $\text{mW/cm}^2$

## 4.2 EUT Description

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kind of EUT                 | Wireless Audio RF Module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Operating Frequency Band    | <input type="checkbox"/> Wireless Microphone: 494.000 MHz ~ 501.000 MHz<br>and 498.200 MHz ~ 505.200 MHz<br><input type="checkbox"/> WLAN: 2 412 MHz ~ 2 462 MHz<br><input type="checkbox"/> WLAN: 2 422 MHz ~ 2 452 MHz<br><input checked="" type="checkbox"/> WLAN: 5 150 MHz ~ 5 250 MHz<br><input type="checkbox"/> WLAN: 5 250 MHz ~ 5 350 MHz<br><input type="checkbox"/> WLAN: 5 470 MHz ~ 5 725 MHz<br><input checked="" type="checkbox"/> WLAN: 5 725 MHz ~ 5 825 MHz<br><input type="checkbox"/> WLAN: 5 755 MHz ~ 5 795 MHz<br><input type="checkbox"/> WLAN: 5 775 MHz<br><input type="checkbox"/> FHSS: 2 402 MHz ~ 2 480 MHz<br><input type="checkbox"/> GFSK Modulation: 2403 MHz , 2443 MHz , 2478 MHz |
| Device Category             | <input type="checkbox"/> Portable (< 20 cm separation)<br><input checked="" type="checkbox"/> Mobile (> 20 cm separation)<br><input type="checkbox"/> Others                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Exposure Evaluation Applied | <input checked="" type="checkbox"/> MPE<br><input type="checkbox"/> SAR<br><input type="checkbox"/> N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## 5. Calculated MPE Safe Distance

### 5.1 Test data (Master mode)

According to above equation, the following result was obtained.

| Operating Freq.<br>Band  | Operating<br>Mode | Target Power<br>W/tolerance | Max tune up<br>power |       | Antenna Gain |        | Safe<br>Distance<br>(cm) | Power<br>Density<br>(mW/cm <sup>2</sup> )<br>@ 20 cm<br>Separation | Limit<br>(mW/<br>cm <sup>2</sup> ) |
|--------------------------|-------------------|-----------------------------|----------------------|-------|--------------|--------|--------------------------|--------------------------------------------------------------------|------------------------------------|
|                          |                   | (dBm)                       | (dBm)                | (mW)  | Log          | Linear |                          |                                                                    |                                    |
| 5 150 MHz ~<br>5 250 MHz | 802.11n<br>(HT20) | 18.31 ± 0.5                 | 18.81                | 76.03 | 4.299        | 2.691  | 4.03                     | 0.040 7                                                            | 1.00                               |
| 5 725 MHz ~<br>5 825 MHz | 802.11n<br>(HT20) | 18.69 ± 0.5                 | 19.19                | 82.03 | 6.861        | 4.854  | 5.66                     | 0.080 1                                                            | 1.00                               |

According to above table, for 5 150 ~ 5 250 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(76.03 * 2.691)/1.00} = 4.03 \text{ cm}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 76.03 * 2.691 / (4 * 3.14 * 20^2) = 0.040 7$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



**Tested by: Haram Lee / Assistant Manager**

## 5.2 Test data (Client mode)

According to above equation, the following result was obtained.

| Operating Freq.<br>Band  | Operating<br>Mode | Target Power<br>W/tolerance | Max tune up<br>power |       | Antenna Gain |        | Safe<br>Distance<br>(cm) | Power<br>Density<br>(mW/cm <sup>2</sup> )<br>@ 20 cm<br>Separation | Limit<br>(mW/<br>cm <sup>2</sup> ) |
|--------------------------|-------------------|-----------------------------|----------------------|-------|--------------|--------|--------------------------|--------------------------------------------------------------------|------------------------------------|
|                          |                   | (dBm)                       | (dBm)                | (mW)  | Log          | Linear |                          |                                                                    |                                    |
| 5 150 MHz ~<br>5 250 MHz | 802.11n<br>(HT20) | 18.03 ± 0.5                 | 18.53                | 71.29 | 4.299        | 2.691  | 3.91                     | 0.038 2                                                            | 1.00                               |
| 5 725 MHz ~<br>5 825 MHz | 802.11n<br>(HT20) | 17.94 ± 0.5                 | 18.44                | 69.82 | 6.861        | 4.854  | 5.19                     | 0.067 4                                                            | 1.00                               |

According to above table, for 5 150 ~ 5 250 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(71.29 * 2.691)/1.00} = 3.91 \text{ cm}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 71.29 * 2.691 / (4 * 3.14 * 20^2) = 0.038 2$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



**Tested by: Haram Lee / Assistant Manager**