



Radio Frequency Exposure Evaluation Report

FOR:

Zonar Systems

Model Name:

V4

Product Description:

Vehicle mounted telematics device

FCC ID: SEJ-V4

IC ID: 5226A-V4

Applied Rules and Standards:

CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091),
ISED RSS-102 Issue 5

Report number: EMC_ZONAR-016-17001_FCC_ISED_MPE

DATE: 03-12-2018



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3462B-2

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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 ISED 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/ISED rule parts based on available specifications.

Company Name	Product Description	Model #
Zonar Systems	Vehicle mounted telematics device	V4

Responsible for Testing Laboratory:

2018-03-12	Compliance	James Donnellan (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2018-03-12	Compliance	Elijah Garcia (EMC 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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2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
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Compliance Manager:	James Donnellan
Responsible Project Leader:	Ruther Navarro

2.2. Identification of the Client / Manufacturer

Applicant's Name:	Zonar Systems
Street Address:	18200 Cascade Avenue South
City/Zip Code	Seattle, WA 98188
Country	USA
Contact Person:	David Pascoe
Phone No.	+1 (206) 878 2459
e-mail:	David.pascoe@zonarsystems.com

3. Equipment under Assessment

Model No	V4
HW Version	1
SW Version	4
FCC-ID	SEJ-V4
IC-ID	5226A-V4
Product Description	Vehicle mounted telematics device
Transceiver Technology / Type(s) of Modulation	<p>ublox TOBY-L200-02S-00; FCC ID: XPYTOBYL200; IC ID: 8595A-TOBYL200 •850/1900 MHz GSM/GPRS/EDGE; GSM&GPRS&EDGE(MCS-1-4): GMSK; EDGE(MCS-5-8): 8PSK; •850/1700/1900 MHz WCDMA / HSPA+; HSDPA Category 14 data rate - 21 Mbps; HSUPA Category 6 data rate - 5.76 Mbps; modulation: all QPSK (no QAM in uplink for given data rates) •850/1700/1900/2600/700 MHz LTE; LTE Band 2 (PCS),4 (AWS),5 (850),7 (2600),17 (700)</p> <p>ublox Ella-W131; FCC ID: PV7-WIBEAR11N-SF1; IC ID: 7738A-WB11NSF1 802.11b: DSSS 802.11g/n: OFDM 802.11n: MCS (20 & 40 MHz)</p> <p>Laird BT900; FCC ID: SQGBT900; IC ID: SQGBT900 Bluetooth version 4.0, Low Energy, using Dynamic Sequence Spread Spectrum with GFSK modulation. Bluetooth Basic/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK</p>

Frequency Range	<p>GSM 850: 824.2-848.8 MHz; 123 channels; PCS 1900: 1850.2-1909.8 MHz; 298 channels; FDD V: 826.4 - 846.6 MHz; 101 channels; FDD II: 1852.4 – 1907.6 MHz; 276 channels; FDD IV: 1712.4 – 1752.6 MHz; 201 channels; LTE Band 2: 1850 - 1910 MHz; 60 MHz bandwidth; LTE Band 4: 1710 - 1755 MHz; 45 MHz bandwidth; LTE Band 5: 824 - 849 MHz; 25 MHz bandwidth; LTE Band 7: 2500 - 2570 MHz; 70 MHz bandwidth; LTE Band 17: 704 - 716 MHz; 12 MHz bandwidth;</p> <p>Nominal band: 2412 MHz (Ch. 1) – 2472 (Ch.13), 13 channels</p> <p>Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (Ch. 0) – 2480 MHz (Ch. 39), 40 channels</p> <p>Nominal band: 2400 MHz – 2483.5 MHz Center to center: 2402 MHz (Ch. 0) – 2480 MHz (Ch. 78), 79 Channels</p>
Max. declared antenna gain	taoglas antenna solutions, Part No: PCS.06.A Havok; Peak Gain: 3.72dBi.
Co-located Transmitters/ Antennas?	Yes – the 3 radio modules operate independently and may transmit simultaneously
Power Supply/ Rated Operating Voltage Range	8VDC (Low) / 12VDC (Nominal) / 30VDC (Max)
Operating Temperature Range	–40°C ~ 85°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

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

4.1. Power Density Limits acc. to FCC 1.1310(e)

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
1500 – 100.000	1.0	30

4.2. Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c)

- Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm;

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 cannot be claimed for mobile applications MPE measurement is required for TCB approval.

