



Radio Frequency Exposure Evaluation Report

FOR:
Zipcar Inc.

Brand:
Zipcar

Model Name:
M400

Marketing Name:
M400

Product Description:
Provide telemetry data to Zipcar backend.

FCC ID: 2AYUAM400
IC ID: 21268-M400

Per:
CFR Part1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
ISED RSS-102 Issue 5

Report number: EMC_ZIPCA_009_20001_FCC_ISSED_MPE_Rev1

DATE: 4/30/2021



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TABLE OF CONTENTS

1	Assessment.....	3
2	Administrative Data	4
2.1	Identification of the Testing Laboratory Issuing the Test Report.....	4
2.2	Identification of the Client / Manufacturer	4
2.3	Identification of the Manufacturer	4
3	Equipment under Assessment.....	5
4	RF Exposure Limits and FCC and IC Basic Rules	7
4.1	Power Density Limits acc. to FCC 1.1310(e)/ RSS-102 i5, cl. 4:	7
4.2	Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):	7
4.3	RF Exposure Estimation (MPE Estimation)	7
5	Evaluation	8
5.1	Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation.....	8
5.2	Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation.....	9
6	Revision History	10

1 Assessment

This RF Exposure evaluation report, provides evidence for compliance of the below identified device, with the RF Exposure limits for mobile devices, as defined in FCC CFR Part1 (1.1307 & 1.1310), Part 2 (2.1091), and IC standard ISSED RSS-102 Issue 5, under worst case conditions (measured or rated RF output power, antenna gain, distance towards human body. Multiple transmitter information as presented by the applicant). In addition, maximum antenna gain, or minimum distance towards the human body calculated respectively where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications for worst case conditions at 20cm distance to the body.

Company	Description	Model Name
Zipcar Inc.	Provide telemetry data to Zipcar backend.	M400

Report reviewed by: TCB Evaluator

4/30/2021	Compliance	Wang, Kevin (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

4/30/2021	Compliance	Issa Ghanma (EMC Engineer)	
Date	Section	Name	Signature

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Lab Manager:	Wang, Kevin
Responsible Project Leader:	Saman, Rami

2.2 Identification of the Client / Manufacturer

Applicant's Name:	Zipcar Inc.
Street Address:	35 Thomson Place
City/Zip Code	Boston, MA 02210
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	-----
City/Zip Code	-----
Country	-----

3 Equipment under Assessment

Model No:	M400
FCC ID:	2AYUAM400
IC ID:	21268-M400
HW Version :	E4
SW Version :	670
Power Supply/ Rated Operating Voltage Range:	Low 9 V, High 14 V DC
Integrated Module Info:	<ul style="list-style-type: none"> ❖ Bluetooth LE version 4.2: <ul style="list-style-type: none"> • Module name : ST Microelectronics • Model number : BlueNRG-M0 • FCC ID : S9NBNRGM0AL • IC ID : 8976C-BNRGM0AL ❖ Cellular Module: <ul style="list-style-type: none"> • Name / Number : Telit / LE910C1-NF • FCC / IC ID : RI7LE910CXNF / 5131A-LE910CXNF ❖ 125 KHz AWID SR2400 Card reader: <ul style="list-style-type: none"> • FCC ID : OGSSR2400 • IC ID : 6449A-SR2400A
Regulatory Band:	<ul style="list-style-type: none"> ❖ Bluetooth LE version 4.2: <ul style="list-style-type: none"> • Nominal band: 2400 MHz – 2483.5 MHz; • Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels ❖ Cellular Module: <ul style="list-style-type: none"> • 4G Bands : B 2, B 4, B 5, B 12, B 13, B 14, B 66, B 71 • 3G Bands : B II, B IV, B V ❖ 125 KHz AWID SR2400 Card reader

Antenna Type and Peak gain:	<ul style="list-style-type: none"> ❖ Bluetooth LE: Dedicated on PCB <ul style="list-style-type: none"> • Maximum total gain : +0.5 dBi max peak ❖ External Antenna Mounted Under Dash: <ul style="list-style-type: none"> • Optimus MA220 2in1 GPS-GLONASS-GALILEO/ LTE External Adhesive Antenna for Glass & Plastic Mount. • Peak gain [dBi] <ul style="list-style-type: none"> ▪ 698 ~ 798 MHz : -0.71 ▪ 791 ~ 862 MHz : -0.05 ▪ 824 ~ 894 MHz : -0.05 ▪ 880 ~ 960 MHz : -1.07 ▪ 1710 ~ 1880 MHz : 2.21 ▪ 1850 ~ 1990 MHz : 1.71 ▪ 1920 ~ 2170 MHz : 1.63 ▪ 2570 ~ 2690 MHz : - 0.63
Maximum Conducted Output Power (dBm):	<ul style="list-style-type: none"> ❖ Bluetooth LE version 4.2: 5.31 dBm ❖ Cellular Module: 25.14 dBm ❖ 125 KHz AWID SR2400 Card reader: 96 dBμV/m 12V (Radiated)
Sample Revision:	<input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production

4 RF Exposure Limits and FCC and IC Basic Rules

For the specific described radio apparatus the following basic limits and rules apply for both, FCC and IC where not indicated differently.

