TEST REPORT

Applicant:	Particle Industries, Inc.
EUT Description:	Tachyon
Model:	TACH4ROW, TACH8ROW
Brand:	Particle
Standards:	EN IEC 62311: 2020
Date of Receipt:	2025/06/25
Date of Issue:	2025/08/28

TOWE. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

the results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of the model are manufactured with identical electrical and mechanical components. All sample tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise. without written approval of TOWE, the test report shall not be reproduced except in full.

Jim Huang
Approved By:

Carey Chen
Reviewed By:

Revision History

Rev.	Issue Date	Description	Revised by
01	2025/08/28	Original	Carey Chen

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1 General Description

1.1 Lab Information

1.1.1 Testing Location

These measurements tests were conducted at the Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. facility located at F401 and F101, Building E, Hongwei Industrial Zone, Liuxian 3rd Road, Bao'an District, Shenzhen, China.
Tel.: +86-755-27212361
Contact Email: info@towewireless.com

1.1.2 Test Facility / Accreditations

A2LA (Certificate Number: 7088.01)
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

FCC Designation No.: CN1353
Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. has been recognized as an accredited testing laboratory. Designation Number: CN1353.

ISED CAB identifier: CN0152
Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.
CAB identifier: CN0152
Company Number: 31000

1.2 Client Information

1.2.1 Applicant

Applicant:	Particle Industries, Inc.
Address:	548 Market St, PMB 34833, San Francisco, CA 94104, USA

1.2.2 Manufacturer

Manufacturer:	Particle Industries, Inc.
Address:	548 Market St, PMB 34833, San Francisco, CA 94104, USA

1.3 Product Information

EUT Description:	Tachyon		
Model:	TACH4ROW, TACH8ROW		
Brand:	Particle		
Hardware Version:	V1.2		
Software Version:	1.0.160		
Frequency Bands:	Band	TX Frequency	RX Frequency
	E-GSM900	880MHz ~ 915MHz	925MHz ~ 960MHz
	DCS1800	1710MHz ~ 1785MHz	1805MHz ~ 1880MHz
	WCDMA Band I	1920MHz ~ 1980MHz	2110MHz ~ 2170MHz
	WCDMA Band V	824MHz ~ 849MHz	869MHz ~ 894MHz
	WCDMA Band VIII	880MHz ~ 915MHz	925MHz ~ 960MHz
	LTE Band 1	1920MHz ~ 1980MHz	2110MHz ~ 2170MHz
	LTE Band 3	1710MHz ~ 1785MHz	1805MHz ~ 1880MHz
	LTE Band 5	824MHz ~ 849MHz	869MHz ~ 894MHz
	LTE Band 7	2500MHz ~ 2570MHz	2620MHz ~ 2690MHz
	LTE Band 8	880MHz ~ 915MHz	925MHz ~ 960MHz
	LTE Band 20	832MHz ~ 862MHz	791MHz ~ 821MHz
	LTE Band 28	703MHz ~ 748MHz	758MHz ~ 803MHz
	LTE Band 32	/	1452MHz ~ 1496MHz
	LTE Band 34	2010MHz ~ 2025MHz	2010MHz ~ 2025MHz
	LTE Band 38	2570MHz ~ 2620MHz	2570MHz ~ 2620MHz
	LTE Band 40	2300MHz ~ 2400MHz	2300MHz ~ 2400MHz
	LTE Band 41	2496MHz ~ 2690MHz	2496MHz ~ 2690MHz
	LTE Band 42	3400MHz ~ 3600MHz	3400MHz ~ 3600MHz
	NR Band n1	1920 ~ 1980MHz	2110 ~ 2170MHz
	NR Band n3	1710 ~ 1785MHz	1805 ~ 1880MHz
	NR Band n5	824 ~ 849 MHz	869 ~ 894 MHz
	NR Band n7	2500 ~ 2570 MHz	2620 ~ 2690 MHz
	NR Band n8	880 ~ 915 MHz	925 ~ 960 MHz
	NR Band n20	832 ~ 862MHz	791 ~ 821 MHz
	NR Band n28	703 ~ 748 MHz	758 ~ 803 MHz
	NR Band n38	2570 ~ 2620 MHz	2570 ~ 2620 MHz
	NR Band n40	2300 ~ 2400 MHz	2300 ~ 2400 MHz
	NR Band n41	2496 ~ 2690MHz	2496 ~ 2690MHz
	NR Band n77	3300 ~ 4200 MHz	3300 ~ 4200 MHz
	NR Band n78	3300 ~ 3800 MHz	3300 ~ 3800 MHz
	Bluetooth	2402 ~ 2480 MHz	2402 ~ 2480 MHz
	Wi-Fi 2.4G	2412~ 2472 MHz	2412~ 2472 MHz
	5G WIFI(U-NII-1)	5150 ~ 5250MHz	5150 ~ 5250MHz
	5G WIFI(U-NII-2A)	5250 ~ 5350MHz	5250 ~ 5350MHz

