Wireless Device
Over the Air RF Performance
LTE Cat-M1 Summary Report for Carrier bands

REPORT NO.: OR181128C04

MODEL NO.: E402D

RECEIVED DATE: 2018.12.05

TESTED DATE: 2018.12.05 ~ 2018.12.18

ISSUED: 2019.01.09

MANUFACTURER: Particle Industries,Inc

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

ISSUED BY: Bureau Veritas Consumer Products Service (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories.

ADDRESS: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)

TEST LOCATION: No. 19, Hwa Ya 2nd rd., Kueishan, Taoyuan, Taiwan, R.O.C.

RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
OR181128C04	Original release	2019.01.09

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GENERAL INFORMATION

APPLICANT:	Particle Industries, Inc
MANUFACTURER:	Particle Industries, Inc
MODEL NO.:	E402D
SERIES NUMBER/ESN/IMEI:	352753090204676
HARDWARE VERSION:	V1.00
SOFTWARE VERSION:	V0.8.0
PRODUCT TYPE:	IOT device
CELLULAR SYSTEM:	LTE
CELLULAR BAND:	LTE: FDD 2/3/4/5/8/12/13/20/28
POWER CLASS:	LTE: 3
GPRS MULTI-SLOT CLASS:	N/A
EGPRS MULTI-SLOT CLASS:	N/A
ANTENNA TYPE:	External
CONFIGURATION OF PRIMARY MECHANICAL MODE:	Monoblock

The above equipment has been tested by **Bureau Veritas Consumer Products Service (H.K.) Ltd., Taoyuan Branch.**

PREPARED BY : Oscar Chu / Engineer **, DATE :** 2019.01.09

APPROVED BY : Johnny Liu / Supervisor **, DATE :** 2019.01.09

1. Test Lab Environment Conditions

Temperature	23˚C
Humidity	46%

2. Test Equipment List

TYPE OF EQUIPMENT	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
Wideband and Radio Communication Tester	R&S CMW 500	120658	2019/11/24
Signal Analyzer	Agilent N9020A	MY50110101	2019/11/26

3. Device Configuration

3.1. Bands and Protocols Supported by Each Antenna

Antenna Label	Bands and Protocols for Which the Antenna Is Connected to the Transmitter	Bands and Protocols for Which the Antenna Is Connected to the Primary Receiver and Is Always Active	Bands and Protocols for Which the Antenna Is Connected to the Primary Receiver and Is Dynamically Active	Bands and Protocols for Which the Antenna Is Connected to the Secondary Receiver and Is Always Active	Bands and Protocols for Which the Antenna Is Connected to the Secondary Receiver and Is Dynamically Active	Protocol/Band Pairs Which Cannot Be Used for Single Point Offset Tests per (Section 5.13, Section 6.15, and Section 6.13.3.3) Because the Antenna Tuning Changes
A	LTE 2/3/4/5/8/12/13 /20/28	LTE 2/3/4/5/8/12/13 /20/28	-	-	-	-

3.2. EUTs Used For Each Test

Serial number/ ESN/IMEI	CATL/ Chamber used	RAT(s)	Band(s)	Test Type(s)	Test Condition(s)
352753090204676	OTA2-HY	LTE	All	All	FS

4. Evaluation Summary

4.1. Total Radiated Power (TRP)

Band	Chan.	Freq. (MHz)	Cond. Pwr. (dBm)	Antenna Label					TRP (dBm)					NHPRP±45 (dBm)					NHPRP±30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 2	18650	1851.58	-	A	-	-	-	-	21.7	-	-	-	-	20.9	-	-	-	-	19.8	-	-	-	-
	18900	1880	-	A	-	-	-	-	21.5	-	-	-	-	20.6	-	-	-	-	19.5	-	-	-	-
	19150	1908.42	-	A	-	-	-	-	21.4	-	-	-	-	20.5	-	-	-	-	19.4	-	-	-	-
LTE FDD 4	20000	1711.58	-	A	-	-	-	-	22.5	-	-	-	-	21.8	-	-	-	-	20.8	-	-	-	-
	20175	1732.5	-	A	-	-	-	-	22.3	-	-	-	-	21.6	-	-	-	-	20.5	-	-	-	-
	20350	1753.42	-	A	-	-	-	-	22.3	-	-	-	-	21.4	-	-	-	-	20.3	-	-	-	-
LTE FDD 12	23035	699.97	-	A	-	-	-	-	21.8	-	-	-	-	21.4	-	-	-	-	20.4	-	-	-	-
	23095	707.41	-	A	-	-	-	-	22.0	-	-	-	-	21.5	-	-	-	-	20.6	-	-	-	-
	23155	715.03	-	A	-	-	-	-	21.9	-	-	-	-	21.5	-	-	-	-	20.5	-	-	-	-

