



BUREAU
VERITAS

Test Report No: RE2208WDG0098-2



TEST REPORT



Applicant:	Particle Industries, Inc
Address:	325 9th St, San Francisco, CA 94103 USA, 415-319-1553

Manufacturer or Supplier:	Particle Industries, Inc
Address	325 9th St, San Francisco, CA 94103 USA, 415-319-1553
Product	Tracker SoM LTE CAT1/3G/2G
Brand Name	Particle
Model	T523M
Additional Model & Model Difference	T524M, See items 2.1 note
Date of tests	May 18, 2020 ~ Jul 18, 2020

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

EN 300 330 V2.1.1 (2017-02)

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Lucas Chen Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	

Date: Sep. 02, 2022

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RE200518N021-2	Original release	Aug. 14, 2020
RE2208WDG0098-2	Based on the original report RE200518N021-2 changed the address about the applicant and manufacturer, but it doesn't need to be retested.	Sep. 02, 2022



1. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: ETSI EN 300 330 V2.1.1 (2017-02)			
CLAUSE IN ETSI EN 300 330	TEST PARAMETER	TEST APPLICABILITY	PASS/FAIL
	TRANSMITTER PARAMETERS		
4.3.4	Transmitter H-filed requirements	Applicable	N/A
4.3.1	Permitted range of operating frequency	Applicable	N/A
4.3.3	modulation bandwidth	Applicable	N/A
4.3.8	Transmitter radiated spurious domain emission limits<30MHz	Applicable	N/A
4.3.9	Transmitter radiated spurious domain emission limits>30MHz	Applicable	N/A
	RECEIVER PARAMETERS		
4.4.2	Receiver spurious radiation	Applicable(Note1)	PASS
4.4.4	Blocking or desensitization	Not Applicable(Note2)	N/A

- Note: 1. These requirements does not apply to receivers used in combination with permanently co-located transmitters continuously transmitting. In these cases the receivers will be tested together with the transmitter in operating mode
2. Receiver blocking or desensitization is only applicable for channelized systems where channel definitions are used.



1.1. TEST INSTRUMENTS

9KHz~30MHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101564	Mar. 17,21
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	1519B-045	May 27,21
Amplifier	Burgeon	BPA-530	100210	Mar. 14,21
Test Software	ADT	ADT_Radiated_V 8.7.07	N/A	N/A

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 10m Chamber.

30MHz~1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Mar. 17,21
Bilog Antenna	Teseq	CBL 6111D	30643	Jun. 22,20
Amplifier	Burgeon	BPA-530	100220	Mar. 14,21
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Apr. 20,21
Test software	ADT	ADT_Radiated_ V7.6.15.9.2	N/A	N/A

NOTE:

1. The test was performed in 966 Chamber (a 3m Semi-anechoic chamber).
2. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above1GHz if tested.



Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 21,21
Power Sensor	Keysight	U2021XA	MY55060018	May 21,21
Digital Multimeter	FLUKE	15B	A1220009DG	Sep. 18,20
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Nov. 14,19
Oscilloscope	Agilent	DSO9254A	MY51260160	Sep. 17,20
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	May 21,21
Spectrum Analyzer	Keysight	N9020A	MY55400499	Mar. 17,21
Signal Generator	Agilent	N5183A	MY50140980	Sep. 18,20
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Sep. 11,20
Wireless Connectivity Tester	Rohde&Schwarz	CMW270	100908	Sep. 17,20
Vector Signal Generator	Rohde&Schwarz	SMBV100A	257579	Sep. 11,20
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	May 19,21
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A

NOTE:

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



1.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio frequency	$\pm 1.06 \times 10^{-8}$
RF power (Conducted)	± 0.34 dB
RF power (Radiated)	± 3.294 dB
Temperature	± 0.23 °C
Humidity	± 0.3 %

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

1.3. MAXIMUM MEASUREMENT UNCERTAINTY

For the test methods, according to ETSI EN 300 330 standard, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [5] and shall correspond to an expansion factor (coverage factor) $k = 1.96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Maximum measurement uncertainty

PARAMETER	UNCERTAINTY
RF frequency	$\pm 1 \times 10^{-7}$
RF power (Conducted)	± 1.0 dB
RF power (Radiated)	± 6.0 dB
Temperature	± 1 °C
Humidity	± 5.0 %



