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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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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)

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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 AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART E Section 15.407 KDB 789033 D01 General UNII Test Procedures
Modifications on the Equipment to Achieve 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.

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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 5 GHz Band (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 5 GHz Band (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 5 GHz 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.

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

-. None

3. EUT MODIFICATIONS

-. None

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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 mW/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric filed strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combing 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 (mW) = P (W) / 1 000, d (cm) = 0.01 * d (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 mW/cm²

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4.2 EUT Description

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

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5. Calculated MPE Safe Distance

5.1 Test data (Master mode)

According to above equation, the following result was obtained.

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
		(dBm)	(dBm)	(mW)	Log	Linear			
5 150 MHz ~ 5 250 MHz	802.11n (HT20)	18.31 ± 0.5	18.81	76.03	4.299	2.691	4.03	0. 040 7	1.00
5 725 MHz ~ 5 825 MHz	802.11n (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,

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

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5.2 Test data (Client mode)

According to above equation, the following result was obtained.

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
		(dBm)	(dBm)	(mW)	Log	Linear			
5 150 MHz ~ 5 250 MHz	802.11n (HT20)	18.03 ± 0.5	18.53	71.29	4.299	2.691	3.91	0. 038 2	1.00
5 725 MHz ~ 5 825 MHz	802.11n (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,

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

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