4.3. Exemption Limits for Routine Evaluation to RSS-102 2.5.2

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;
- Operating frequency > 300MHz < 6GHz: excluded if ERP < 2.7W / 34.3dBm;

4.4. Exposure Limits RSS-102 4

For the purpose of this standard, ISED has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6

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 dBm	Duty Cycle %	Limits for Routine Environmental Evaluation Applicability, EIRP dBm	Exempt from Routine evaluation (Yes/No)
GSM 850	32.8	50	< 31.17	No
GSM 1900	31.5	50	< 33.6	Yes
UMTS V	31.8	100	< 31.17	No
UMTS IV	33.0	100	< 33.34	Yes
UMTS II	32.8	100	< 33.6	Yes
LTE Band 2	28.1	100	< 33.6	Yes
LTE Band 4	28.3	100	< 33.34	Yes
LTE Band 5	28.0	100	< 31.17	Yes
LTE Band 7	27.2	100	< 34.47	Yes
LTE Band 17	27.5	100	< 30.68	Yes
BTLE	11.9	100	< 34.38	Yes
BT BR/EDR	11.9	100	< 34.38	Yes
802.11b/g/n	28.1	100	< 34.38	Yes

Note: EIRP power calculation is based on the Stated RF output power and tune-up tolerance provided by the manufacturer

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	Limit mW/cm ²	Verdict
GSM 850	35.79	50	24	0.26215	< 0.566	Pass
GSM 1900	34.53	50	24	0.19614	< 1.000	Pass
UMTS V	31.78	100	24	0.20825	< 0.566	Pass
UMTS IV	33.01	100	24	0.27643	< 1.000	Pass
UMTS II	32.81	100	24	0.26399	< 1.000	Pass
LTE Band 2	28.11	100	24	0.08945	< 1.000	Pass
LTE Band 4	28.28	100	24	0.09302	< 1.000	Pass
LTE Band 5	28.05	100	24	0.08822	< 0.566	Pass
LTE Band 7	27.23	100	24	0.07304	< 1.000	Pass
LTE Band 17	27.54	100	24	0.07845	< 0.477	Pass
BTLE	11.91	100	24	0.00215	< 1.000	Pass
BT BR/EDR	11.98	100	24	0.00218	< 1.000	Pass
802.11b/g/n	28.12	100	24	0.05482	< 1.000	Pass

Conclusion:

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

6. Routine Environmental Evaluation Applicability Simultaneous Transmission

- Possible simultaneous transmissions: According to the manufacturer the three radio modules incorporated within the device operate independently from each other. Theoretically the worst case of simultaneous transmission is with two transmitters operating at the highest output power mode, within the same band (Wi-Fi+ GSM 1900).

Transmission Mode	Ratio of Power Density to Applicable limit for Stand Alone Operation	Sum of the Ratios for the Highest Possible Simultaneous Operation	Limits for the Highest Combined Ratio	Exempt from Routine evaluation
Wi-Fi + GSM 850	0.49 (Wi-Fi) 0.26 (GSM 850)	0.49+0.26=0.75	< 1	Yes

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

Conclusion:

- The equipment meets the MPE requirements limits for simultaneous transmission.

7. Revision History

Date	Report Name	Changes to report	Report prepared by
03-12-2018	EMC_ZONAR-016-17001_FCC_ISSED_MPE	Initial Version	Elijah Garcia