

# ISED RF Exposure Test Report

**Report No.** : W7L-P23120015SA02  
**Applicant** : Particle Industries, Inc  
**Address** : 325 9th Street, San Francisco, CA 94103, United States Of America  
**Product** : M SoM  
**Brand Name** : Particle  
**Model Name** : M404  
**IC** : 20127-M404  
**Standards** : RSS-102 Issue5 / IEEE C95.3-2002  
KDB 447498 D01 General RF Exposure Guidance v06  
**Sample Received Date** : Dec. 27, 2023  
**Date of Testing** : Dec. 27, 2023 ~ Jan. 26, 2024

**CERTIFICATION:** The above equipment have been tested by **BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO., LTD.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by A2LA or any government agencies.

**Prepared By :**



Jerry Chen / Engineer

**Approved By :**



Luke Lu / Manager

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Certificate # 3939.01

## Release Control Record

Report No.	Reason for Change	Date Issued
W7L-P23120015SA02	Initial release	Feb. 26, 2024

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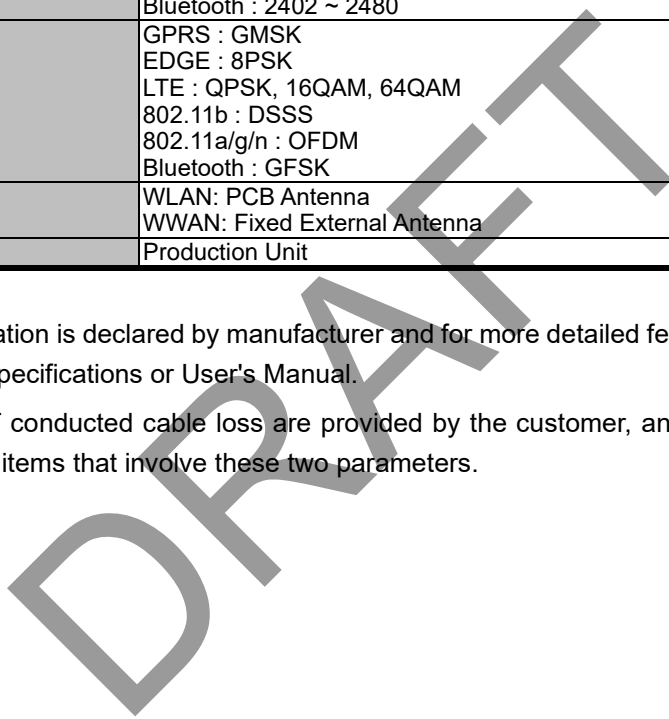


### 1. Description of Equipment Under Test

<b>EUT Type</b>	M SoM
<b>Brand Name</b>	Particle
<b>Model Name</b>	M404
<b>Tx Frequency Bands (Unit: MHz)</b>	GSM850 : 824.2 ~ 848.8 GSM1900 : 1850.2 ~ 1909.8 LTE Band 2 : 1850.7 MHz ~ 1909.3 MHz LTE Band 4 : 1710.7 MHz ~ 1754.3 MHz LTE Band 5 : 824.7 MHz ~ 848.3 MHz LTE Band 12 : 699.7 MHz ~ 715.3 MHz LTE Band 13 : 779.5 MHz ~ 784.5 MHz LTE Band 25 : 1850.7MHz ~ 1914.3MHz LTE Band 26 : 814.7MHz ~ 848.3MHz LTE Band 66 : 1710.7 MHz ~ 1779.3 MHz WLAN : 2412 ~ 2462, 5180 ~ 5240, 5260 ~ 5320, 5500 ~ 5700, 5745 ~ 5825 Bluetooth : 2402 ~ 2480
<b>Uplink Modulations</b>	GPRS : GMSK EDGE : 8PSK LTE : QPSK, 16QAM, 64QAM 802.11b : DSSS 802.11a/g/n : OFDM Bluetooth : GFSK
<b>Antenna Type</b>	WLAN: PCB Antenna WWAN: Fixed External Antenna
<b>EUT Stage</b>	Production Unit

**Note:**

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.
2. Antenna gain and EUT conducted cable loss are provided by the customer, and the laboratory will record the results based on these items that involve these two parameters.



## 2. MPE(Maximum Permissible Exposure) Assessment

### 2.1 Introduction

RF exposure evaluation is the method used to evaluate the RF field strength levels generated by a device. RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.