	5G WIFI(U-NII-2C)	5470 ~ 5725MHz	5470 ~ 5725MHz
	5G WIFI(U-NII-3)	5725 ~ 5850MHz	5725 ~ 5850MHz
	Wi-Fi 6E	5945 ~ 6425MHz	5945 ~ 6425MHz
LTE CA:	UL CA_3C; UL CA_7C; UL CA_8B; UL CA_38C; UL CA_40C; UL CA_42C; UL CA_1A-3A; UL CA_1A-7A; UL CA_1A-8A; UL CA_1A-20A; UL CA_1A-28A; UL CA_1-42A; UL CA_3A-7A; UL CA_3A-8A; UL CA_3A-20A; UL CA_3A-28A; UL CA_3A-42A; UL CA_7A-20A; UL CA_7A-28A; UL CA_8A-40A; DL CA_20A-32A;		
EN-DC:	DC_1A_n28A, DC_3A_n28A, DC_7A_n28A, DC_20A_n28A[1], DC_3A_n7A, DC_1A_n77A, DC_3A_n77A, DC_8A_n77A, DC_28A_n77A, DC_41A_n77A, DC_1A_n78A, DC_3A_n78A, DC_7A_n78A, DC_8A_n78A, DC_20A_n78A, DC_28A_n78A, DC_38A_n78A, DC_41A_n78A;		
Power Class:	Class 2:	LTE Band 41(Non-EU); NR Band n41; NR Band n77; NR Band n78;	
	Class 3:	All Frequency Bands	
UL MIMO:	NR Band n38; NR Band n40; NR Band n41; NR Band n77; NR Band n78;		
Antenna Type:	☐ External, ☒ Integrated		

Antenna Gain:	Band	Ant (dBi)
	E-GSM900	-2.7
	DCS1800	-0.4
	WCDMA Band I	-0.4
	WCDMA Band V	-0.5
	WCDMA Band VIII	-2.7
	LTE Band 1	-0.4
	LTE Band 3	-0.4
	LTE Band 5	-0.5
	LTE Band 7	0.0
	LTE Band 8	-2.7
	LTE Band 20	-1.1
	LTE Band 28	-0.5
	LTE Band 34	-0.2
	LTE Band 38	0.4
	LTE Band 40	-1.1
	LTE Band 41	1.0
	LTE Band 42	1.2
	NR Band n1	-0.4
	NR Band n3	-0.4
	NR Band n5	-0.5
	NR Band n7	0.0
	NR Band n8	-2.7
	NR Band n20	-1.1
	NR Band n28	-0.5
	NR Band n38	0.4
	NR Band n40	-1.1

	NR Band n41	1.0
	NR Band n77	2.2
	NR Band n78	2.2
	Bluetooth	-0.3
	Wi-Fi 2.4G	-0.3
	5G WIFI(U-NII-1)	2.3
	5G WIFI(U-NII-2A)	2.3
	5G WIFI(U-NII-2C)	2.3
	5G WIFI(U-NII-3)	2.3
	Wi-Fi 6E	1.5

Remark:
1. The above EUT's information was declared by applicant, please refer to the specifications or user's manual for more detailed description.
2. According to the customer's Letter of model difference, TACH4ROW and TACH8ROW are identical with each other, except for RAM and model number difference.
Note:
[1] DC_20A_n28A: Referring to Note 8 in Table 5.5B.4.1-1 of ETSI TS 138 521-3, The frequency range in band n28 / 28 is restricted for this band combination to 703 - 733 MHz for the UL and 758-788 MHz for the DL.

2 Maximum Permissible RF Exposure

2.1 Reference Levels

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/m²)
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.

The field calculation does not take into account the antenna size, which is assumed to be a point source. An ideal isotropic antenna is used as a reference to compare the performance of practical antennas: *P* watts is radiated, from a point, uniformly over the surface of sphere of radius *r*.

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

where

G is the antenna gain relative to an isotropic antenna;

θ, ϕ are elevation and azimuth angles to point of investigation;

r is the distance from observation point to the antenna;

η_0 is the characteristic impedance of free space.

