

RADIOCOMMUNICATIONS EQUIPMENT

COMPLIANCE ASSESSMENT FOR FCC 47 CFR 1.1310 RADIOFREQUENCY RADIATION EXPOSURE LIMITS MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Client:	Imarda NZ Ltd
Address:	Level 2, 135 Broadway, Newmarket Auckland 1023, New Zealand
Report Number:	0710IMA_V301_FCC(MPE)
Date of Assessment	09 Jul 2015
File Number:	IMA140207A
Equipment Name:	Vector V301
Equipment Model Nos:	V301-336-XWP-030 V301-336-IW-030
Equipment FCC ID:	TXXV301
Equipment Description:	Telematic Device for use in Vehicles
Result:	COMPLIES (General Population/Uncontrolled Exposure)
Assessed by:	Phillip Kane 
Approved by:	Colin Gan Senior Engineer 
Date of Issue:	10 Jul 2015
<p>Results appearing herein relate only to the sample(s) assessed through the submitted test report(s).</p> <p>This report is issued errors and omissions exempt and is subject to withdrawal at Austest Laboratories discretion.</p>	

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EQUIPMENT DETAILS	
MANUFACTURER:	Imarda NZ Ltd
MODELS:	V301-336-XWP-030 & V301-336-IW-030
OPERATING FREQUENCY:	Bluetooth: 2402 - 2480MHz ^{Note 1} WiFi: 2412 - 2462MHz ^{Note 1} GSM: 850/900/1800/1900MHz ^{Note 2} UMTS: 800/850/900/1900/2100MHz ^{Note 2}
TRANSMITTER POWER INTO ANTENNA:	Bluetooth: -6.3dBm (0.00023W) Max. ^{Note 1} WiFi: 22.4dBm (0.1738W) Max. ^{Note 1} <u>GSM:</u> ^{Note 2} 850: 33dBm ±2dB (3.162W) Max. 900: 33dBm ±2dB (3.162W) Max. 1800: 30dBm ±2dB (1.585W) Max. 1900: 30dBm ±2dB (1.585W) Max. <u>FDD:</u> ^{Note 2} 800: 24dBm +1/-3dB (0.316W) Max. 850: 24dBm +1/-3dB (0.316W) Max. 900: 24dBm +1/-3dB (0.316W) Max. 1900: 24dBm +1/-3dB (0.316W) Max. 2100: 24dBm +1/-3dB (0.316W) Max.
TYPE OF ANTENNA:	WiFi/BT/2G/3G: 2J426 non-integral combined antenna ^{Notes 1 & 3} BT / WiFi: RGFRA9937380A3T Surface mount antenna ^{Notes 1 & 4}
ANTENNA GAIN:	WiFi/BT/2G/3G: 0dBi ^{Notes 1 & 3} WiFi/Bluetooth: 2dBi ^{Notes 1 & 4}

Notes:

1. *Data taken from FCC Title 47 Part 15 Subparts A & C Test Report No. 0710IMA_V301_FCC15C, dated 10 Jul 2015 by Austest Laboratories.*
2. *Data taken from Cinterion PHS8-P module specifications file "phs8-p_hd_v02001.pdf".*
3. *Data obtained from file "Ant_2J426.pdf" for Antenna 2J426 as provided by client.*
4. *Data obtained from file "1-RGFRA9937380A3T.pdf" for Antenna RGFRA9937380A3T as provided by client.*

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FCC § 15.247(b) RF Exposure Criteria for Intentional Radiators:

RF Exposure Requirements: FCC §1.1307(b)(1) and §1.1307(b)(2):

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: FCC §1.1310:

As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Maximum Permissible Exposure:

(As specified in Table 1B of 47 CFR 1.1310 – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure)

<i>Frequency range (MHz)</i>	<i>Power density (mW/cm²)</i>
300 – 1500	f/1500
1,500 – 100000	1.0

MPE Calculation:

The transmitter antenna configurations for MPE considerations are as follows:

- 3G/GSM, GPS & WiFi operation: 2J426 non-integral combined antenna
- Bluetooth operation: RGFRA9937380A3T Surface mount antenna.

The BT/WiFi and cellular antennas are considered co-located as they are less than 20cm apart for the purpose of the MPE calculations.

The following radio modules will be used in the Vector 301 (Model: V301-336-IW-030) that will result in co-location of the antennas for the modules:

- Cinterion PHS8-P 3G/GSM module (FCC ID: QIPPHS8-P)
- Telit JF2 GPS module
- Wi2Wi WiFi transceiver, p/n W2SW0001
- CSR Bluecore4 Bluetooth transceiver, p/n BC41B143A06-ANN-E4

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MPE compliance of Model: V301-336-IW-030 will also cover compliance of Model: V301-336-XWP-030, since the only difference in the latter is the removal of the GSM module.