### 2.2 RF Radiation Exposure Limits

The electronic and electro-technical apparatus shall comply with the basic restriction as specified in IC RSS-102. A summary of the reference levels is given in below table.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003 – 10	83	90	-	6
0.1 – 10	-	0.73/f	-	6
1.1 – 10	87f <sup>0.5</sup>	-	-	6
10 – 20	27.46	0.0728	2	6
20 – 48	58.07f <sup>0.25</sup>	0.1540f <sup>0.25</sup>	8.944/f <sup>0.5</sup>	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	3.142 f <sup>0.3417</sup>	0.008335 f <sup>0.3417</sup>	0.02619 f <sup>0.6834</sup>	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	616000/f <sup>1.2</sup>
150000 – 300000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000/f <sup>1.2</sup>

**RF Field Strength Limits for Devices Used by the General Public**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003 – 10	170	180	-	6
0.1 – 10	-	1.6/f	-	6
1.29 – 10	193/f <sup>0.5</sup>	-	-	6
10 – 20	61.4	0.163	10	6
20 – 48	129.8/f <sup>0.25</sup>	0.3444/f <sup>0.25</sup>	44.72/f <sup>0.5</sup>	6
48 – 100	49.33	0.1309	6.455	6
100 – 6000	15.60 f <sup>0.25</sup>	0.04138 f <sup>0.25</sup>	0.6455f <sup>0.5</sup>	6
6000 – 15000	137	0.364	50	6
15000 – 150000	137	0.364	50	616000/f <sup>1.2</sup>
150000 – 300000	0.354 f <sup>0.5</sup>	9.40 x 10 <sup>-4</sup> f <sup>0.5</sup>	3.33 x 10 <sup>-4</sup> f	616000/f <sup>1.2</sup>

**RF Field Strength Limits for Controlled Use Devices**

**Notes:**

- f = frequency in MHz

### **2.3 MPE Assessment Method**

Calculations can be made to predict RF field strength and power density levels around typical RF sources. For example, in the case of a single radiating antenna, a prediction for power density in the far-field of the antenna can be made by use of the general Equations below. This equation is generally accurate in the far-field of an antenna but will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction.

$$\text{Power Density (S)} = \frac{PG}{4\pi R^2} = \frac{\text{EIRP}}{4\pi R^2}$$

Where

S = Power Density, unit in W/m<sup>2</sup>

P = Power input to the antenna, unit in Watts

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna, unit in meter

EIRP = Effective isotropically radiated power

### **2.4 MPE Calculation for Standalone Operations**

The manufacturer expects that the radiated component of this device will not close to the human body during normal usage and the warning statement was also stated in the user instruction. Since the transmitting antenna will be kept at least 20 cm away from the human body, the MPE level is calculated based on this condition and the result is listed in below table.



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## CALCULATION FOR MAXIMUM E.I.R.P

Band	Antenna Gain (dBi)	Maximum Tune up Power (dBm)	Average EIRP (W)	Power Density (W/m <sup>2</sup> )	Limit (W/m <sup>2</sup> )	Power Density / Limit	Result (PASS / FAIL)
Bluetooth LE	3	8.5	0.014	0.028	5.351	0.005	Pass
2.4GHz WLAN	3	17.0	0.100	0.199	5.366	0.037	Pass
5.2GHz WLAN	6.8	15.0	0.151	0.301	9.047	0.033	Pass
5.3GHz WLAN	6.8	18.5	0.339	0.674	9.142	0.074	Pass
5.5GHz WLAN	6.8	17.0	0.240	0.477	9.425	0.051	Pass
5.8GHz WLAN	6.8	18.5	0.339	0.674	9.710	0.069	Pass
GSM850	2.8	34.0	4.786	1.199	2.576	0.466	Pass
GSM1900	5.3	29.0	2.692	0.674	4.477	0.151	Pass
LTE Band 2	5.3	25.0	1.072	2.133	4.477	0.476	Pass
LTE Band 4	5.3	25.0	1.072	2.133	4.243	0.503	Pass
LTE Band 5	2.8	25.0	0.603	1.199	2.577	0.465	Pass
LTE Band 12	2.8	25.0	0.603	1.199	2.303	0.521	Pass
LTE Band 13	2.8	25.0	0.603	1.199	2.480	0.484	Pass
LTE Band 25	5.3	25.0	1.072	2.133	4.477	0.476	Pass
LTE Band 26	2.8	25.0	0.603	1.199	2.577	0.465	Pass
LTE Band 66	5.3	25.0	1.072	2.133	4.243	0.503	Pass

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## 2.5 CONCLUSION OF SIMULTANEOUS TRANSMITTER

Both of the WLAN and WWAN can transmit simultaneously, the formula of calculated the MPE is:

$CPD1/LPD1 + CPD2/LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Band	Antenna Gain (dBi)	Maximum Tune up Power (dBm)	Average EIRP (W)	Power Density (W/m <sup>2</sup> )	Power Density / Limit	$\Sigma$ (Power Density / Limit)	Limit	Result
LTE Band 12	2.8	25.0	0.603	1.199	0.521	0.600	1.000	PASS
5.3GHz WLAN	6.8	18.5	0.339	0.674	0.074			
Bluetooth LE	3	8.5	0.014	0.028	0.005			

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### **3. Information on the Testing Laboratories**

We, BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD., were founded in 2015 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The road map of all our labs can be found in our web site also.

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