



## RF Exposure Evaluation Report

For

**Product Name: Auto Data Server**

**Brand Name: iEi**

**Model No.: AVL-3000**

**Series Model : N/A**

**FCC ID: RFHAVL3000**

**Standards: FCC 47 CFR 1.1307/ CFR 1.1310 / CFR 2.1091**

**Test Report Number: C130923R01-RPB**

Issued for

**IEI Integration Corp.**

**No.29,Zhongxing Rd., Xizhi Dist., New Taipei City 22161, Taiwan(R.O.C.)**

Issued by

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TESTING CERT #2541.01

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## TABLE OF CONTENTS

<b>1</b>	<b>TEST RESULT CERTIFICATION .....</b>	<b>4</b>
<b>2</b>	<b>EUT DESCRIPTION.....</b>	<b>5</b>
<b>3</b>	<b>RF Exposure Evaluation .....</b>	<b>6</b>
	3.1. RF Exposure Compliance Requirement.....	6
	3.2. EUT RF Exposure Evaluation .....	7



## Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 16, 2014	Initial Issue	ALL	Jeff.Fang



## 1 TEST RESULT CERTIFICATION

<b>Product Name:</b>	Auto Data Server
<b>Brand Name:</b>	iEi
<b>Model Name:</b>	AVL-3000
<b>Series Model :</b>	N/A
<b>Device Category:</b>	Mobile Device
<b>Applicant: Address:</b>	<b>IEI Integration Corp.</b> No.29,Zhongxing Rd., Xizhi Dist., New Taipei City 22161, Taiwan(R.O.C.)
<b>Manufacturer: Address:</b>	<b>IEI Integration Corp.</b> No.29,Zhongxing Rd., Xizhi Dist., New Taipei City 22161, Taiwan(R.O.C.)
<b>Date of Test:</b>	December 5, 2013 and April 16, 2014
<b>Test Result :</b>	Conform

APPLICABLE STANDARDS	
Standard	Test Result
FCC 47 CFR 1.1307	No non-compliance noted
FCC 47 CFR 1.1310	No non-compliance noted
FCC 47 CFR 2.1091	No non-compliance noted

U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307, 1.1310 and 2.1091 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Tested  
by:

*Blent Wang*  
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Approved  
by:

*Jeff Fang*  
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## 2 EUT DESCRIPTION

<b>Product Name:</b>	Auto Data Server		
<b>Brand Name:</b>	iEi		
<b>Model Name:</b>	AVL-3000		
<b>Series Model :</b>	N/A		
<b>Model Discrepancy:</b>	N/A		
<b>Power Supply:</b>	Power supply: INPUT: DC9-36V		
<b>Frequency Range :</b>	RFID: 902 ~ 928MHz Bluetooth: 2402 ~ 2480MHz WLAN: 2412 ~2472MHz GPRS / EDGE 850: 824.2 ~848.8MHz GPRS / EDGE 1900: 1850.2 ~1909.8MHz WCDMA / HSDPA /HSUPA / HSPA+Band II: 1852.4 ~1907.6MHz WCDMA / HSDPA /HSUPA / HSPA+Band V: 826.4 ~846.6MHz		
<b>Transmit Power :</b>	RFID: 24.78dBm	Bluetooth: 3.16dBm WLAN: 802.11b:21.08dBm 802.11g:19.07dBm 802.11n HT20:19.14dBm 802.11n HT40:18.27dBm	GPRS 850:33.04dBm GPRS 1900:30.79dBm EDGE 850:27.25dBm EDGE 1900:27.30dBm WCDMA Band II:24.52dBm HSDPA Band II:24.47dBm HSUPA Band II:24.68dBm WCDMA Band V:24.48dBm HSDPA Band V:24.26dBm HSUPA Band V:24.45dBm
<b>Antenna Specification:</b>	RFID: 8.5dBi Gain	Bluetooth: 2 dBi Gain WLAN: 2 dBi Gain	GPRS/EDGE850: -1 dBi Gain GPRS/EDGE1900: 0 dBi Gain WCDMA/HSPA Band II: 0 dBi Gain WCDMA/HSPA Band V: -1 dBi Gain

