



Radio Frequency Exposure Evaluation Report

For:
Xirgo Technologies, LLC

Model Name:
XT4971A

Product Description:
Solar Energy Harvesting Smart Trailer Solution

FCC ID: GKM-XT4971A
IC ID: 10281A-XT4971A

Per:

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

Report number: EMC_XIRGO_117_17001_FCC_ISED_MPE

DATE: 12/12/2017



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2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

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2.2 Identification of the Client / Manufacturer

Applicant's Name:	Xirgo Technologies, LLC
Street Address:	188 Camino Ruiz
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Country	USA
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Identification of the Manufacturer

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

3 Equipment under Assessment

Model #:	XT4971A
HW Version :	XT4971A-001
SW Version :	XT4971A-01
FCC-ID :	GKM-XT4971A
IC ID:	10281A-XT4971A
HVIN:	N/A
PMN:	N/A
Product Description:	Solar Energy Harvesting Smart Trailer Solution
Regulatory Band:	<p>Bluetooth EDR/BDR, Bluetooth LE Nominal band: 2400 ~ 2483.5 MHz</p> <p>ZigBee Radio:2405 ~ 2475MHz</p> <p>Cellular: WCDMA/UMTS FDD BAND II : 1852.4MHz ~ 1907.6MHz WCDMA/UMTS FDD BAND V : 826.4MHz ~ 846.6MHz LTE BAND 2 : 1850.7MHz ~ 1909.3MHz LTE BAND 4 : 1710.7MHz ~ 1754.3MHz LTE BAND 5 : 824.7MHz ~ 848.3MHz LTE BAND 12 : 699.7MHz ~ 715.3MHz</p>
Integrated Module Info:	<p>Bluetooth EDR/BDR Chipset name: TI's CC2564 single chip.</p> <p>Bluetooth LE Chipset name: TI's CC2564 single chip.</p> <p>ZigBee Radio: TI's CC2530 in conjunction with TI's CC2591 LNA/PA chip FCC ID: GKM-XT4800, IC ID: 10281A-XT4800</p> <p>Cellular: uBlox Toby-R202 FCC ID: XPY1EHQ24NN, IC ID:8595A-1EHQ24NN</p>

Antenna Type:	<p>Bluetooth EDR/BDR, Bluetooth LE On board Antenna from Johanson Technologies, PN 2450AT18A100E with a typical gain of 0.5 dBi peak and -0.5 dBi average.</p> <p>ZigBee Radio: Shares the same antenna with the Bluetooth: 0.5 dBi peak and -0.5 dBi average</p> <p>Cellular: The Device uses an LTE multi-band antenna from Taoglas.</p> <ul style="list-style-type: none"> • 700-960MHz Peak Gain(dBi): 0.77 / Average Gain(dBi): -2.5 • 1700-2170MHz Peak Gain(dBi): 3.17 / Average Gain(dBi): -1.8
Maximum Conducted Output Power	<p>Bluetooth EDR/BDR: from report # 101978620LEX-003 11.219dBm</p> <p>Bluetooth LE: from report # 101978620LEX-002 11.219dBm</p> <p>ZigBee Radio: from report # EMC_Xirgo-080-14001_DTS_rev2 10.76dBm</p> <p>Cellular: from modular grant in WATTS WCDMA Band II: 0.2811w WCDMA Band V: 0.2831w LTE Band 2: 0.15w LTE Band 4: 0.163w LTE Band 5: 0.144w LTE Band 12: 0.1584w</p>
Rated Operating Voltage Range:	8 VDC to 24VDC
Operating Temperature Range:	-40°C to 70°C
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 x f (MHz) ^{0.6834}	6
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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
UMTS II	1850.00	36.900	2.24	33.50	27.66	Exempt
UMTS V	824.00	33.900	1.29	31.11	25.29	Exempt
LTE 2	1850.00	36.900	2.25	33.51	24.94	Exempt
LTE 4	1710.00	36.900	2.13	33.28	25.29	Exempt
LTE 5	824.00	33.900	1.29	31.12	22.36	Exempt
LTE 12	699	33.900	1.16	30.64	22.77	Exempt
BT-LE	2400	36.900	2.68	34.28	11.72	Exempt
BT EDR/BDR	2400	36.900	2.68	34.28	11.72	Exempt
ZigBee	2405	36.900	2.68	34.28	11.26	Exempt

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 and BT can transmit simultaneously

Radio	freq MHz	EIRP in W	Canada W/m2	Actual W/m2	How much of limit is used up
Band II	1852.4	0.58	4.480	1.161	25.91%
Band V	826.4	0.34	2.581	0.673	26.06%
Band 2	1857.5	0.31	4.489	0.620	13.82%
Band 4	1717.5	0.34	4.255	0.673	15.81%
Band 5	829	0.17	2.586	0.343	13.25%
Band 12	706.5	0.19	2.319	0.391376	16.24%
BT-LE	2402	0.015	5.351	0.030	0.55%
BT EDR/BDR	2402	0.015	5.351	0.030	0.55%
ZigBee	2405	0.013	5.355	0.027	0.50%

Conclusion:

- **The worst case simultaneous transmission is Band V simultaneous with BT EDR/BDR Or BT-LE which is using 26.61% 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
12/12/2017	EMC_XIRGO_117_17001_FCC_ISED_MPE	Initial Release	Issa Ghanma