



Test Report No.: REP20120008-1



RADIO TEST REPORT

(EN 301 511)

Product: Boron 2G/3G

Model Name: BRN310, BRN314

Applicant: Particle Industries, Inc

Address: 126 Post St, 4th floor, San Francisco, CA 94108 USA

Manufacturer: Particle Industries, Inc

Address: 126 Post St, 4th floor, San Francisco, CA 94108 USA

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Report No.: REP20120008-1

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RE180921W002-1	Original release	Nov. 14, 2018
REP20120008-1	Based on the original report RE180921W002-1 change the product name and models, which not affect RF function. So all the test data re-use from RE180921W002-1.	Dec. 25, 2020



1 CERTIFICATION

PRODUCT: Boron 2G/3G
BRAND NAME: Particle Industries, Inc
MODEL NAME: BRN310, BRN314
APPLICANT: Particle Industries, Inc
TESTED: Sep. 24, 2018 ~ Oct. 22, 2018
TEST SAMPLE: Production Unit
STANDARD: EN 301 511 V12.5.1 (2017-03)
TEST ITEM: Radiated spurious emissions - MS allocated channel
(Clause 4.2.16)
Radiated spurious emissions - MS in idle mode
(Clause 4.2.17)

The above equipment has 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 EMC characteristics under the conditions specified in this report.

TESTED BY : Alex **DATE** : Dec. 25, 2020
(Alex Chen / Engineer)

APPROVED BY : Luke Lu **DATE** : Dec. 25, 2020
(Luke Lu / Manager)

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

HARMONIZED STANDARD EN 301 511				
TEST CASE	TEST DESCRIPTION	VERDICT		TS 151 010-1 clause
		GSM 900	GSM 1800	
4.2.16	Radiated spurious emissions - MS allocated channel.	PASS	PASS	12.2.1
	Normal Temperature / Normal Voltage	N/A(see note)	N/A(see note)	
	Normal Temperature / Low Voltage	N/A(see note)	N/A(see note)	
	Normal Temperature / High Voltage	N/A(see note)	N/A(see note)	
4.2.17	Radiated spurious emissions - MS in idle mode.	PASS	PASS	12.2.2
	Normal Temperature / Normal Voltage	N/A(see note)	N/A(see note)	
	Normal Temperature / Low Voltage	N/A(see note)	N/A(see note)	
	Normal Temperature / High Voltage	N/A(see note)	N/A(see note)	

Note: more detail please refer to the original report RE180921W002-1

2.1 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jul. 09,18	Jul. 08,19
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jul. 09,18	Jul. 08,19
3m Fully-anechoic Chamber	ETS-LINDGREN	10m*5m*5m	Euroshieldpn-CT0001143-1217	Mar. 16,18	Mar. 15,19
RS Antenna_LF	Rohde&Schwarz	R&S® HL046E	HL064E	NA	NA
Horn Antenna	ETS-LINDGREN	3117	00168692	Nov. 26,16	Nov. 25,18
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510523	Mar. 16,18	Mar. 15,19
Radio Communication Analyzer	ANRITSU	MT8820C	6201465426	Mar. 02,18	Mar. 01,19

NOTE:

1. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Fully-anechoic Chamber.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

PARAMETER	UNCERTAINTY
All emissions, radiated	±3.294 dB
DC and low frequency voltages	±0.3 %

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Boron 2G/3G
BRAND NAME	Particle Industries, Inc
MODEL NAME	BRN310, BRN314
MODULATION TYPE	GSM, GPRS: GMSK EDGE: 8PSK
OPERATING FREQUENCY	GSM 900 Tx: 880.2MHz ~ 914.8MHz Rx: 925.2MHz ~ 959.8MHz DCS 1800 Tx: 1710.2MHz ~ 1784.8MHz Rx: 1805.2MHz ~ 1879.8MHz
ANTENNA TYPE	Fixed External Antenna
MAX. ANTENNA GAIN	GSM 900: 0dBi
	DCS 1800: 0dBi
HW VERSION	V1.00
SW VERSION	V1.00
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, with the larger-gain Antenna.
3. The differences of BRN310 and BRN314 are as follow: BRN310 uses eSIM of Korea. BRN314 uses eSIM of Twilio.

