

# RF EXPOSURE REPORT FCC

APPLICANT

**Nwave Technologies Inc**

MODEL NAME

**NPS-4.5**

FCC ID

**2ADCZ-NPS-4-5**

REPORT NUMBER

**HA220510-NWT-001-R04**

# TEST REPORT

**Date of Issue**  
November 2, 2022

**Test Site**  
Hyundai C-Tech, Inc. dba HCT America, Inc.  
1726 Ringwood Ave, San Jose, CA 95131, USA

<b>Applicant</b>	Nwave Technologies Inc
<b>Applicant Address</b>	1410 21st Street Suite R Sacramento, CA 95811 USA
<b>FCC ID</b>	2ADCZ-NPS-4-5
<b>Model Name</b>	NPS-4.5
<b>EUT Type</b>	Nwave Wireless Vehicle Detection Sensor
<b>FCC Classification</b>	Digital Transmission System (DTS) Frequency Hopping Spread Spectrum Transmitter (DSS)
<b>FCC Rule Part(s)</b>	Part 1 (§1.1310), Part 2 (§2.1091)
<b>Test Procedure</b>	KDB 447498 D01 v06

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was in accordance with the procedures specified in §2.947. The results in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are 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.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

**Tested By**



Yongsoo Park

Test Engineer

**Reviewed By**



Sunwoo Kim

Technical Manager

## REVISION HISTORY

*The revision history for this document is shown in the table.*

TEST REPORT NO.	DATE	DESCRIPTION
HA220510-NWT-001-R04	November 2, 2022	Initial Issue

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## 1. EUT DESCRIPTION

<b>Model</b>	NPS-4.5	
<b>Product Name</b>	Nwave Wireless Vehicle Detection Sensor	
<b>RF Specification</b>	LoRaWAN 1.0.3 Class A (125 kHz / 500 kHz) Bluetooth 5.1 LE (1M)	
<b>Transmitter Chain</b>	LoRa : SISO Bluetooth LE : SISO	
<b>Antenna Specification</b>	LoRa (125 kHz / 500 kHz)	0.4 dBi (Peak Gain)
	BLE 1M	0.2 dBi (Peak Gain)
<b>Operating Environment</b>	Outdoor	
<b>Operating Temperature</b>	-40 °C ~ +85 °C	

## 2. INTRODUCTION

### 2.1. LIMIT

The limit for Maximum Permissible Exposure (MPE), specified in FCC Rule Part §1.1310 listed in the table below, shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation specified in §1.1310 (b)

Frequency Range (MHz)	E- Field Strength (V/m)	H- Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (Minutes)
<b>(A) Limits for Occupational / Controlled Exposure</b>				
0.3 – 3.0	614	1.63	*100	6
3.0 – 30	1842 / f	4.89 / f	*900 / f <sup>2</sup>	6
30 – 300	61.4	0.163	1.0	6
300 – 1,500	-	-	f / 300	6
1,500 – 100,000	-	-	5	6
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
0.3 – 1.34	614	1.63	*100	30
1.34 – 30	824 / f	2.19 / f	*180 / f <sup>2</sup>	30
30 – 300	27.5	0.073	0.2	30
300 – 1,500	-	-	f / 1500	30
1,500 – 100,000	-	-	1.0	30

f = frequency in MHz, \* = Plane-wave equivalent power density

### 2.2. MAXIMUM PERMISSIBLE EXPOSURE PREDICTION

Prediction of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S : Power density (mW/cm<sup>2</sup>)

P : Output power to antenna (mW)

G : Antenna gain in linear scale

R : Distance between the center of radiator and observation point (cm)

### 3. RESULT

#### 3.1. MPE Calculation

Bluetooth LE				
Frequency (MHz)	2402 - 2480	MHz		
MPE Limit (mW/cm <sup>2</sup> )	1.0	mW/cm <sup>2</sup>		
Distance (R)	20	Cm		
Output Power (P)	2.3	dBm	1.70	mW
Antenna Gain (G)	0.2	dBi	1.05	-
Power density (S) at distance 20 cm	<b>0.000354</b>	mW/cm <sup>2</sup>	at 20 cm separation distance	

LoRa				
Frequency (MHz)	902.3	MHz		
MPE Limit (mW/cm <sup>2</sup> )	0.602	mW/cm <sup>2</sup>		
Distance (R)	20	Cm		
Output Power (P)	16.8	dBm	47.86	mW
Antenna Gain (G)	0.4	dBi	1.10	-
Power density (S) at distance 20 cm	<b>0.010441</b>	mW/cm <sup>2</sup>	at 20 cm separation distance	

**Note :**

1. Output power (P) e.i.r.p is included tune-up tolerance.

### 3.2. SUMMARY OF RESULTS

Mode	Frequency Range (MHz)	Tune-up Power (dBm) e.i.r.p	Power Density (mW/cm <sup>2</sup> )	MPE Ratio (PD/MPE Limit)
Bluetooth LE	2402 – 2480	2.5	0.000354	0.000354
LoRa	902.3 – 914.9 (125 kHz) 903.0 – 914.2 (500 kHz)	17.2	0.010441	0.017357

BLE and LoRa do not transmit simultaneously. Therefore, the worst-case power density is 0.010441 mW/cm<sup>2</sup> at LoRa operating mode.

#### Sample Calculation

MPE Ratio (LoRa) at 20cm distance =  $0.010441 / 0.602 = \mathbf{0.017357} < 1.0$



***END OF TEST REPORT***