2.2 Simultaneous Transmission

Exposure field strengths can be compared to the reference levels on a sum square basis:

$$\sum_{i=100\text{kHz}}^{1\text{MHz}} \left(\frac{E_i}{c}\right)^2 + \sum_{i>1\text{MHz}}^{300\text{GHz}} \left(\frac{E_i}{E_{L,i}}\right)^2 \le 1$$

E_i is the electric field strength at frequency i;
$EL_{,i}$ is the electric field reference level;
H_i is the magnetic field strength at frequency i;
HL_i is the magnetic field reference level;
c is 610/ f V/m (f in MHz) for occupational exposure and 87/ f /2 V/m (f in MHz) for general public exposure;
d is 1,6l f A/m (f in MHz) for occupational exposure and 0,73/ f A/m (f in MHz) for general public exposure. NOTE The values c and d are only examples.
NOTE The values c and d are only examples

3 RF Exposure Results

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

Output Power into Antenna & RF Exposure Evaluation Distance:

Operating Band	Frequency (MHz)	Max Conducted Average Output Power (dBm)	Antenna Gain (dBi)	EIRP (W)	E Field Strength at R=20cm (V/m)	E Field Strength Limit (V/m)	Max Gain	Conclusion
E-GSM900	880.2	35.00	-2.7	0.20	12.39	40.79	7.64	Pass
DCS1800	1710.2	32.00	-0.4	0.17	11.43	56.86	13.53	Pass
WCDMA Band I	1922.6	25.00	-0.4	0.29	14.71	60.29	11.85	Pass
WCDMA Band V	826.4	25.00	-0.5	0.28	14.54	39.53	8.18	Pass
WCDMA Band VIII	882.6	25.00	-2.7	0.17	11.29	40.85	8.47	Pass
LTE Band 1	1922.5	25.00	-0.4	0.29	14.71	60.29	11.85	Pass
LTE Band 3/CA_3C	1710.7	25.00	-0.4	0.29	14.71	56.87	11.34	Pass
LTE Band 5	824.7	25.00	-0.5	0.28	14.54	39.49	8.17	Pass
LTE Band 7/CA_7C	2502.5	25.00	0	0.32	15.40	61.00	11.95	Pass
LTE Band 8/CA_8B	880.7	25.00	-2.7	0.17	11.29	40.81	8.46	Pass
LTE Band 20	834.5	25.00	-1.1	0.25	13.57	39.72	8.22	Pass
LTE Band 28	704.5	25.00	-0.5	0.28	14.54	36.50	7.49	Pass
LTE Band 34	2012.5	25.00	-0.2	0.30	15.05	61.00	11.95	Pass
LTE Band 38/CA_38C	2572.5	25.00	0.4	0.35	16.13	61.00	11.95	Pass
LTE Band 40/CA_40C	2302.5	25.00	-1.1	0.25	13.57	61.00	11.95	Pass
LTE Band 41	2498.5	28.00	1	0.79	24.41	61.00	8.95	Pass
LTE Band 42/CA_42C	3402.5	25.00	1.2	0.42	17.68	61.00	11.95	Pass
NR Band n1	1922.5	25.00	-0.4	0.29	14.71	60.29	11.85	Pass
NR Band n3	1712.5	25.00	-0.4	0.29	14.71	56.90	11.35	Pass
NR Band n5	826.5	25.00	-0.5	0.28	14.54	39.53	8.18	Pass
NR Band n7	2502.5	25.00	0	0.32	15.40	61.00	11.95	Pass
NR Band n8	882.5	25.00	-2.7	0.17	11.29	40.85	8.47	Pass
NR Band n20	834.5	25.00	-1.1	0.25	13.57	39.72	8.22	Pass
NR Band n28	705.5	25.00	-0.5	0.28	14.54	36.52	7.49	Pass
NR Band n38	2575	25.00	0.4	0.35	16.13	61.00	11.95	Pass
NR Band n40	2305	25.00	-1.1	0.25	13.57	61.00	11.95	Pass
NR Band n41	2501.01	28.00	1	0.79	24.41	61.00	8.95	Pass
NR Band n77	3305.01	28.00	2.2	1.05	28.02	61.00	8.95	Pass
NR Band n78	3305.01	28.00	2.2	1.05	28.02	61.00	8.95	Pass
NR Band n38(MIMO)	2575	25.00	0.4	0.35	16.13	61.00	11.95	Pass
NR Band n40(MIMO)	2305	25.00	-1.1	0.25	13.57	61.00	11.95	Pass
NR Band n41(MIMO)	2501.01	28.00	1	0.79	24.41	61.00	8.95	Pass
NR Band n77(MIMO)	3305.01	28.00	2.2	1.05	28.02	61.00	8.95	Pass
NR Band n78(MIMO)	3305.01	28.00	2.2	1.05	28.02	61.00	8.95	Pass
Bluetooth	2402	8.70	-0.3	0.01	2.28	61.00	--	Pass
Wi-Fi 2.4G	2412	19.31	-0.3	0.08	7.73	61.00	--	Pass
5G WIFI(U-NII-1)	5180	19.08	2.3	0.14	10.15	61.00	--	Pass
5G WIFI(U-NII-2A)	5260	19.08	2.3	0.14	10.15	61.00	--	Pass
5G WIFI(U-NII-2C)	5500	19.08	2.3	0.14	10.15	61.00	--	Pass
5G WIFI(U-NII-3)	5745	19.08	2.3	0.14	10.15	61.00	--	Pass
Wi-Fi 6E	5955	17.97	1.5	0.09	8.15	61.00	--	Pass

Remark:

1. GSM Operating Band: Frame-average power=Burst power+ Division Factors (-9.19).
2. "Max Conducted Average Output Power" comes from the largest "Tune-up" provided by the customer.
3. “Max Gain” The maximum ANT gain supported by EUT.