4.1 Power Density Limits acc. to FCC 1.1310(e)/ RSS-102 i5, cl. 4:

FCC

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

IC

300 – 6000	$0.02619 \times f \text{ (MHz)}^{0.6834}$	6
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4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

FCC

Operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8 dBm (EIRP: 33.9);

Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8 dBm (EIRP: 36.9);

IC

- 300MHz <= operating frequency < 6 GHz: excluded if EIRP < $0.0131 \times f \text{ (MHz)}^{0.6834} \text{ W}$
- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W

4.3 RF Exposure Estimation (MPE Estimation)

Having available the source, based average output power, and peak antenna gain, or the ERP/EIRP of the specified device, and for a known minimum distance of its radiating structures from the body of persons. According to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (mW/cm² or W/m²)

P = power input to the antenna (mW or W)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm or m)

5 Evaluation

5.1 Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation

Band	Lowest frequency [MHz]	Max.Power [W]	EIRP [W]	ISED EIRP limit [W]	Max.Power [dBm]	EIRP [dBm]	FCC EIRP limit [dBm]	Verdict
UMTS II	1852.4	0.501	0.834	2.24	27.0	29.21	36.90	Complies
UMTS IV	1712.4	0.501	0.834	2.12	27.0	29.21	36.90	Complies
UMTS V	826.4	0.501	0.834	1.29	27.0	29.21	33.90	Complies
LTE 2	1860.0	0.501	0.834	2.24	27.0	29.21	36.90	Complies
LTE 4	1715.0	0.501	0.834	2.12	27.0	29.21	36.90	Complies
LTE 5	825.0	0.501	0.834	1.29	27.0	29.21	33.90	Complies
LTE 12	699.7	0.501	0.834	1.15	27.0	29.21	33.90	Complies
LTE 13	799.5	0.501	0.834	1.26	27.0	29.21	33.90	Complies
LTE 14	793.0	0.501	0.834	1.25	27.0	29.21	33.90	Complies
LTE 66	1720.0	0.501	0.834	2.12	27.0	29.21	36.90	Complies
LTE 71	668.0	0.501	0.834	1.11	27.0	29.21	33.90	Complies
BTLE	2402	0.003	0.005	2.676	5.31	7.31	36.90	Complies
RFID	0.125	-	0.001	0.003	-	0.77	Categorically excluded	Complies

The single radios are exempt from routine environmental evaluation.

5.2 Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation

- Calculation made for 20cm.
- Evaluations are based on EIRP measured or calculated from known gain and conducted output power, adding tune up tolerance.
- Cellular can transmit simultaneously with Bluetooth LE, and RFID.

Band	Lowest frequency [MHz]	Max.Power [W]	EIRP [W]	Actual [W/m2]	ISED [W/m2]	FCC [W/m2]	How much of limit is used up [%]
UMTS II	1852.4	0.501	0.834	1.66	4.48	10.00	37.05
UMTS IV	1712.4	0.501	0.834	1.66	4.24	10.00	39.10
UMTS V	826.4	0.501	0.834	1.66	2.58	5.49	64.39
LTE 2	1860.0	0.501	0.834	1.66	4.48	10.00	37.03
LTE 4	1715.0	0.501	0.834	1.66	4.25	10.00	39.06
LTE 5	825.0	0.501	0.834	1.66	2.59	5.53	64.13
LTE 12	699.7	0.501	0.834	1.66	2.30	4.66	72.01
LTE 13	799.5	0.501	0.834	1.66	2.52	5.33	65.74
LTE 14	793.0	0.501	0.834	1.66	2.51	5.29	66.10
LTE 66	1720.0	0.501	0.834	1.66	4/24	10.00	39.08
LTE 71	668.0	0.501	0.834	1.66	2.23	4.44	74.52
BTLE	2402	0.003	0.005	0.01	5.35	10.00	0.20
RFID	0.125	-	0.001	0.0024	1.0	Categorically excluded	0.24

Conclusion:

- The worst-case simultaneous transmission is LTE Band 71 simultaneous with Bluetooth LE, and RFID, which is using 74.95% of a limit of 100 %. The equipment is passing RF exposure requirements for 20cm distance.

6 Revision History

Date	Report Name	Changes to report	Report prepared by
4/6/2021	EMC_ZIPCA_009_20001_FCC_ISSED_MPE	Initial Version	Issa Ghanma
4/30/2021	EMC_ZIPCA_009_20001_FCC_ISSED_MPE_Rev1	<ul style="list-style-type: none">❖ Add 125 KHz card reader to:<ul style="list-style-type: none">• Section 3; Integrated module Info, Regulatory Band, Maximum conducted output power.• Section 5.1, and 5.2<ul style="list-style-type: none">▪ Conclusion❖ Add Limit for below 20 MHz in section 4.2 IC.❖ Conclusion: Include the RFID in the worst-case usage of the 100% limit.	Issa Ghanma

<<< The End >>>