Results of MPE calculations for the EUT in Bluetooth, WiFi and Cellular alone and BT/WiFi co-located with the cellular antenna configurations are included in the following pages.

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MPE Calculation for WiFi Only Operation (2J426 Antenna)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	WiFi		2400	22.40	0.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 1

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 20

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 20 cm) (mW/cm ²)	Cumulative Exposure (%)
1	2400	22.40	0.00	100	0.0346	3.46%
Total Cumulative Exposure						3.46%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.
 Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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MPE Calculation for Bluetooth Only Operation (RGFRA9937380A3T Antenna)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	Bluetooth		2400	-6.30	2.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 1

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 20

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 20 cm) (mW/cm ²)	Cumulative Exposure (%)
1	2400	-6.30	2.00	100	0.0001	0.01%
Total Cumulative Exposure						0.01%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.
 Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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Worst Case MPE Calculation for GSM Only Operation (2J426 Antenna)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	GSM	QIPPHS8-P	850	35.00	0.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 0.57

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 22

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 22 cm) (mW/cm ²)	Cumulative Exposure (%)
1	850	35.00	0.00	100	0.5199	91.75%
Total Cumulative Exposure						91.75%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.

Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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 2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

Worst Case MPE Calculation for 3G Only Operation (2J426 Antenna)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	3G	QIPPHS8-P	800	25.00	0.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 0.53

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 20

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 20 cm) (mW/cm ²)	Cumulative Exposure (%)
1	800	25.00	0.00	100	0.0629	11.80%
Total Cumulative Exposure						11.80%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.
 Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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Worst Case MPE Calculation for Multiple Co-located Tx Sources (BT, WiFi & GSM 850MHz)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	GSM	QIPPHS8-P	850	35.00	0.00
2	Bluetooth		2400	-6.30	2.00
3	WiFi		2400	22.40	0.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 0.57 Tx2 = 1 Tx3 = 1

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 22

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 22 cm) (mW/cm ²)	Cumulative Exposure (%)
1	850	35.00	0.00	100	0.5199	91.75%
2	2400	-6.30	2.00	100	0.0001	0.01%
3	2400	22.40	0.00	100	0.0286	2.86%
Total Cumulative Exposure						94.62%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.
 Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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 2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

Worst Case MPE Calculation for Multiple Co-located Tx Sources (BT, WiFi & 3G 800MHz)

Product Details

Tx Number	Description	FCC ID	Frequency (MHz)	RF Power (Max) (dBm)	Antenna Gain (Max) (dBi)
1	3G	QIPPHS8-P	800	25.00	0.00
2	Bluetooth		2400	-6.30	2.00
3	WiFi		2400	22.40	0.00

Limits for Maximum Permissible Exposure (MPE) (FCC 1.1310 Table 1)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(B) Limits for General Population/Uncontrolled Exposure				
300 to 1500	NA	NA	f/1500	30
1500 to 100,000	NA	NA	1	30

f = frequency in MHz.

* = Plane-wave equivalent power density.

Power Density Limits (mW/cm²): Tx1 = 0.53 Tx2 = 1 Tx3 = 1

MPE Calculations (based on Power Density)

Minimum Separation Distance for Co-located Tx (cm) = 20

Tx Number	Frequency (MHz)	RF Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Power Density (at 20 cm) (mW/cm ²)	Cumulative Exposure (%)
1	800	25.00	0.00	100	0.0629	11.80%
2	2400	-6.30	2.00	100	0.0001	0.01%
3	2400	22.40	0.00	100	0.0346	3.46%
Total Cumulative Exposure						15.26%

Calculations are based on the following formulae:

$$\text{Power Density} = \frac{(\text{Gain} \times \text{Power} \times \text{Duty Cycle})}{(4 \times \pi \times \text{Distance}^2)}$$

$$\text{Cumulative Exposure} = \frac{\text{Power Density at Tx Frequency}}{\text{Power Density Limit at Tx Frequency}} \quad (\text{per OET 65})$$

Note 1: Co-located transmitters are transmitters with antennas within 20cm of each other, which could be transmitting simultaneously.
 Note 2: Where there is only one transmitting antenna, any reference to co-location is invalid.

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Based on worst-case MPE calculations, the minimum separation distance for the Vector 301 (Models: V301-336-XWP-030 & V301-336-IW-030) product with co-located radios is 22cm between the transmission point (generally referring to the transmit antennas or structure) and the human body, which is to be clearly and prominently stated in the product manuals for the above listed combination of radios and maximum antenna gains.

The above minimum safety distance is not valid for transmit antennas with higher antenna gains.

Austest Summary and Recommendations

The equipment complies with FCC 47 CFR 1.1310: Limits for Maximum Permissible Exposure (MPE), Limits for General Population / Uncontrolled Exposure, when the indicated minimum separation distance is adhered to.

If compliance is sought for model numbers other than those listed in the test report, then the compliance folder must hold additional documentation, demonstrating the equivalence of the products between the different model numbers.

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