2. GENERAL INFORMATION

2.1. GENERAL DESCRIPTION OF EUT

PRODUCT	Tracker SoM LTE CAT1/3G/2G
MODEL NO.	T523M
ADDITIONAL MODEL	T524M
POWER SUPPLY	Li+ PIN: DC +3.3V-4.3V or VBUS PIN: DC +4.35V-5.5V or VIN PIN: DC +3.9V-17V
OPERATING TEMPERATURE RANGE	-40 ~ +85°C
MODULATION TYPE	ASK
OPERATING FREQUENCY	13.56MHz for receiving only
NUMBER OF CHANNEL	1
ANTENNA TYPE	Loop Antenna
CABLE	N/A
I/O PORTS	Refer to user's manual

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.
3. Please refer to the EUT photo document (Reference No.: 2208WDG0098) for detailed product photo.
4. Additional model T524M is identical with the test model T523M except the model number for marketing purpose.



2.2. DESCRIPTION OF TEST MODES

The EUT only have 1 channel.

CHANNEL	FREQUENCY (MHz)
1	13.56

2.3. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO						DESCRIPTION
	THFR	PROF	MBW	TSE	RSE	RB	
1	-	-	-	-	√	-	-

Where THFR: Transmitter H-filed requirements TSE: Transmitter Spurious Emissions
 PROF: Permitted range of operating frequency RSE: Receiver Spurious Emissions
 MBW: Modulation Bandwidth
 RB: Receiver Blocking

RECEIVER SPURIOUS EMISSIONS TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	OPERATING FREQUENCY (MHz)	MODULATION TYPE
-	1	13.56	ASK

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
THFR	N/A	N/A	N/A
PROF	N/A	N/A	N/A
MBW	N/A	N/A	N/A
TSE	N/A	N/A	N/A
RSE	21deg. C, 58%RH	DC3.8V from Som test board V03	HU
RB	N/A	N/A	N/A

Remarks: The Som test board V03 is support units, it power by 3.8V battery.



2.4. 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 300 330 V2.1.1 (2017-02)

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

2.5. 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	SOM test Board	Particle	V03	38069A-Y411-200421	N/A

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



3. TEST PROCEDURES AND RESULTS

RECEIVER PARAMETERS

3.1 RECEIVER SPURIOUS RADIATION

3.1.1 LIMITS OF RECEIVER SPURIOUS RADIATION (<30MHz)

FREQUENCY RANGE	9 kHz ≤ f < 10MHz	10MHz ≤ f < 30MHz
Limit	5.5 dBμA/m descending 3 dB/oct	-25 dBμA/m
	57 dBμV/m descending 3 dB/oct	26.5 dBμV/m

3.1.2 LIMITS OF RECEIVER SPURIOUS RADIATION (>30MHz)

FREQUENCY RANGE	FREQUENCIES BELOW 1GHz
Limit	2nW or -57dBm

3.1.3 TEST PROCEDURES

Please refer to Subclause 6.3.1 of EN 300 330 V2.1.1 (2017-02)

3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

3.1.5 TEST SETUP

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



3.1.6 TEST RESULTS

SPURIOUS EMISSION FREQUENCY RANGE	9kHz ~ 30MHz	OPERATING STATE	Receiving
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Angle (°)	Level (dBμA/m)	Limit (dBμA/m)	Margin (dB)
0.0149	180	-9.29	3.33	-11.69
0.0351	180	-12.26	-0.41	-5.64
0.056	180	-19.41	-2.43	-15.26
0.0676	180	-19.61	-3.26	-17.13
0.0859	180	-20.38	-4.30	-16.97
0.1002	180	-25.14	-4.97	-17.89
0.1515	180	-16.37	-6.76	-9.61
3.2396	180	-32.00	-20.09	-11.91
5.4397	180	-32.19	-22.35	-9.84
7.1352	180	-31.70	-23.53	-8.17
13.3026	180	-31.44	-25.00	-6.44
16.3862	180	-32.37	-25.00	-7.37
0.0103	90	-7.92	4.89	-12.81
0.0351	90	-11.69	-0.41	-11.28
0.0619	90	-19.71	-2.88	-16.83
0.075	90	-22.18	-3.71	-18.47
0.0856	90	-19.71	-4.28	-15.43
0.1101	90	-25.02	-5.37	-19.65
0.153	90	-16.67	-6.81	-9.86
2.9934	90	-32.14	-19.74	-12.40
6.1427	90	-32.29	-22.88	-9.41
11.9488	90	-31.70	-25.00	-6.70
14.322	90	-32.25	-25.00	-7.25
19.6997	90	-32.94	-25.00	-7.94