3.2 CONDUCTED POWER

GSM900 & GSM1800

Band	GSM900			GSM1800		
Channel	975	38	124	512	699	885
Frequency	880.2	897.6	914.8	1710.2	1747.6	1784.8
GPRS (GMSK, 1Tx-slot)	31.05	30.96	31.09	28.43	28.53	28.64
GPRS (GMSK, 2Tx-slot)	30.98	30.89	31.02	28.42	28.52	28.63
GPRS (GMSK, 3Tx-slot)	30.53	30.44	30.57	27.80	27.90	28.01
GPRS (GMSK, 4Tx-slot)	29.87	29.78	29.91	26.65	26.75	26.86
EDGE (8PSK, 1Tx-slot)	26.10	26.01	26.14	24.56	24.66	24.77
EDGE (8PSK, 2Tx-slot)	26.09	26.00	26.13	24.55	24.65	24.76
EDGE (8PSK, 3Tx-slot)	25.40	25.31	25.44	23.81	23.91	24.02
EDGE (8PSK, 4Tx-slot)	24.38	24.29	24.42	22.68	22.78	22.89

3.3 DESCRIPTION OF TEST MODES

✧ The EUT was tested under following conditions:

OPERATING CONDITIONS
Linking / Idle mode at GSM 900 (CH 38)
Linking / Idle mode at DCS 1800 (CH 699)

✧ The applicant defined the working voltage as follows:

NORMAL VOLTAGE (NV):	5V
MAXIMUM VOLTAGE (NV):	5.5V
MINIMUM VOLTAGE (NV):	4.5V

NOTE:

Since the EUT is considered a portable unit, it was pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**. Therefore only the test data of **X-plane** was used for radiated emission measurement test.

3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 301 511 V12.5.1 (2017-03)

All tests have been performed and recorded as per the above standard.

3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC source	LONG WEI	PS-6403D	010934269	N/A
2	PC	HP	A6608CN	3CR83825X3	N/A
3	USB	N/A	N/A	N/A	N/A
4	Battery	N/A	N/A	N/A	N/A
5	Adapter	N/A	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	DC Line: Unshielded, Detachable 1.0m
2	AC Line: Unshielded, Detachable 1.5m
3	N/A
4	N/A
5	N/A

NOTE:

1. All power cords of the above support units are non shielded (1.8m).
2. Item 1 was under test table during test.

3.6 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph of the test configuration for reference.

4 TEST TYPES AND RESULTS

4.1 RADIATED SPURIOUS EMISSIONS – MS ALLOCATED A CHANNEL

4.1.1 LIMIT OF RADIATED SPURIOUS EMISSIONS – MS ALLOCATED A CHANNEL

FOR GSM 900

FREQUENCY RANGE	Power level in dBm
30MHz ~ 1GHz	-36
1GHz ~ 4GHz	-30

FOR DCS 1800

FREQUENCY RANGE	Power level in dBm
30MHz ~ 1GHz	-36
1GHz ~ 1710MHz	-30
1710MHz ~ 1785MHz	-36
1785MHz ~ 4GHz	-30

4.1.2 TEST PROCEDURES

Refer to TS 151 010-1, clause 12.2.1.4.

4.1.3 TEST SETUP

For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST RESULTS

Note: For higher frequency, the emission is too low to be detected.

LINKING MODE AT MIDDLE CHANNEL GSM900 (CH 38)

FREQUENCY RANGE	30 ~ 4 GHz	TEST VOLTAGE	230Vac, 50Hz
ENVIRONMENTAL CONDITIONS	25deg.C, 55%RH	TESTED BY	Star Le
OPERATING CONDITIONS	Linking mode at middle channel (CH 38)		

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
50.00	H	-71.54	-36.00	-35.54
266.90	H	-80.55	-36.00	-44.55
545.15	H	-59.98	-36.00	-23.98
654.35	H	-60.59	-36.00	-24.59
834.95	H	-57.59	-36.00	-21.59
978.88	H	-56.11	-36.00	-20.11
1805.40	H	-39.62	-30.00	-9.62
2707.20	H	-46.50	-30.00	-16.50
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
50.00	V	-72.42	-36.00	-36.42
250.25	V	-77.91	-36.00	-41.91
364.10	V	-76.07	-36.00	-40.07
519.60	V	-60.66	-36.00	-24.66
734.50	V	-59.15	-36.00	-23.15
836.70	V	-57.52	-36.00	-21.52
1804.99	V	-39.58	-30.00	-9.58
2706.30	V	-47.57	-30.00	-17.57



