



Radio Frequency Exposure Evaluation Report

For

Xirgo Technologies, Inc

GPS Asset Tracking Device

FCC ID: GKM-XT4800

IC ID: 10281A-XT4800

Model No.: XT-4860G5

Applied Rules and Standards

**CFR Part Part 1 (1.1307 &1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General 24 RF Exposure Guidance v05r02**

Industry Canada RSS-102, Issue 4 of March 2010

Report number: EMC_XIRGO-079-14001_MPE

DATE: 09-02-2014

1 Administrative Data

1.1 Identification of the Testing Laboratory Issuing the Test Report

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Compliance Manager:	Milton Ponce de Leon
Responsible Project Leader:	Muhammad Umair Annes

1.2 Identification of the Client / Manufacturer

Applicant's Name:	Xirgo Technologies, Inc
Street Address:	188 Camino Ruiz
City/Zip Code	Camarillo, CA/ 93012
Country	USA
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2 Equipment under Assessment

Marketing Name / Description:	GPS Asset Tracking Device
FCC-ID:	GKM-XT4800
IC certification no.:	10281A-XT4800
Model Number:	XT-4860G5
Product Description:	GPS Asset Tracking Device
Transmitter information:	1. pre-certified 3.75G Radio Module: uBlox LISA-U200-01 (FW22.9) FCC ID: XPYLISAU200; IC ID: 8595-LISAU200N 4-band GSM/GPRS / EDGE, MS class 33 850/900/1700/1900 MHz WCDMA / HSPA+ 2. ZigBee IEEE 802.15.4 (2.4GHz); 3. GPS 1575.42 MHz
Antennae:	Internal Monopole, 850MHz: -2 dBi 1900MHz: 0 dBi 1700 MHz: 0 dBi
Co-located Transmitters/ Antennas?	☒ Yes ☐ No
Device Category:	☒ Fixed Installation ☐ Mobile (mark mobile if both possible) ☐ Portable ☐ mixed Mobile and Portable
Exposure Category:	☐ Occupational/ Controlled ☒ General Population/ Uncontrolled
Rated Operating Voltage:	Vmin: 8.0V/ Vnom: 12.0V/ Vmax: 24V, supplied by solar or car battery;
Rated Operating temperature range:	Tmin: -30°C / Tmax: 70°C
Test Sample Status:	Pre-production

3 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 and IC rule parts based on available specifications.

Company	Description	Model #
Xirgo Technologies, Inc	GPS Asset Tracking Device	XT-4860G5

Report reviewed by:

09-02-2014	Compliance	Milton Ponce de Leon (Test Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

09-02-2014	Compliance	Muhammad Umair Annes (Test Lab Manager)	
Date	Section	Name	Signature

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 Maximum Permissible Exposure (MPE) Limits acc. to FCC 1.1310(e) / RSS-102, cl. 4.2:

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30 (IC:6)
1500 – 100.000 (IC:1500 – 150000)	1.0	30 (IC: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):

Operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (IC: 2.5W / 34.0dBm EIRP);

Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (IC: 5.0W / 37.0dBm EIRP);

4.3 EMC Output Power Limits (ERP/EIRP) acc. to FCC part 22/24/27 / IC RSS-132, RSS-133, RSS-139 (to be additionally taken into account for maximum antenna gain considerations)

part 22: 7W ERP / 38.5dBm (IC: 11.5W / 40.6dBm EIRP)

part 24: 2W EIRP / 33.0dBm

part 27: 1W EIRP / 30.0dBm

Per KDB 447498 D01 FCC allows calculative estimation of RF exposure for mobile applications when routine environmental evaluation categorical exclusion applies and also for fixed applications.

When categorical exclusion can not be claimed for mobile applications MPE measurement is required for TCB approval.

RSS-102 of Industry Canada does generally not require RF exposure evaluation for fixed or mobile applications which stay below the given exclusion limits.

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 it's radiating structures from the body of persons according to it's 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

The following calculations are – for the portion of the cellular transmitter - based on the the specified maximum conducted average output power of the cellular module incorporated in the EUT and thus – with the given peak antenna gain - resulting in the theoretical worst case maximum average ERP/EIRP, because all measured conducted average values are lower.

5.1 Routine Environmental Evaluation Applicability

Based on the theoretical maximum average ERP/EIRP, see above.