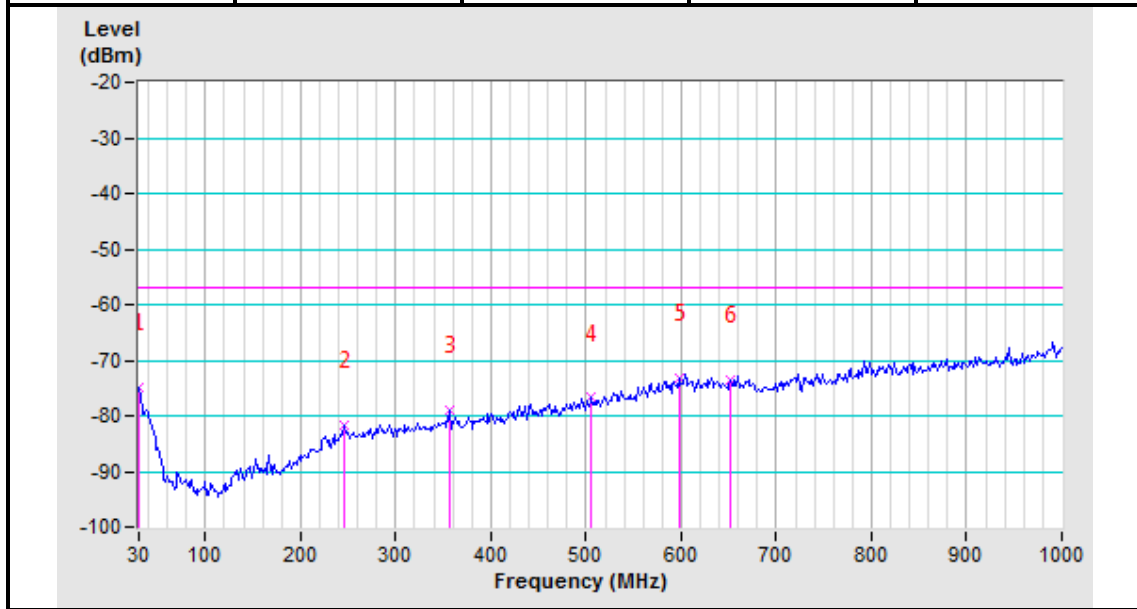


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SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING STATE	Receiving
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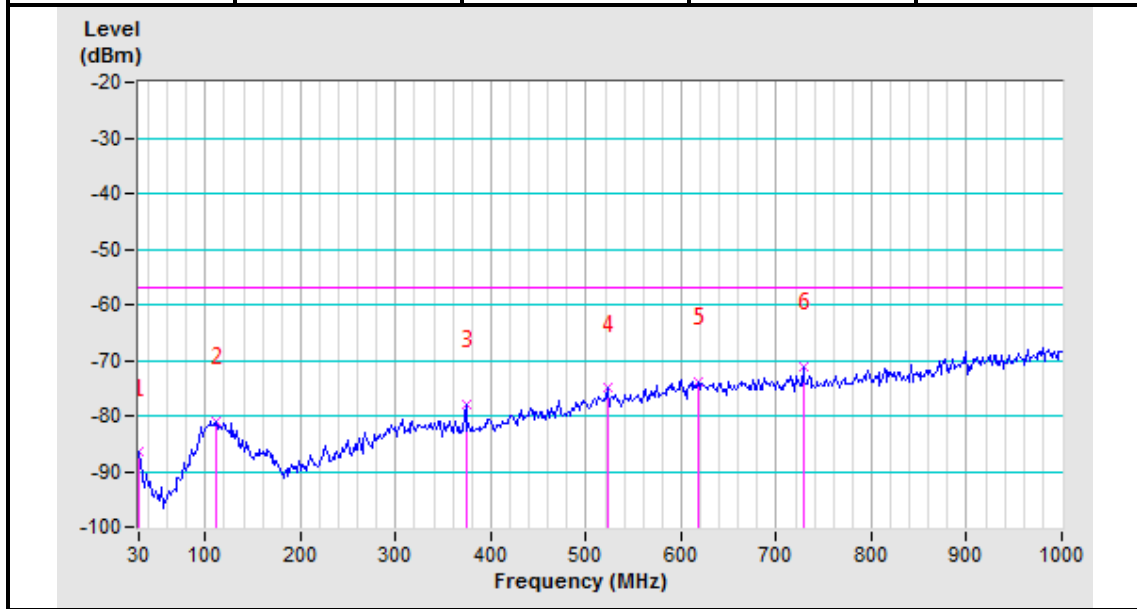
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
30.00	H	-74.93	-57.00	-17.93
246.07	H	-81.54	-57.00	-24.54
356.44	H	-79.00	-57.00	-22.00
505.67	H	-76.75	-57.00	-19.75
597.39	H	-73.28	-57.00	-16.28
651.79	H	-73.49	-57.00	-16.49





SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING STATE	Receiving
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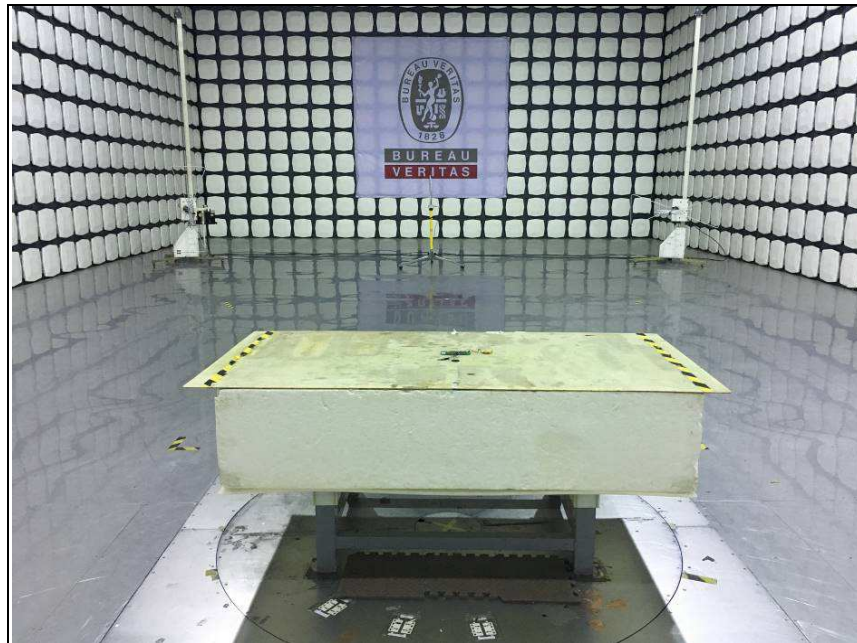
SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
30.00	V	-86.58	-57.00	-29.58
110.83	V	-81.00	-57.00	-24.00
373.54	V	-78.03	-57.00	-21.03
522.77	V	-75.07	-57.00	-18.07
617.60	V	-73.96	-57.00	-16.96
727.96	V	-71.13	-57.00	-14.13



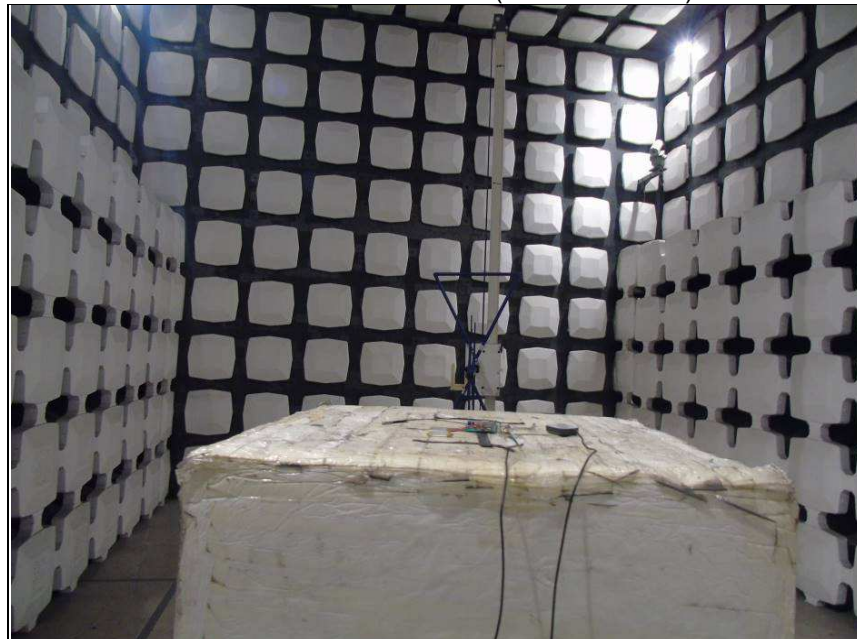


4. PHOTOGRAPHS OF THE TEST CONFIGURATION

SPURIOUS EMISSION (9KHz-30MHz)



SPURIOUS EMISSION (30MHz-1GHz)





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5. 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.

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