RADIO TEST REPORT

(EN 62311)

Applicant:	Particle Industries,Inc
Address:	325 9th Street, San Francisco, CA 94103, United States Of America

Manufacturer or Supplier:	Particle Industries,Inc
Address:	325 9th Street, San Francisco, CA 94103, United States Of America
Product:	M SoM
Brand Name:	Particle
Model Name:	M404
Date of tests:	Dec. 27, 2023 ~ Feb. 23, 2024
The tests have been carried out according to the requirements of the following standard:	
☒ **EN IEC 62311:2020**	
CONCLUSION: The submitted sample was found to COMPLY with the test requirement	

Prepared by Jerry Chen Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
Jerry chen Date: Feb. 26, 2024	Luke Lu Date: Feb. 26, 2024

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P23120015SA03	Original release	Feb. 26, 2024

BV 7Layers Communications Technology (Shenzhen) Co., Ltd.

Room B37, Warehouse A5, No.3 Chiwan 4th Road, Zhaoshang Street, Nanshan District Shenzhen, Guangdong, People's Republic of China

Tel: +86 755 8869 6566
Fax: +86 755 8869 6577
Email: customerservice.sw@bureauveritas.com

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

PRODUCT	M SoM	
BRAND NAME	Particle	
MODEL NAME	M404	
NOMINAL VOLTAGE	VCC: 3.8V. 3V3:3.3V	
MODULATION TYPE	**BT_LE**	GFSK
	WLAN	DSSS, OFDM
	GPS/GALILEO/GLONASS/BDS	BPSK
	GSM/GPRS/EDGE	GMSK, 8PSK
	LTE	QPSK/16QAM
OPERATING FREQUENCY	**WLAN**	2412 ~ 2462MHz for 11b/g/n(HT20) 5180 ~ 5240MHz, 5260 ~ 5320 MHz, 5500 ~ 5720MHz, 5745 ~ 5825 MHz for 11a/ n/ac(HT20)/n/ac(HT40)
	BT_LE	2402MHz ~ 2480MHz
	GPS/GALILEO/GLONASS/BDS	1559MHz ~ 1610MHz
	GSM	880.2MHz ~ 914.8MHz (FOR GSM 900) 1710.2MHz ~ 1784.8MHz (FOR DCS 1800)
	LTE	1922.5MHz~ 1977.5MHz (FOR LTE Band1) 1710.7MHz ~ 1784.3MHz (FOR LTE Band3) 880.7MHz ~ 914.3MHz (FOR LTE Band8) 834.5MHz~ 859.5MHz (FOR LTE Band20) 704.5MHz ~ 746.5MHz (FOR LTE Band28)
HW VERSION	v0.2	
SW VERSION	v5.5.2	
I/O PORTS	Refer to user's manual	
CABLE SUPPLIED	N/A	

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2 RF EXPOSURE MEASUREMENT

2.1 INTRODUCTION

This International Standard applies to electronic and electrical equipment for which no dedicated product- or product family standard regarding human exposure to electromagnetic fields applies.

The frequency range covered is 0 Hz to 300 GHz.

The object of this generic standard is to provide assessment methods and criteria to evaluate such equipment against basic restrictions or reference levels on exposure of the general public related to electric, magnetic and electromagnetic fields and induced and contact current.

2.2 LIMIT

The table of the reference field levels shown as below is given in Annex III of the Council Recommendation 1999/519/EC.

Reference levels for electric, magnetic and electromagnetic fields (0 Hz to 300 GHz, unperturbed rms values)

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (μT)	Equivalent plane wave power density S_{eq} (W/m^2)
0-1 Hz	—	$3,2 \times 10^4$	4×10^4	—
1-8 Hz	10 000	$3,2 \times 10^4/f^2$	$4 \times 10^4/f^2$	—
8-25 Hz	10 000	4 000/f	5 000/f	—
0,025-0,8 kHz	250/f	4/f	5/f	—
0,8-3 kHz	250/f	5	6,25	—
3-150 kHz	87	5	6,25	—
0,15-1 MHz	87	0,73/f	0,92/f	—
1-10 MHz	$87/f^{1/2}$	0,73/f	0,92/f	—
10-400 MHz	28	0,073	0,092	2
400-2 000 MHz	$1,375\ f^{1/2}$	$0,0037\ f^{1/2}$	$0,0046\ f^{1/2}$	f/200
2-300 GHz	61	0,16	0,20	10

Notes:

1. f as indicated in the frequency range column.
2. For frequencies between 100 kHz and 10 GHz, S_{eq}, E^2, H^2, and B^2 are to be averaged over any six-minute period.
3. For frequencies exceeding 10 GHz, S_{eq}, E^2, H^2, and B^2 are to be averaged over any $68/f^{1.05}$ -minute period (f in GHz).
4. No E-field value is provided for frequencies < 1 Hz, which are effectively static electric fields. For most people the annoying perception of surface electric charges will not occur at field strengths less than 25 kV/m. Spark discharges causing stress or annoyance should be avoided.