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LINKING MODE AT MIDDLE CHANNEL DCS1800 (CH 699)

FREQUENCY RANGE	30 ~ 4 GHz	TEST VOLTAGE	230Vac, 50Hz
ENVIRONMENTAL CONDITIONS	25deg.C, 55%RH	TESTED BY	Star Le
OPERATING CONDITIONS	Linking mode at middle channel (CH 699)		

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
34.78	H	-65.81	-36.00	-29.81
54.05	H	-69.89	-36.00	-33.89
166.55	H	-67.48	-36.00	-31.48
257.90	H	-77.87	-36.00	-41.87
545.50	H	-62.29	-36.00	-26.29
736.50	H	-61.31	-36.00	-25.31
2358.60	H	-47.44	-30.00	-17.44
2411.40	H	-39.57	-30.00	-9.57
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
31.38	V	-73.15	-36.00	-37.15
170.60	V	-63.95	-36.00	-27.95
258.35	V	-76.58	-36.00	-40.58
521.50	V	-61.13	-36.00	-25.13
647.00	V	-60.50	-36.00	-24.50
850.00	V	-58.46	-36.00	-22.46
2352.00	V	-50.45	-30.00	-20.45
2411.40	V	-41.38	-30.00	-11.38

4.2 RADIATED SPURIOUS EMISSIONS – MS IN IDLE MODE

4.2.1 LIMIT OF RADIATED SPURIOUS EMISSIONS – MS IN IDLE MODE

FOR GSM 900 & DCS 1800

Frequency Range	Power level in dBm
30MHz ~ 880MHz	-57
880MHz ~ 915MHz	-59
915MHz ~ 1000MHz	-57
1GHz ~ 1710MHz	-47
1710MHz ~ 1785MHz	-53
1785MHz ~ 4GHz	-47

4.2.2 TEST PROCEDURES

Refer to TS 151 010-1 [2], clause 12.2.2.4.

4.2.3 TEST SETUP

For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST RESULTS

Note: For higher frequency, the emission is too low to be detected.

IDLE MODE AT MIDDLE CHANNEL GSM900 (CH 38)

FREQUENCY RANGE	30 ~ 4 GHz	TEST VOLTAGE	230Vac, 50Hz
ENVIRONMENTAL CONDITIONS	25deg.C, 55%RH	TESTED BY	Star Le
OPERATING CONDITIONS	Idle mode at middle channel (CH 38)		

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
35.42	H	-75.46	-57.00	-18.46
54.75	H	-74.97	-57.00	-17.97
250.45	H	-78.15	-57.00	-21.15
433.80	H	-76.89	-57.00	-19.89
586.75	H	-75.13	-57.00	-18.13
817.60	H	-71.30	-57.00	-14.30
2050.00	H	-68.84	-47.00	-21.84
3016.00	H	-61.65	-47.00	-14.65
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36.62	V	-73.23	-57.00	-16.23
50.00	V	-72.56	-57.00	-15.56
250.45	V	-78.31	-57.00	-21.31
503.15	V	-75.40	-57.00	-18.40
672.25	V	-75.04	-57.00	-18.04
971.50	V	-71.91	-57.00	-14.91
1948.00	V	-68.04	-47.00	-21.04
3070.00	V	-63.53	-47.00	-16.53