4.2. Total Isotropic Sensitivity (TIS)

Band	Chan.	Freq. (MHz)	Cond. Pwr. (dBm)	Antenna Label					TIS (dBm)					NHPIS±45 (dBm)					NHPIS±30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 2	18650	1851.58	-	A	-	-	-	-	-104.8	-	-	-	-	-103.9	-	-	-	-	-102.8	-	-	-	-
	18900	1880	-	A	-	-	-	-	-104.9	-	-	-	-	-104.0	-	-	-	-	-102.9	-	-	-	-
	19150	1908.42	-	A	-	-	-	-	-104.8	-	-	-	-	-103.9	-	-	-	-	-102.7	-	-	-	-
LTE FDD 4	20000	1711.58	-	A	-	-	-	-	-107.0	-	-	-	-	-106.3	-	-	-	-	-105.2	-	-	-	-
	20175	1732.5	-	A	-	-	-	-	-107.5	-	-	-	-	-106.9	-	-	-	-	-105.9	-	-	-	-
	20350	1753.42	-	A	-	-	-	-	-106.8	-	-	-	-	-106.2	-	-	-	-	-105.2	-	-	-	-
LTE FDD 12	23035	699.97	-	A	-	-	-	-	-97.7	-	-	-	-	-97.1	-	-	-	-	-96.0	-	-	-	-
	23095	707.41	-	A	-	-	-	-	-95.8	-	-	-	-	-95.2	-	-	-	-	-94.1	-	-	-	-
	23155	715.03	-	A	-	-	-	-	-94.6	-	-	-	-	-94.1	-	-	-	-	-93.0	-	-	-	-

5. Pass/Fail Criteria

5.1. Total Radiated Power (TRP) Results

Band	Device Held Up to Head for Voice (Yes/No)	Channel	UL RB Allocation	TX Frequency (MHz) [center of UL RB allocation]	FS			HL			HR			BHHL			BHHR		
					Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
LTE FDD 2	No	18650	12 RB with RBstart=0	1851.58	TBD	21.7	Info	-	-	-	-	-	-	-	-	-	-	-	-
		18900	12 RB with RBstart=19	1880		21.5	Info		-	-		-	-		-	-		-	-
		19150	12 RB with RBstart=38	1908.42		21.4	Info		-	-		-	-		-	-		-	-
LTE FDD 4	No	20000	12 RB with RBstart=0	1711.58	TBD	22.5	Info	-	-	-	-	-	-	-	-	-	-	-	-
		20175	12 RB with RBstart=19	1732.5		22.3	Info		-	-		-	-		-	-		-	-
		20350	12 RB with RBstart=38	1753.42		22.3	Info		-	-		-	-		-	-		-	-
LTE FDD 12	No	23035	8 RB with RBstart=0	699.97	TBD	21.8	Info	-	-	-	-	-	-	-	-	-	-	-	-
		23095	8 RB with RBstart=8	707.41		22.0	Info		-	-		-	-		-	-		-	-
		23155	8 RB with RBstart=17	715.03		21.9	Info		-	-		-	-		-	-		-	-

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor)
Note 2: “Yes” applies if the device supports voice operation in the talking position against the head in any cellular radio mode
Note 3: “No” would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

5.2. Total Isotropic Sensitivity (TIS) Results

Band	Device Held Up to Head for Voice (Yes/No)	Channel	DL RB Allocation	RX Frequency (MHz)	FS			HL			HR			BHHL			BHHR		
					Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
LTE FDD 2	No	650	50 RB with RBstart=0	650	TBD	-104.8	Info	-	-	-	-	-	-	-	-	-	-	-	-
		900	50 RB with RBstart=0	900		-104.9	Info		-	-		-	-		-	-		-	-
		1150	50 RB with RBstart=0	1150		-104.8	Info		-	-		-	-		-	-		-	-
LTE FDD 4	No	2000	50 RB with RBstart=0	2115	TBD	-107.0	Info	-	-	-	-	-	-	-	-	-	-	-	-
		2175	50 RB with RBstart=0	2132.5		-107.5	Info		-	-		-	-		-	-		-	-
		2350	50 RB with RBstart=0	2150		-106.8	Info		-	-		-	-		-	-		-	-
LTE FDD 12	No	5035	25 RB with RBstart=0	731.5	TBD	-97.7	Info	-	-	-	-	-	-	-	-	-	-	-	-
		5095	25 RB with RBstart=0	737.5		-95.8	Info		-	-		-	-		-	-		-	-
		5155	25 RB with RBstart=0	743.5		-94.6	Info		-	-		-	-		-	-		-	-

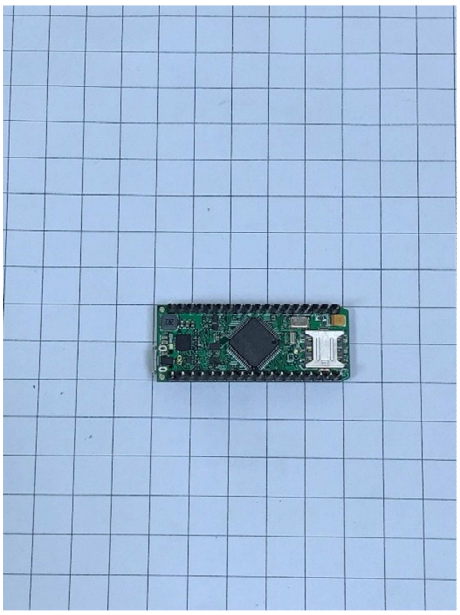
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor)
Note 2: “Yes” applies if the device supports voice operation in the talking position against the head in any cellular radio mode
Note 3: “No” would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

6. Measurement Uncertainty

The expanded measurement uncertainties are listed below. These uncertainties refer to a coverage factor of 2, corresponding to 95% confidence level.