Simultaneous Transmission:

Due to the EUT support LTE CA and ENDC and MIMO, both can transmit simultaneously.

The corresponding MEs must be expressed in terms of power density in the 2.2-chapter summation Therefore.

Mode	Configuration
1	WWAN + Wi-Fi 2.4G + Bluetooth
2	WWAN + 5G WIFI + Bluetooth
3	WWAN + Wi-Fi 6E + Bluetooth

Operating Band	Frequency (MHz)	E Field Strength at R=20cm (V/m)	E Field Strength Limit (V/m)	MEs
E-GSM900	880.2	12.39	40.79	0.3037
DCS1800	1710.2	11.43	56.86	0.2010
WCDMA Band I	1922.6	14.71	60.29	0.2439
WCDMA Band V	826.4	14.54	39.53	0.3678
WCDMA Band VIII	882.6	11.29	40.85	0.2763
LTE Band 1	1922.5	14.71	60.29	0.2439
LTE Band 3/CA_3C	1710.7	14.71	56.87	0.2586
LTE Band 5	824.7	14.54	39.49	0.3682
LTE Band 7/CA_7C	2502.5	15.40	61.00	0.2525
LTE Band 8/CA_8B	880.7	11.29	40.81	0.2766
LTE Band 20	834.5	13.57	39.72	0.3416
LTE Band 28	704.5	14.54	36.50	0.3984
LTE Band 34	2012.5	15.05	61.00	0.2467
LTE Band 38/CA_38C	2572.5	16.13	61.00	0.2644
LTE Band 40/CA_40C	2302.5	13.57	61.00	0.2224
LTE Band 41	2498.5	24.41	61.00	0.4001
LTE Band 42/CA_42C	3402.5	17.68	61.00	0.2899
NR Band n1	1922.5	14.71	60.29	0.2439
NR Band n3	1712.5	14.71	56.90	0.2585
NR Band n5	826.5	14.54	39.53	0.3678
NR Band n7	2502.5	15.40	61.00	0.2525
NR Band n8	882.5	11.29	40.85	0.2763
NR Band n20	834.5	13.57	39.72	0.3416
NR Band n28	705.5	14.54	36.52	0.3981
NR Band n38	2575	16.13	61.00	0.2644
NR Band n40	2305	13.57	61.00	0.2224
NR Band n41	2501.01	24.41	61.00	0.4001
NR Band n77	3305.01	28.02	61.00	0.4594
NR Band n78	3305.01	28.02	61.00	0.4594
NR Band n38(MIMO)	2575	16.13	61.00	0.2644
NR Band n40(MIMO)	2305	13.57	61.00	0.2224
NR Band n41(MIMO)	2501.01	24.41	61.00	0.4001
NR Band n77(MIMO)	3305.01	28.02	61.00	0.4594
NR Band n78(MIMO)	3305.01	28.02	61.00	0.4594
Bluetooth	2402	2.28	61.00	0.0373
Wi-Fi 2.4G	2412	7.73	61.00	0.1267
5G WIFI(U-NII-1)	5180	10.15	61.00	0.1664
5G WIFI(U-NII-2A)	5260	10.15	61.00	0.1664
5G WIFI(U-NII-2C)	5500	10.15	61.00	0.1664
5G WIFI(U-NII-3)	5745	10.15	61.00	0.1664
Wi-Fi 6E	5955	8.15	61.00	0.1336

The worst-case combination: **WWAN + 5G WIFI + Bluetooth**

Combination	MEs	Total MEs	Limit	Conclusion
UL CA_3A-28A	$(0.2586)^{\wedge 2} + (0.3984)^{\wedge 2}$	0.2256	<1	PASS
DC_41A_n78A	$(0.4001)^{\wedge 2} + (0.4594)^{\wedge 2}$	0.3711	<1	PASS
NR Band n78(MIMO)	$(0.4594)^{\wedge 2}$	0.2110	<1	PASS
NR Band n78	$(0.4594)^{\wedge 2}$	0.2401	<1	PASS
5G WIFI	$(0.1664)^{\wedge 2}$			
Bluetooth	$(0.0373)^{\wedge 2}$			

~The End~