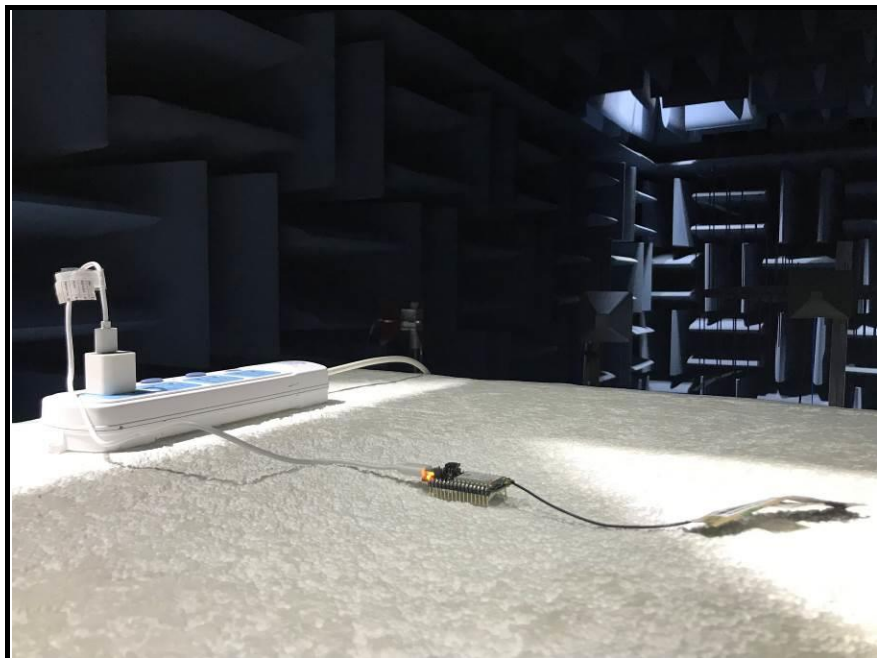
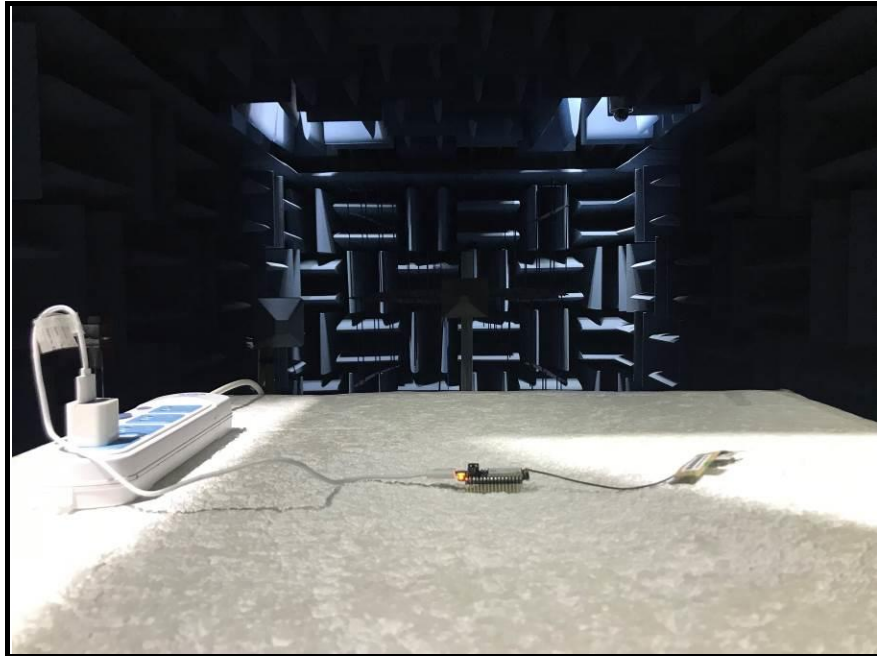
IDLE MODE AT MIDDLE CHANNEL DCS1800 (CH 699)

FREQUENCY RANGE	30 ~ 4 GHz	TEST VOLTAGE	230Vac, 50Hz
ENVIRONMENTAL CONDITIONS	25deg.C, 55%RH	TESTED BY	Star Le
OPERATING CONDITIONS	Idle mode at middle channel (CH 699)		

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
38.00	H	-76.65	-57.00	-19.65
54.75	H	-73.85	-57.00	-16.85
250.45	H	-79.41	-57.00	-22.41
477.50	H	-76.57	-57.00	-19.57
733.05	H	-76.16	-57.00	-19.16
990.50	H	-71.73	-57.00	-14.73
1921.00	H	-67.45	-47.00	-20.45
3220.00	H	-62.21	-47.00	-15.21
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
51.90	V	-73.54	-57.00	-16.54
243.80	V	-80.58	-57.00	-23.58
454.70	V	-77.57	-57.00	-20.57
608.60	V	-74.66	-57.00	-17.66
803.35	V	-73.39	-57.00	-16.39
990.50	V	-70.67	-57.00	-13.67
1993.00	V	-69.22	-47.00	-22.22
3001.00	V	-59.93	-47.00	-12.93

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

TX AND RX SPURIOUS EMISSION





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6 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---