**Note:** for more details, please refer to the User's manual of the EUT.



## 3 RF Exposure Evaluation

### 3.1. RF Exposure Compliance Requirement

#### 3.1.1. Limits

According 47 CFR 1.1310 FCC MPE limits for General population/Uncontrolled Exposure are showing in the Table1:

Table1

Frequency Range	Electric Field Strength [E] (V/m)	Magnetic Field Strength [H](A/m)	Power density [S](mW/cm <sup>2</sup> )	Averaging time (min)
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	-----	-----	f/1500	30
1500 – 100,000	-----	-----	1	30

f = frequency in MHz

\* = Plane-wave equivalent Power Density

The EUT will be only used with a separation of 20 cm or greater between the antennas and the user or nearby person and therefore can be consider a mobile transmitter per 47 CFR 2.1091(b). Due to deployment conditions, device has to comply with Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled Exposure.

#### 3.1.2. Test Procedure

Based on FCC Bulletin OET 65, the MPE calculations in case of multiple transmitters have been e performed on the following and assumptions and equations:

1. For transmitters which operate in the frequency band with a same MPE limit the Power Densities are summed. The Total Power Density shall not exceed the Limit for this band.
2. For transmitters which operate in frequency bands with a different MPE the Power Densities are calculated separately for each band, and then divided by Limit for each band. The sum of these ratios shall not exceed 1.



### 3. Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

Where  $E$  = Field strength in Volts / meter  
 $P$  = Power in Watts  
 $G$  = Numeric antenna gain  
 $d$  = Distance in meters  
 $S$  = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where  $d$  = Distance in cm  
 $P$  = Power in mW  
 $G$  = Numeric antenna gain  
 $S$  = Power density in mW / cm<sup>2</sup>

4. According Table3, limit for EV-DO transmitter in 824.2 – 848.8 MHz band shall be calculated at the lowest frequency (worst case) as:

$$824.2 / 1500 = 0.55 \text{ mW/cm}^2$$

5. According Table3, limit for EV-DO transmitter in 902 – 928 MHz band shall be calculated at the lowest frequency (worst case) as:

$$902 / 1500 = 0.60 \text{ mW/cm}^2$$

## 3.2. EUT RF Exposure Evaluation

For RFID:

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
RFID	902-928	24.78	8.5	20	0.4235	0.60



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## For Bluetooth:

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
1Mbps	2402-2480	0.37	2	20	0.00034	1
3Mbps		3.16	2	20	0.00065	1

## For WLAN:

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
802.11b	2412-2462	21.08	2	20	0.04044	1
802.11g		19.07	2	20	0.02546	1
802.11 n(20MHz)		19.14	2	20	0.02587	1
802.11 n(40MHz)		18.27	2	20	0.02118	1

## For WWAN:

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Duty cycle	Power density (mW/cm2)	Limit (mW/cm2)
GPRS850	824.2-848.8	33.04	-1	20	0.25	0.07958	0.55
EDGE850		27.25	-1	20	0.25	0.02098	0.55
GPRS1900	1850.2-1909.	30.79	0	20	0.25	0.05968	1
EDGE1900	8	27.30	0	20	0.25	0.02672	1
WCDMA Band II	1852.4-1907.	24.52	0	20	1	0.05635	1
HSDPA Band II		24.47	0	20	1	0.05570	1
HSUPA Band II		24.68	0	20	1	0.05846	1
WCDMA Band V	826.4-846.6	24.48	-1	20	1	0.04435	0.55
HSDPA Band V		24.26	-1	20	1	0.04216	0.55
HSUPA Band V		24.45	-1	20	1	0.04404	0.55





Note: WLAN and WWAN can not transmit at the same time.

All of the RFID&Bluetooth&WLAN can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$\text{RFID+Bluetooth+WLAN 2.4G} = 0.4235/0.60 + 0.00065 + 0.04044 = 0.746923 \text{ mW/cm}^2$$

All of the RFID&Bluetooth&WWAN can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$\text{RFID+Bluetooth+WWAN(GPRS850)} = 0.4235/0.60 + 0.00065 + 0.07958/0.55 = 0.851174 \text{ mW/cm}^2$$

$$\text{RFID+Bluetooth+WWAN(GPRS1900)} = 0.4235/0.60 + 0.00065 + 0.05968 = 0.766163 \text{ mW/cm}^2$$

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm<sup>2</sup> even if the calculation indicates that the power density would be larger.)

**END OF REPORT**