	TRP Measurement (dB)				
Test Configuration	**LTE700**	**Cellular**	**AWS-1 Tx**	**PCS**	**LTE41**
Free Space	1.25	1.34	1.43	1.46	1.52
Larger form over 30 cm	1.59	1.36	1.46	1.47	1.53
	TIS Measurement (dB)				
Test Configuration	**LTE700**	**Cellular**	**PCS**	**AWS-1 Rx**	**LTE41**
Free Space	1.61	1.68	1.78	1.73	1.82
Larger form over 30 cm	1.88	1.70	1.79	1.75	1.83

APPENDIX A. EUT Photographs



EUT front side

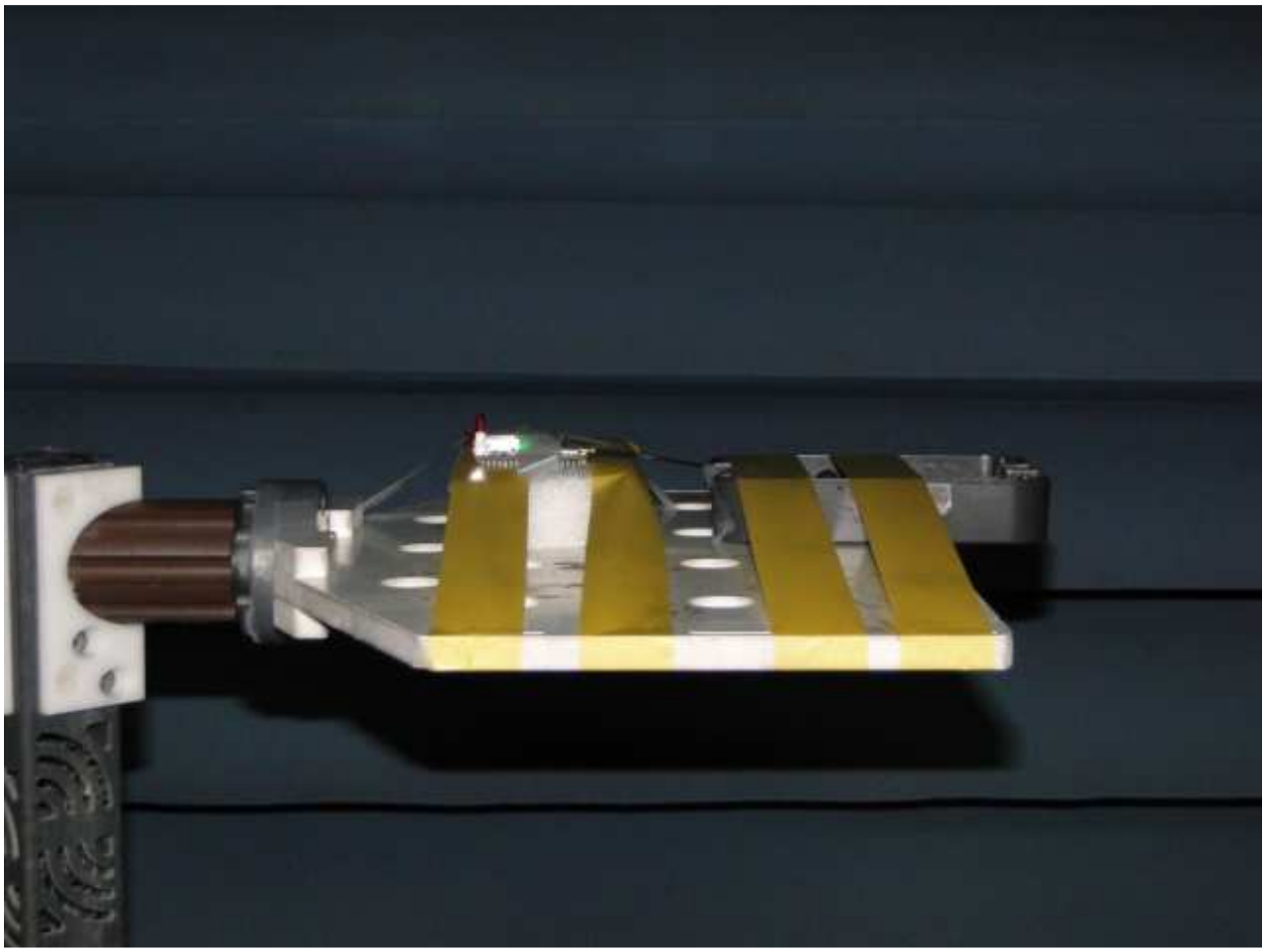
EUT rear side

Antenna

Antenna

Battery

APPENDIX B. EUT SETUP Photographs



Free Space