Radio Frequency Exposure Evaluation Report

For:
Badger Meter

Model:
ORION Cellular INTL

Product Description:
This product reads connected water meters and transmits the readings over the cellular network.
There is a 915 MHz ISM band proprietary XCVR

FCC ID: GIF2017OCEV5INTL
IC ID: 1046A-OCEV5INTL

Per:

CFR Part Part1 (1.1307 &1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06

Report number: EMC_BADGE_010_17001_FCC_ISED_MPE

DATE: 03/21/2018

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecom.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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 Part 1 (1.1307 &1.1310), Part 2 (2.1091) and IC standard 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 is 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.

Date	Section	Name	Signature
03/21/2018	Compliance	James Donnellan (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
03/21/2018	Compliance	Issa Ghanma (EMC Engineer)	Digitally signed by ISSA GHANMA DN: cn=ISSA GHANMA, c=US, o=CETECOM Inc., email=issa.ghanma@cetecom.com Date: 2018.03.21 14:02:23 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (405) 586-6299
Project Manager:	Cathy Palacios
Project Engineer:	Issa Ghanma

2.2 Identification of the Client / Manufacturer

Applicant's Name:	Badger Meter
Street Address:	4545 W. Brown Deer Road
City/Zip Code	Milwaukee, WI 53223
Country	USA
Contact Person:	Randy Schultz
Phone No.	(414) 371-5941
e-mail:	rschultz@badgermeter.com

Identification of the Manufacturer

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

3 Equipment under Assessment

Model #:	68305
HW Version :	7
SW Version :	1.5.584
FCC-ID :	GIF2017OCEV5INTL
IC ID:	1046A-OCEV5INTL
HVIN:	ORION Cellular INTL
PMN:	ORION Cellular INTL
Product Description:	This product reads connected water meters and transmits the readings over the cellular network. There is a 915 MHz ISM band proprietary XCVR.
Regulatory Band:	**ISM 915 MHz:** Nominal band: 902 MHz – 928MHz Center to center: 904.93 MHz (ch 1) – 923.75 MHz (ch 48), 48 Channels
Integrated Module Info:	**Cellular:** Manufacturer: Telite Model: HE910-D FCC ID: RI7HE910 IC ID: 5131A-HE910
Antenna Type:	-SR4L002. No MIMO capability. -Antenna type: Chip -Antenna gain824 – 960 MHz: Peak: 1.00 dBi Average (Linear): -1.5 dBi
Maximum Conducted Output Power	**ISM 915 MHz:** 8.55 dBm
Rated Operating Voltage Range:	Low: 2.8V / Nominal: 3.6V / High: 3.66V DC
Operating Temperature Range:	Low: -20 ˚C / Nominal: 20 ˚C / High:40 ˚C
Sample Revision:	☐Prototype Unit; ■Production Unit; ☐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/cm²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

IC

300 – 6000	0.02619 x f (MHz) $^{0.6834}$	6

4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.109(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

FCC
operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (EIRP: 33.9);
operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (EIRP: 36.9);

IC
300MHz < = operating frequency < 6 GHz: excluded if EIRP < 0.0131 x f (MHz) $^{0.6834}$ 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 Evaluations

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

band	lowest frequency [MHz]	FCC EIRP limit	IC EIRP limit in W	IC EIRP limit in dBm	EIRP in dBm	Verdict
923.7 MHz ISM	904.9	33.900	1.37	31.38	9.55	Exempt
Cellular	Exempt. The cellular grant for Telite HE-310-D permits mobile application for >20 cm and the antennas used are also meeting the grant conditions.					

The single radios are exempt from routine environmental evaluation.

5.2 Analysis of RF Exposure for simultaneous transmission

- Evaluations are based on worst case power density limits for Canada.
- Calculations are made for 20cm.
- Evaluations are based on EIRP measured or calculated from known gain and conducted output power.
- Cellular Telite HE-910-D: Antenna gain as declared is less than the maximum antenna gain in the modular grant under FCC ID: RI7HE910/ IC ID: 5131A-HE910.
- Cellular and ISM 915 radio cannot transmit simultaneously

6 Revision History

Date	Report Name	Changes to report	Report prepared by
03/21/2018	EMC_BAGDE_010_17001_FCC_ISED_MPE	Initial Release	Issa Ghanma