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 1023, New Zealand
Report Number:	0706COR_V301-336-IX_FCC(MPE) *[This report supersedes report 0523COR_V301-336-1X_FCC(MPE)]*
Date of Assessment	16 May 2016
File Number:	COR160421
Equipment Name:	V301
Equipment Model Nos:	V301-336-IX
Equipment FCC ID:	TXXV301-IX
Equipment Description:	Vehicle Tracking Device
Result:	**COMPLIES** (General Population/Uncontrolled Exposure)
Assessed by:	**Phillip Kane**
Approved by:	**Colin Gan** **Senior Engineer**
Date of Issue:	06 Jul 2016

Results appearing herein relate only to the sample(s) assessed through the submitted test report(s).

This report is issued errors and omissions exempt and is subject to withdrawal at Austest Laboratories discretion.

EQUIPMENT DETAILS	
MANUFACTURER:	Imarda NZ Ltd
MODELS:	V301-336-IX
OPERATING FREQUENCY:	Bluetooth: 2402 - 2480MHz 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 GSM: 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. FDD: 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:	BT/2G/3G: 2J426 non-integral combined antenna Notes 1 & 3 BT: *RGFRA9937380A3T* Surface mount antenna Notes 1 & 4
ANTENNA GAIN:	BT/2G/3G: 0dBi Notes 1 & 3 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.*

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)

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

MPE Calculation:

The transmitter antenna configurations for MPE considerations are as follows:

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

The Bluetooth 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 V301 (Model: V301-336-IX) 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
- CSR Bluecore4 Bluetooth transceiver, p/n BC41B143A06-ANN-E4

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

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/cm^2): 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:

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

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

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.

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/cm^2): 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:

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

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

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.

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/cm^2): 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:

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

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

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.

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

MPE CALCULATIONS (FCC)

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

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/cm^2): Tx1 = **0.57** Tx2 = **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%
				Total Cumulative Exposure		**91.76%**

Calculations are based on the following formulae:

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

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

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.

Worst Case MPE Calculation for Multiple Co-located Tx Sources (BT & 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

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/cm^2): Tx1 = **0.53** Tx2 = **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%
				Total Cumulative Exposure		**11.80%**

Calculations are based on the following formulae:

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

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

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.

Based on worst-case MPE calculations, the minimum separation distance for the V301 (Model: V301-336-IX) 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.