Pr is the declared (rated) conducted output power upper tune-up tolerance limit value (of the integrated cellular module);

Transmission Mode	Pr	peak gain	attenuation	duty cycle	EIRP, source based time averaged (EIRPmax)	total EIRP simultaneous transmissions intra-band (worst cases only)	FCC & IC Limit for Routine Environmental Evaluation Applicability, EIRP	excluded?
	dBm	dB	dB	%	dBm	dBm	dBm	
GSM 850	32.5	-2.0	n.a.	12.5	21.5	n.a.	33.9	yes
GPRS 850 1TS	32.5	-2.0	n.a.	12.5	21.5	n.a.	33.9	yes
GPRS 850 2TS	32.5	-2.0	n.a.	25	24.5	n.a.	33.9	yes
GPRS 850 3TS	31.7	-2.0	n.a.	37.5	25.4	n.a.	33.9	yes
GPRS 850 4TS	30.5	-2.0	n.a.	50	25.5	n.a.	33.9	yes
EDGE 850 1TS	27	-2.0	n.a.	12.5	16.0	n.a.	33.9	yes
EDGE 850 2TS	27	-2.0	n.a.	25	19.0	n.a.	33.9	yes
EDGE 850 3TS	26.2	-2.0	n.a.	37.5	19.9	n.a.	33.9	yes
EDGE 850 4TS	25	-2.0	n.a.	50	22.0	n.a.	33.9	yes
WCDMA Bd V	23.0	-2.0	n.a.	100	21.0	n.a.	33.9	yes
GSM 1900	29.5	0.0	n.a.	12.5	20.5	n.a.	36.9	yes
GPRS 1900 1TS	29.5	0.0	n.a.	12.5	20.5	n.a.	36.9	yes
GPRS 1900 2TS	29.5	0.0	n.a.	25	23.5	n.a.	36.9	yes
GPRS 1900 3TS	28.7	0.0	n.a.	37.5	24.4	n.a.	36.9	yes
GPRS 1900 4TS	27.5	0.0	n.a.	50	24.5	n.a.	36.9	yes
EDGE 1900 1TS	26.0	0.0	n.a.	12.5	17.0	n.a.	36.9	yes
EDGE 1900 2TS	26.0	0.0	n.a.	25	20.0	n.a.	36.9	yes
EDGE 1900 3TS	25.2	0.0	n.a.	37.5	20.9	n.a.	36.9	yes
EDGE 1900 4TS	24.0	0.0	n.a.	50	21.0	n.a.	36.9	yes
WCDMA Bd II	23.0	0.0	n.a.	100	23.0	n.a.	36.9	yes
WCDMA Bd IV	23.0	0.0	n.a.	100	23.0	n.a.	36.9	yes
ZigBee 2.4 GHz	10.8	0.5	n.a.	100	11.3	n.a.	36.9	yes

Result: The transmitters in the equipment are categorically excluded from Routine Environmental Evaluation. There are no intra-band co-transmissions possible in the device.

5.2 Compliance with MPE (Power Density) limits

Limits:

S_{max} @ 824MHz = 0.55mW/cm² (824MHz is worst case as lowest operating frequency in the cellular band);

S_{max} @ 1900MHz and @ 2400MHz = 1.0mW/cm²:

The highest source base time averaged EIRP_{max} per band calculated with the rated peak antenna gain values are taken from the table in section 5.1 above;

The highest power density is resulting from the formula: $S = \text{EIRP}_{\text{max}} / 4 * \pi * r^2$;

The power density is calculated for the minimum distance $r = 20\text{cm}$ (which is a very unlikely narrow distance for the device under consideration);

Highest source base time averaged EIRP with GPRS 850 MHz, 4TS: 25.5dBm;

Resulting maximum power density at 850MHz: **S(850MHz) = 0.07mW/cm²**

Highest source base time averaged EIRP with GPRS 1900 MHz, 4TS: 24.5dBm;

Resulting maximum power density at 1900MHz: **S(1900MHz) = 0.06mW/cm²**

Highest source base time averaged EIRP with WLAN 2.4GHz: 11.3dBm;

Resulting maximum power density at 2400MHz: **S(2400MHz) = 0.002mW/cm²**

Result: The equipment fulfills the MPE limits for the minimum distance between the antenna and the human body of 20cm, for the rated peak antenna gain.

5.3 Simultaneous Transmission MPE Test Exclusion (per KDB 447498 D01)

Possible simultaneous transmissions: Cellular Radio and ZigBee.

Highest power density to the limit ratio for the Cellular Transmitter: $0.07\text{mW/cm}^2 / 0.55\text{mW/cm}^2 = \mathbf{0.13}$

Power density to the limit ratio for the WLAN Transmitter: $0.002\text{mW/cm}^2 / 1.0\text{mW/cm}^2 = \mathbf{0.002}$

Σ of Power Density (MPE) ratios = 0.013 + 0.002 = 0.015 < 1

Result: The equipment is excluded from simultaneous transmission MPE test.

5.4 Maximum allowed Antenna Gain – G_{max}

not applicable since fixed internal antenna is used in the product.

6 Revision History

Date	Change Description	Revision
09-02-2014	n.a.	initial