RE051-21-100068-1-A Ed. 0

MPE test report

According to the standard:

CFR 47 FCC PART 15

Equipment under test:
MEMS DATA CAPTURE WAND+

FCC ID: FI5-WAN02-1

Company:
MICHELIN NORTH AMERICA (US) INC.

Distribution: Mr CHANAL **(Company:** EXOTIC SYSTEMS)

Number of pages: 9

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	23-Apr-21	Creation	S. LOUIS, Radio Technician	

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DESIGNATION OF PRODUCT:	MEMS DATA CAPTURE WAND+
Serial number (S/N):	20:72:31:7D:54:53 - radiated sample 20:6A:31:80:54:53 conducted sample
Reference / model (P/N):	Zone 2
Software version:	Pack 2.0.4
MANUFACTURER:	MICHELIN NORTH AMERICA (US) INC.

COMPANY CERTIFYING THE PRODUCT FOR TESTS:

Company:	MICHELIN NORTH AMERICA (US) INC.
Address:	One Parkway South Greenville, SC 29615 United States
Responsible:	Mr Flaker

COMPANY SUBMITTING THE PRODUCT FOR TESTS:

Company:	EXOTIC SYSTEMS
Address:	29 RUE GEORGES BESSE 63100 CLERMONT FERRAND FRANCE
Responsible:	Mr CHANAL
DATES OF TEST:	From 16-Nov-20 to 19-Nov-20
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	T. LEDRESSEUR ***VISA:*** 
WRITTEN BY:	T. LEDRESSEUR

CONTENTS

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **WAND**, in accordance with normative reference.

The equipment under test integrates:

- Bluetooth Low Energy radio function
- RFID UHF radio module operational at 920 MHz,
- RFID radio module operational at 125 kHz.
- Receiver at 433 MHz

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Industrial use, but tested with class B limit
Power source:	Internal battery 7.4Vdc, rechargeable with AC/DC adapter

RFID UHF

Antenna type and gain:	2.3 dBi / integral flex antenna
Operating frequency range:	From 917.1 MHz to 926.9 MHz
Number of channels:	50
Channel spacing:	200kHz
Modulation:	DSB-ASK

BLE

Antenna type and gain:	3 dBi / integral ceramic antenna
Operating frequency range:	From 2402 MHz to 2480 MHz
Number of channels:	40
Channel spacing:	2 MHz
Modulation:	GFSK

RFID

Antenna type and gain:	0 dBi / integral antenna
Operating frequency range:	125kHz
Number of channels:	1
Channel spacing:	Not concerned
Modulation:	ASK

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

The product is functional during the charge.

The BLE and RFID UHF can emit simultaneously.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 (2021)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment
OET BULLETIN 65	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

4. RF EXPOSURE

RFID part:

In accordance with KDB 447498 D01 General RF Exposure Guidance v06, Paragraph 4.3.1.

The product must respect the exclusion limit for 10-g extremity SAR and a separation distances less than 50mm:

Maximum measured power = 79.35 dBµV/m = **30.9 x 10-6 mW** at 125 kHz.
with $P = (E \times d)^2 / (30 \times Gp)$ *with d = 10 m and Gp = 1*

The power threshold determined by the equation in 4.3.1.c) 1) for 50 mm and 100 MHz is multiplied by ½

According this formula:

Power threshold, mW = [[[(50*7.5) / √ (0.100)] + (50-50) * (100/150)] * [1 + log(100/0.1342)] * ½]
Power threshold, mW = 2295.96 mW

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.

RFID UHF part:

The product must respect the exclusion limit for 10-g extremity SAR.

Maximum measured power = 0.760 W at 917.1 MHz

As declared by the manufacturer the product emit maximum 30s on a period of 6min.
The maximum duty cycle is 8.3% on the reference period of 6min, so the power computed is: 60.8mW

In addition the minimum test separation distance *of the antenna is 40mm*

*[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≤ 7.5*

According this formula:
Power threshold, mW = [(7.5 * min. test separation distance, mm) / √f(GHz)]
Power threshold, mW = [(7.5 * 40) / √(0.9171)]
Power threshold, mW = 313.3 mW

The maximum measured power is lower than 313.3 mW.

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 40 mm between the user and the antenna.

The MPE ratio is then calculated for the simultaneous transmission.

$$\textit{MPE ratio(RFID)} = \frac{60.8}{313.3} = 0.194$$

BLE part:

The product must respect the exclusion limit for 10-g extremity SAR.

Maximum measured power = 0.0029 W at 2402 MHz

*[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≤ 7.5*

According this formula:
Power threshold, mW = [(7.5 * min. test separation distance, mm) / √f(GHz)]
Power threshold, mW = [(7.5 * 5) / √(2.402)]
Power threshold, mW = 24.2 mW

The maximum measured power is lower than 24.2 mW.

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.

The MPE ratio is then calculated for the simultaneous transmission.

MPE ratio(BLE) = $\frac{2.9}{24.2}$ ***= 0.12***

Calculus for simultaneous transmission

$\sum$ of MPE ratio = MPE ratio(RFID) + MPE ratio(BLE) = 0.194 + 0.12 = 0.314 ≤ 1.0

The product meet the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498