EMF TEST REPORT

Test Report No.	**: OT-237-RWD-071**
Reception No.	**: 2305001469**
Applicant	**: Geoplan Co., Ltd.**
Address	**: 622, Geumjeong SKV1, 142, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, South Korea**
Manufacturer	**: GEOWORKS Co.,Ltd.**
Address	**: Geumjeong SKV1 607, 142, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, South Korea**
Type of Equipment	**: UWB+BLE Combo Module**
FCC ID.	**: 2ASPN-MNN2CSX0**
Model Name	**: GMU-NN2CSx.0**
Multiple Model Name	**: GMU-NN2Cxx.0**
Serial number	**: N/A**
Total page of Report	**: 7 pages (including this page)**
Date of Incoming	**: March 17, 2023**
Date of issue	**: July 28, 2023**

SUMMARY

The equipment complies with the regulation; ***FCC CFR 47 PART 1.1310 and PART 2.1091***

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.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



Tested by	Reviewed by	Approved by
Myeong-Hwa, Jang / Sr. Engineer	Tae-Ho, Kim / Chief Engineer	Jae-Ho, Lee / Chief Engineer
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

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

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-237-RWD-071	July 28, 2023	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : Geoplan Co., Ltd.

Address : 622, Geumjeong SKV1, 142, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, South Korea

Contact Person : Arron, Kim / Principal Research Engineer

Telephone No. : +82-10-9580-1067

FCC ID : 2ASPN-MNN2CSX0

Model Name : GMU-NN2CSx.0

Brand Name : -

Serial Number : N/A

Date : July 28, 2023

EQUIPMENT CLASS	UWB – ULTRA WIDEBAND TRANSMITTER
E.U.T. DESCRIPTION	UWB+BLE Combo Module
THIS REPORT CONCERNS	Original Grant
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
Modifications on the Equipment to Achieve Compliance	None

-. 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 Geoplan Co., Ltd., Model GMU-NN2CSx.0 (referred to as the EUT in this report) is a UWB+BLE Combo Module.

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

Device Type	UWB+BLE Combo Module	
Temperature Range	-20 °C ~ 75 °C	
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	UWB	6 498.60 MHz, 7 989.20 MHz
MODULATION TYPE	Bluetooth LE	GFSK
	UWB	BPSK
RF OUTPUT POWER	Bluetooth LE	1 Mbps: -1.89 dBm 2 Mbps: -0.94 dBm
	UWB	-41.30 dBm/MHz (Average) 0 dBm/50MHz (Peak)
ANTENNA TYPE	Bluetooth LE	PCB Antenna
	UWB	Chip Antenna
ANTENNA GAIN	Bluetooth LE	4.98 dBi
	UWB	2.20 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	32 MHz, 38.4 MHz	

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

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
GMU-NN2CSx.0	Basic Model	☑
GMU-NN2Cxx.0	The model is identical to basic model except that the security IC has been removed.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacturer is responsible for the compliance of all variants.

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

4.2 EUT Description

Kind of EUT	UWB+BLE Combo Module
Device Category	☐ Portable (< 20 cm separation) ☐ Mobile (> 20 cm separation) ■ Others
Exposure Evaluation Applied	■ MPE ☐ SAR ☐ N/A

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4.3 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	LE_1 Mbps	-1.89 ± 1.0	-0.89	0.81	4.98	3.15	0.45	0.000 5	1
	LE_2 Mbps	-0.94 ± 1.0	0.06	1.01			0.50	0.000 6	1
6 000 ~ 8 000	UWB_CH5	-46.55 ± 1.0	-45.55	0.000 03	2.00	1.58	0.001 9	0.000 000 009	1
	UWB_CH9	-43.22 ± 1.0	-42.22	0.000 06	2.20	1.66	0.002 8	0.000 000 02	1

According to above table, for 2 400 ~ 2483.5 MHz Band(LE_1 Mbps), safe distance,

$D = 0.282 * \sqrt{(0.81 * 3.15)/1.00} = 0.45$ cm.

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

$$S = P * G / (4\pi * R^2) = 0.81 * 3.15 / (4 * \pi * 20\text{^}2) = 0.000\ 5$$

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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