2.3 CLASSIFICATION OF THE ASSESSMENT METHODS

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the WWAN easy install sheet. So, this product under normal use is located on electromagnetic far field between the human body.

Far Field Calculation Formula

$$E = \eta_0 H = \frac{\sqrt{30PG(\theta,\phi)}}{r}$$

G = antenna gain relative to an isotropic antenna
θ,ϕ = elevation and azimuth angles to point of investigation
r = distance from observation point to the antenna
η_0 = Characteristic impedance of free space

2.4 TEST RESULTS

CALCULATION FOR MAXIMUM E.I.R.P

BLUETOOTH

OPERATING BAND(MHz)	Frequency (MHz)	Antenna Gain (dBi)	Tune- up Conducted Power (dBm)	Output Power E.I.R.P. (dBm)	Output Power E.I.R.P. (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	E-Field Strength/ Limit	PASS / FAIL
Bluetooth LE	2402	3	6.5	9.50	8.91	2.59	61	0.042	PASS

2.4G WIFI

OPERATING BAND(MHz)	Frequency (MHz)	Antenna Gain (dBi)	Tune-up ConductedPower (dBm)	Output Power E.I.R.P. (dBm)	Output Power E.I.R.P. .(mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	E-Field Strength/ Limit	PASS / FAIL
2.4G	2412	3	17.0	20.00	100.00	8.66	61	0.142	PASS

5G WIFI

OPERATING BAND(MHz)	Frequency (MHz)	Antenna Gain (dBi)	Tune-up ConductedPower (dBm)	Output Power E.I.R.P. (dBm)	Output Power E.I.R.P. .(mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	E-Field Strength/ Limit	PASS / FAIL
Band 1	5180	6.8	12.0	18.80	75.86	7.54	61	0.124	PASS
Band 2	5260	6.8	12.0	18.80	75.86	7.54	62	0.122	PASS
Band 3	5500	6.8	12.5	19.30	85.11	7.99	63	0.127	PASS
Band 4	5475	6.8	7.0	13.80	23.99	4.24	64	0.066	PASS

GSM

OPERATING BAND(MHz)	Frequency (MHz)	Antenna Gain (dBi)	Tune- up Conducted Power (dBm)	Tune-up Conducted AV Power (dBm)	Tune- up Conducted AV Power (mw)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	E-Field Strength/ Limit	PASS / FAIL
GSM 900	880.2	2.8	35.0	25.97	395.37	23.77	40.79	0.583	PASS
PCS 1800	1710.2	5.3	32.0	22.97	198.15	22.44	56.86	0.395	PASS

LTE

OPERATING BAND(MHz)	Frequency (MHz)	Antenna Gain (dBi)	Tune-up ConductedPower (dBm)	Output Power E.I.R.P. (dBm)	Output Power E.I.R.P. .(mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	E-Field Strength/ Limit	PASS / FAIL
Band 1	1922.5	5.3	25.0	30.30	1071.52	28.35	60.29	0.470	PASS
Band 3	1710.7	5.3	25.0	30.30	1071.52	28.35	56.87	0.498	PASS
Band 8	880.7	2.8	25.0	27.80	602.56	21.26	40.81	0.521	PASS
Band 20	834.5	2.8	25.0	27.80	602.56	21.26	39.72	0.535	PASS
Band 28	704.5	2.8	25.0	27.80	602.56	21.26	36.5	0.582	PASS

COLLOCATED EXPOSURE FIELD STRENGTHS CALCULATION

Band	Frequency (MHz)	(E-Field Strength)/ (Limit)	Σ((E-Field Strength)/ (Limit)) of	PASS / FAIL
BT-LE	2402	0.042	0.767	PASS
WLAN	2412	0.142		
WWAN	880.2	0.583		

Note:

Simultaneous Transmitter requirements： Σ((E-Field Strength)/ (Limit))≤1

2.5 CONCLUSION

According to Council Recommendation 1999/519/EC and RED (Directive2014/53/EU), the RF exposure analysis concludes that the RF Exposure is CE compliant.

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