



Radio Frequency Exposure Evaluation Report

FOR:

Xirgo Technologies, LLC

Model Name:

XT6075

Product Description:

Reefer Container Monitoring Device

FCC ID: GKM-XT6075

IC ID: 10281A-XT6075

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-XIRGO-118-17001-FCC-MPE

DATE: 09-05-2017



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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 #
Xirgo Technologies Inc.	Reefer Container Monitoring Device	XT6075

Responsible for Testing Laboratory:

09-05-2017	Compliance	Peter Nevermann (Director RC&E)	
Date	Section	Name	Signature

Responsible for the Report:

09-05-2017	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. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

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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:	Xirgo Technologies, LLC
Street Address:	188 Camino Ruiz
City/Zip Code	Camarillo, CA 93012
Country	USA
Contact Person:	Johnny Chen
Phone No.	805-980-7103
e-mail:	JChen@xirgotech.com

3. Equipment under Assessment

Model No	XT6075
HW Version	XT6075-001
SW Version	XT6075-01
FCC-ID	GKMXT6075
IC-ID	10281A-XT6075
Product Description	Reefer Container Monitoring Device
Transceiver Technology / Type(s) of Modulation	Cellular Module u-Blox TOBY-R200 supporting WCDMA/UMTS Band II, V LTE 2, 4, 5, 12 GSM 850, PCS 1900 Zigbee: Module Name: CC2530F256RHAT in the 2.4 GHz ISM band GPS Module Name: UBX-M8030 Model number: UBX-M8030-KT-B3000A
Frequency Range	Cellular: 699 MHz – 1910 MHz Zigbee 2405-2480 MHz
Max. declared antenna gain	LTE5 of 3.43 dBi, LTE2 of 5.13 dBi, LTE4 of 4.86 dBi and LTE12 4.07 dBi 2.4GHz Band 1.78 dBi
Co-located Transmitters/ Antennas?	Celular & Zigbee
Power Supply/ Rated Operating Voltage Range	Vmin: 30V DC / 20-48 V AC
Operating Temperature Range	-30°C to 75°C
Sample Revision	<input type="checkbox"/> Prototype <input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production
Device Category	<input type="checkbox"/> Fixed Installation <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable
Exposure Category	<input type="checkbox"/> Occupational/ Controlled <input checked="" type="checkbox"/> 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 (MHz) /1500	30
1500 – 100.000	1.0	30

4.2. Routine Environmental Evaluation Categorical Exclusion Limits acc. To FCC 2.1091I

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.

4.3. 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;

4.4. 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 dBm	Duty Cycle %	Limits for Routine Environmental Evaluation Applicability, EIRP dBm	Exempt from Routine evaluation (Yes/No)
LTE 2	27.1	100	< 33.59	Yes
LTE 5	25.5	100	< 31.19	Yes
LTE 4	27.1	100	< 33.59	Yes
LTE12	26.1	100	< 31.19	Yes
WCDMA II	29.8	100	< 33.59	Yes
WCDMA V	27.7	100	< 31.19	Yes
PCS 1900	35.9	50	< 33.59	No
GSM 850	36.5	50	< 31.19	No
Zigbee	11.8	100	< 33.59	Yes

Note: Cellular EIRP is based on the grant for the integrated module XPY1EHM44NN plus the antenna gain provided for the antenna.

Note: Zigbee EIRP is based on max out power from the TI data sheet for CC2530, as in the document "SWRS081B –APRIL 2009–REVISED FEBRUARY 2011" plus antenna gain.

Conclusion:

- Since the EIRP is not less than the FCC limit for GSM550/PCS 1900 this device is not exempt from Routine evaluation.

5.2. Compliance with MPE (Power Density) limits

Power Density Calculation						
Band of Operation MHz	EIRP dBm	Maximum Duty Cycle %	Distance cm	Power Density mW/cm ²	FCC / IC Limit mW/cm ²	Verdict
LTE 2	27.1	100	30	0.045	1.00 / 0.45	Pass
LTE 5	25.5	100	30	0.031	0.55 / 0.26	Pass
LTE 4	27.1	100	30	0.045	1.00 / 0.42	Pass
LTE12	26.1	100	30	0.036	0.47 / 0.23	Pass
WCDMA II	29.8	100	30	0.084	1.00 / 0.45	Pass
WCDMA V	27.7	100	30	0.052	0.55 / 0.26	Pass
PCS 1900	35.9	50	30	0.172	1.00 / 0.45	Pass
GSM 850	36.5	50	30	0.197	0.55 / 0.26	Pass
Zigbee	11.8	100	30	0.001	1.00 / 0.53	Pass

Conclusion:

- The equipment fulfills the MPE limits for the minimum 30cm distance between the antenna and the human body

6. Routine Environmental Evaluation Applicability 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 – GSM 850 and Zigbee.

Transmission Mode	Ratio of Power Density to Applicable limit for Stand Alone Operation [mW/cm ²]	Worst case IC limit [mW/cm ²]	Combined Ratio	Limits for the Highest Combined Ratio	Exempt from Routine evaluation
GSM 850 and Zigbee	0.197 and 0.001	0.26 and 0.53	$0.197 / 0.26 + 0.001 / 0.53 = 0.76$	< 1	Yes

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

Conclusion:

- The equipment is excluded from simultaneous transmission MPE test.

7. Maximum allowed Antenna Gain – Gmax

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

8. Revision History

Date	Report Name	Changes to report	Report prepared by
09-05-2017	EMC-XIRGO-118-17001-FCC-MPE	Initial Version	James Donnellan