



Radio Frequency Exposure Evaluation Report

FOR:

The Morey Corporation

Model Name:

MC3M

Product Description:

Location and monitoring transmitter

FCC ID: AB3-0001

Applied Rules and Standards:

CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
Industry Canada RSS-102, Issue 5 of March 2015

Report number: EMC-MOREY-026-17011-FCC-MPE

DATE: 09-18-2017



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1. Assessment

This RF Exposure evaluation report provides information about compliance of the below identified device with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091), and IC standard RSS-102, under given 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 is calculated, respectively, where relevant.

The device meets the limits as stipulated by the above given FCC / IC rule parts based on available specifications.

Company Name	Product Description	Model #
The Morey Corporation	Location and monitoring transmitter	MC3M

Responsible for Testing Laboratory:

09-18-2017	Compliance	Peter Nevermann (Director RC&E)	
Date	Section	Name	Signature

Responsible for the Report:

09-18-2017	Compliance	James Donnellan (Sr. EMC Test Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.
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Contents

1. Assessment	2
2. Administrative Data	4
2.1. Identification of the Testing Laboratory Issuing the Test Report	4
2.2. Identification of the Client / Manufacturer	4
3. Equipment under Assessment	5
4. RF Exposure Limits and FCC	6
4.1. Power Density Limits acc. To FCC 1.1310I	6
4.2. Power Density Limits according to RSS 102	6
4.3. Routine Environmental Evaluation Categorical Exclusion Limits acc. To FCC 2.1091	7
4.4. Exemption Limits for Routine Evaluation — RF Exposure Evaluation RSS-102.....	7
4.5. RF Exposure Estimation (MPE Estimation).....	7
5. Evaluations	8
5.1. Routine Environmental Evaluation Applicability Stand Alone transmission	8
5.2. Compliance with MPE (Power Density) limits Stand Alone transmission	9
5.3. Compliance with MPE (Power Density) Simultaneous Transmission	10
6. Maximum allowed Antenna Gain – Gmax	11
7. Revision History	12

2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
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Director Radio Com. and EMC:	Peter Nevermann
Responsible Project Leader:	Ruther Navarro

2.2. Identification of the Client / Manufacturer

Applicant's Name:	The Morey Corporation
Street Address:	100 Morey Drive
City/Zip Code	Woodridge Illinois
Country	USA
Contact Person:	Matthew

3. Equipment under Assessment

Model No	MC3M
HW Version	E
SW Version	R1.00.00
FCC-ID	AB3-0001
IC-ID	
Product Description	Location and monitoring transmitter
Transceiver Technology / Type(s) of Modulation	Cellular Module u-Blox TOBY-R202 supporting: • WCDMA/UMTS Band II, V • LTE 2, 4, 5, 12 BT Module BT121-A by Silicon Laboratories • Supporting BT-BDR/EDR • BT-LE
Max. declared antenna gain from taoglas PCS06A datasheet and BT regulatory report	Band 2 2.92 dBi Band 4 3.05 dBi Band 5 0.77 dBi Band 12 -0.21 dBi 2.4 GHz 1dBi
Co-located Transmitters/ Antennas?	Celular & BT
Sample Revision	☐ Prototype ☒ Production ☐ Pre-Production
Device Category	☐ Fixed Installation ☒ Mobile ☐ Portable
Exposure Category	☐ Occupational/ Controlled ☒ General Population/ Uncontrolled

4. RF Exposure Limits and FCC

For the specific described radio apparatus the following basic limits and rules apply

4.1. Power Density Limits acc. To FCC 1.1310I

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

4.2. Power Density Limits according to RSS 102

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	$0.73 / f$	-	6**
1.1-10	$87 / f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000 / f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

4.3. Routine Environmental Evaluation Categorical Exclusion Limits acc. To FCC 2.1091

Mobile devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; the Specialized Mobile Radio Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter; and the Citizens Broadband Radio Service pursuant to part 96 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if:

- (20) They operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more,
or
- (ii) They operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

4.4. Exemption Limits for Routine Evaluation — RF Exposure Evaluation RSS-102

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

4.5. 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. Evaluations

5.1. Routine Environmental Evaluation Applicability Stand Alone transmission

Transmission Mode	EIRP/ERP dBm	Duty Cycle %	Limits for Routine Environmental Evaluation Applicability W EIRP worst case Canada	Exempt from Routine evaluation (Yes/No)
LTE 2	24.681	100	< 33.52	Yes
LTE 5	20.204	100	< 31.11	Yes
LTE 4	25.172	100	< 33.28	Yes
LTE12	19.638	100	< 30.64	Yes
WCDMA II	27.409	100	< 33.52	Yes
WCDMA V	23.139	100	< 31.11	Yes
BT-BDR/EDR	12.139	100	< 34.28	Yes
BT-LE	12.761	100	< 34.28	Yes

Note: Cellular ERP/EIRP is based on the conducted power from Toby R202 grant + gain for Taoglas PCS06A

Note: BT EIRP conducted power of BT121 BT module gain + 1dBi gain from test report on file

Conclusion:

The device is exempt from routine evaluation for stand alone operation.

5.2. Compliance with MPE (Power Density) limits Stand Alone transmission

Power Density Calculation						
Band of Operation MHz	EIRP dBm	Maximum Duty Cycle %	Distance cm	Power Density W/m ²	IC Limit (worst case) W/m ²	Verdict
LTE 2	24.681	100	20	0.58	4.49	Pass
LTE 5	20.204	100	20	0.34	2.59	Pass
LTE 4	25.172	100	20	0.65	4.25	Pass
LTE12	19.638	100	20	0.30	2.32	Pass
WCDMA II	27.409	100	20	1.10	4.48	Pass
WCDMA V	23.139	100	20	0.67	2.58	Pass
BT-BDR/EDR	12.139	100	20	0.03	5.35	Pass
BT-LE	12.761	100	20	0.04	5.35	Pass

Conclusion:

- The equipment fulfills the MPE limits for the minimum 20cm distance between the antenna and the human body

5.3. Compliance with MPE (Power Density) Simultaneous Transmission

Possible simultaneous transmissions: According to the manufacturer the cellular radio modules incorporated within the device can only operate on one band with one of the broadband modes at the time. Theoretically the worst case of simultaneous transmission is with the two transmitters operating at the highest output power mode – UMTS II and BT-LE

Transmission Mode	Ratio of Power Density to Applicable limit for Stand Alone Operation [W/m ²]	Worst case IC limit [W/m ²]	Combined Ratio	Limits for the Highest Combined Ratio	Verdict
UMTS II and BT-LE	1.10 and 0.04	4.48 and 5.35	$1.10 / 4.48 + 0.04 / 5.35 = 0.25$	< 1	Pass

Note: Power Density to Applicable limit for Stand Alone Operation are derived from table in section 5.2

Conclusion:

- The equipment is compliant with MPE limits at distances greater 20 cm.

6. Maximum allowed Antenna Gain – Gmax

- Not applicable since single custom antenna is used with the product.

7. Revision History

Date	Report Name	Changes to report	Report prepared by
09-18-2017	EMC-MOREY-026-17011-FCC-MPE	Initial Version	James Donnellan