



Radio Frequency Exposure Evaluation Report

for

Trapeze Software ULC

Rugged and Compact Vehicular Computer

FCC ID: RZ3-RAN4661

IC ID: 2234A-RAN4661, Model Name: Ranger 4 HSPAP

Applied Rules and Standards

**CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC OET Bulletin 65 (1997-01) Supplement C (2001-01),
FCC KDB 447498 D01 General 24 RF Exposure Guidance v05r01**

Industry Canada RSS-102, Issue 4 of March 2010

Report number: #EMC_MENTO-013-13001_MPE

DATE: 2014-02-18



**FCC:
Accredited**

**IC recognized #
3462B-1**

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1 Administrative Data

1.1 Testing Laboratory Issuing the Test Report

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1.2 Client / Manufacturer

Client and Manufacturer:	Trapeze Software ULC
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2 Equipment under Test (EUT)

Model Name:	Ranger 4 HSPAP
FCC-ID:	RZ3-RAN4661
IC-ID:	2234A-RAN4661, Model Number: Ranger 4 HSPAP
Marketing Name / Description:	Rugged and Compact Vehicular Computer
Product Description:	Vehicular computer incorporating pre-certified 3G cellular, 2.4GHz WLAN and Bluetooth radio modules (see details below)
Transmitter information:	- Option NV GTM661W 3G Module GSM, GPRS, EDGE 850, 900, 1800 and 1900 MHz UMTS WCDMA / HSDPA / HSUPA 800, 850, 1900, 2100 MHz FCC: NCMOMO6612 / IC: 2734A-MO6612 GPRS class 12, EDGE class 12 UMTS (WCDMA), HSDPA category 10, HSUPA category 6 5.76 Mbps uplink max - Redpine RS9110-N-11-02 WIFI Module, FCC-ID: XF6-RS9110N1102; IC: 8407A-91101102; - Bluetooth v2.1– Bluegiga WT21-N-HCIFCC-ID: QOQWT21N, IC: 5123A-BGTWT21N; - GPS
Antenna info (antenna as presented for testing with the development board):	- cellular: monopole printed trace antenna, documented peak gain 0.54 dBi @ 850 MHz, 1.89 dBi @ 1900 MHz; - WLAN: Taoglas FXP70.07.0100A flexible printed circuit antenna; 5 dBi peak gain; - Bluetooth: Taoglas CA-14 2.4GHz SMT chip Antenna, 1dBi;
Co-located Transmitters/ Antennas?	☒ Yes ☐ No
Test Sample Status:	Production
Device Category:	☒ Fixed Installation/ Mobile ☐ Portable
Exposure Category:	☐ Occupational/ Controlled ☒ General Population/ Uncontrolled

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.

Manufacturer	Device Description	Model Name
Trapeze Software ULC	Rugged and Compact Vehicular Computer	Ranger 4 HSPAP

Responsible for the Report:

2014-02-18 Compliance Josie Sabado
(Test Lab Manager)

Date	Section	Name	Signature
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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 – considering the given peak antenna gain of the recommended antennae - resulting in the theoretical worst case maximum average ERP/EIRP, because all measured conducted average values are lower.

Since the antenna cable loss in a final host installation is unknown it is not considered in the below calculations.

5.1 Routine Environmental Evaluation Applicability

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

In addition source based time averaging over the TDMA multiframe is taken into account for GSM/EDGE operation.

The worst case cellular mode of operation is GPRS 850MHz with 4 timeslots in the uplink (multislot class 12), resulting in the highest duty cycle of 50%, so that the source based time average is -3dB below the GPRS 850MHz 1 timeslot average power. (see highest values in bold letters in below table)

Transmission Mode	Calculated Maximum EIRP (rated max. conducted average power*1 + peak gain)	EIRP, source based time averaged	simultaneous transmission (summation of single EIRP, worst cases listed only)	FCC & IC Limit for Routine Environmental Evaluation Applicability, EIRP	Routine Environmental Evaluation Exclusion?
MHz	dBm	dBm	dBm	dBm	dBm
GSM/GPRS 850	33.0+0.54	30.54(1.13W)	30.9(1.23W)	33.9	yes
EDGE 850	28.0+0.54	25.54		33.9	yes
UMTS FDD V	24.0+0.54	24.54		33.9	yes
GSM/GPRS 1900	30.0+1.89	28.89		36.9	yes
EDGE 1900	27.0+1.89	25.89		36.9	yes
UMTS FDD II	25.0+1.89	26.89		36.9	yes
WLAN 2.4GHz *2	19.68	19.68(0.093W)	30.9(1.23W)	36.9	yes

*1 specified upper tolerance limit of the integrated module;

*2 EIRP value with the specified peak gain of 5dBi;

Result: The equipment is categorically excluded from Routine Environmental Evaluation, also for the worst case of simultaneous transmission of the incorporated transmitters with the highest output power.

5.2 Compliance with MPE (Power Density) limits

Limits:

S_{max} @ 824MHz = 0.55mW/cm²;

S_{max} @ >1500MHz = 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 estimated with the far field formula: $S = \text{EIRP}_{\text{max}} / 4\pi r^2$;

The power density is calculated for the minimum distance for mobile and fixed applications $r = 20\text{cm}$;

Highest source base time averaged EIRP with GPRS 850 MHz, 4TS, single transmitter: 30.54(1.13W);

Resulting maximum power density at 850MHz: **S(850MHz) = 0.22mW/cm²**

Maximum EIRP of the WLAN transmitter: 19.68(0.093W);

Resulting maximum power density at 2400MHz: **S(2400MHz) = 0.02mW/cm²**

Highest source base time averaged EIRP with GPRS 850 MHz, 4TS with WLAN simultaneous transmission, accumulated EIRP: 30.9(1.23W)dBm;

Resulting maximum power density at 850MHz: **S(850MHz) = 0.25mW/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 and also for the worst case of simultaneous transmission of the cellular and the WLAN transmitter.

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

Maximum MPE ratio at 850 MHz: $S(850\text{MHz}) / S_{\text{max}} @ 824\text{MHz} = 0.22\text{mW/cm}^2 / 0.55\text{mW/cm}^2 = 0.4$;

Maximum MPE ratio at 2.4 GHz: $S(2400\text{MHz}) / S_{\text{max}} @ >1500\text{MHz} = 0.02\text{mW/cm}^2 / 1.0\text{mW/cm}^2 = 0.02$;

Σ of Power Density (MPE) ratios = 0.4 + 0.02 = 0.42 < 1;

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

6 Revision History

Date	Change Description	Created By
2014-02-18	Original Version	J. Sabado