



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

|   |   |   |  |
|---|---|---|--|
| Client:   | GE Mining Industrea Mining Technology   |   |  |
| Address:  | 3 Co-Wyn Close, Fountaindale, NSW 2258, Australia   |   |  |
| Report Number:  | 0322GEI_PROD0847-2_FCC(MPE)<br><i>[This report supersedes report 0216GEI_CASIVU_FCC(MPE)]</i> |   |  |
| Date of Assessment  | 16 Feb 2016   |   |  |
| File Number:  | GEI150515-A   |   |  |
| Equipment Name:   | CAS IVU   |   |  |
| Equipment Model No:   | PROD0847-2  |   |  |
| Equipment FCC ID:   | YIY-PROD08472   |   |  |
| Equipment Description:  | Collision Avoidance System with 920MHz V2V Radio  |   |  |
| Result:   | <b>COMPLIES</b><br>(General Population/Uncontrolled Exposure)                                 |   |  |
| Assessed by:  | <b>Colin Gan</b>  |  |  |
| Approved by:  | <b>Phillip Kane</b>   |  |  |
| Date of Issue:  | 22 Mar 2016   |   |  |
| <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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| <b>EQUIPMENT DETAILS</b>   |   |
|--|---|
| <b>MANUFACTURER:</b>   | GE Mining Industrea Mining Technology   |
| <b>MODEL:</b>  | PROD0847-2  |
| <b>OPERATING FREQUENCY &amp; TRANSMITTER POWER INTO ANTENNA:</b> | <p><u>V2V Radio</u> <small>Note 1:</small><br/>           920MHz ..... 20.5dBm</p> <p><u>3G/GSM (PROD0847-2 only)</u> <small>Note 2:</small><br/>           824.2MHz – 848.8MHz ..... 1.585W (32.0dBm)<br/>           826.4MHz – 846.6MHz ..... 0.182W (22.6dBm)<br/>           1850.2MHz – 1909.8MHz ..... 0.933W (29.7dBm)<br/>           1852.4MHz – 1907.6MHz ..... 0.200W (23.1dBm)</p> <p><u>WiFi</u> <small>Note 3:</small><br/>           2412.0MHz – 2472.0MHz ..... 0.0327W<br/>           5180.0MHz – 5240.0MHz ..... 0.0217W<br/>           5260.0MHz – 5320.0MHz ..... 0.0233W<br/>           5500.0MHz – 5700.0MHz ..... 0.0211W<br/>           5745.0MHz – 5825.0MHz ..... 0.0063W</p> |
| <b>TYPE OF ANTENNA &amp; GAIN</b> <small>Note 4:</small>         | <p><u>V2V Radio:</u><br/>           Laird Technologies TRAB9023NP antenna ..... 4.0dBi</p> <p><u>3G/GSM (PROD0847-2 only):</u><br/>           Laird Technologies TRA6927M3xxN antenna<br/>           824.2MHz – 848.8MHz ..... 0dBi<br/>           826.4MHz – 846.6MHz ..... 0dBi<br/>           1850.2MHz – 1909.8MHz ..... 1.7dBi<br/>           1852.4MHz – 1907.6MHz ..... 1.7dBi</p> <p><u>WiFi:</u><br/>           Syskim OYH02ø22-NF antenna ..... &lt; 5.0dBi</p>   |

**Notes:**

1. Data taken from FCC Title 47 Part 15 Subparts A & C Test Report No. 0322GEI\_PROD0847-2\_FCC15C, dated 22 Mar 2016 by Austest Laboratories.
2. Data taken from FCC ID: N7NMC8705 Certification Grant (Single Modular).
3. Data taken from FCC ID: XF6-RS9110N1103 Certification Grant (Single Modular).
4. Data obtained from respective antenna specifications 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/cm<sup>2</sup>)</i> |
|------------------------------|--|
| 300 – 1500                   | f/1500                                   |
| 1,500 – 100,000              | 1.0                                      |

**MPE Calculation:**

The transmitter antenna configurations for MPE considerations are as follows:

1. V2V Radio + Cellular (824.2MHz) + WiFi (2412MHz) Worst Case Configuration.
2. V2V Radio + Cellular (824.2MHz) + WiFi (5260MHz) Worst Case Configuration.

Results of MPE calculations for the EUT in the stated configurations are included in the following pages.

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**Model PROD0847-2 - V2V Radio + Cellular (824.2MHz) + WiFi (2412MHz) Worst Case Configuration**

**Product Details (Model PROD0847-2)**

| Tx Number | Description | FCC ID          | Frequency (MHz) | RF Power (Max) (dBm) | Antenna Gain (Max) (dBi) |
|-----------|-------------|-----------------|-----------------|----------------------|--------------------------|
| 1         | V2V Radio   |                 | 920             | 20.50                | 4.00                     |
| 2         | Cellular    | N7NMC8705       | 824.2           | 32.00                | 0.00                     |
| 3         | WiFi        | XF6-RS9110N1103 | 2412            | 15.15                | 5.00                     |

**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 <sup>2</sup> ) | Averaging Time (Minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 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<sup>2</sup>): Tx1 = **0.61** Tx2 = **0.54** Tx3 = **1.00**

**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 <sup>2</sup> ) | Cumulative Exposure (%) |
|----------------------------------|-----------------|----------------|--------------------|----------------|--|-------------------------|
| 1                                | 920             | 20.50          | 4.00               | 100            | 0.0561   | 9.19%                   |
| 2                                | 824.2           | 32.00          | 0.00               | 100            | 0.3153   | 58.39%                  |
| 3                                | 2412            | 15.15          | 5.00               | 100            | 0.0206   | 2.06%                   |
| <b>Total Cumulative Exposure</b> |                 |                |                    |                |  | <b>69.64%</b>           |

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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## Model PROD0847-2 - V2V Radio + Cellular (824.2MHz) + WiFi (5260MHz) Worst Case Configuration

### Product Details (Model PROD0847-2)

| Tx Number | Description | FCC ID          | Frequency (MHz) | RF Power (Max) (dBm) | Antenna Gain (Max) (dBi) |
|-----------|-------------|-----------------|-----------------|----------------------|--------------------------|
| 1         | V2V Radio   |                 | 920             | 20.50                | 4.00                     |
| 2         | Cellular    | N7NMC8705       | 824.2           | 32.00                | 0.00                     |
| 3         | WiFi        | XF6-RS9110N1103 | 5260            | 13.67                | 5.00                     |

### 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 <sup>2</sup> ) | Averaging Time (Minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 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<sup>2</sup>): Tx1 = **0.61** Tx2 = **0.54** Tx3 = **1.00**

### 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 <sup>2</sup> ) | Cumulative Exposure (%) |
|----------------------------------|-----------------|----------------|--------------------|----------------|--|-------------------------|
| 1                                | 920             | 20.50          | 4.00               | 100            | 0.0561   | 9.19%                   |
| 2                                | 824.2           | 32.00          | 0.00               | 100            | 0.3153   | 58.39%                  |
| 3                                | 5260            | 13.67          | 5.00               | 100            | 0.0147   | 1.47%                   |
| <b>Total Cumulative Exposure</b> |                 |                |                    |                |  | <b>69.05%</b>           |

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 distances** between the transmission point (generally referring to the transmit antennas or structure) and the human body for the CAS IVU product (Model PROD0847-2) with co-located radios is **20cm**, which is to be clearly and prominently stated in the product manual 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 distances are 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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