EMC Technologies Pty Ltd
ABN 82 057 105 549
176 Harrick Road, Keilor Park
Victoria 3042, Australia

Ph: + 613 9365 1000
Fax: + 613 9331 7455
Email: sales@emctech.com.au

FCC MPE Calculation Report

Test Sample: Collison Avoidance System
Model Number: CAS-GPS NODE
Part Number: PROD1052-LF2 (FCC ID: YIY-PROD10522)
FCC ID: YIY-PROD10522

Report Number: M160206-3
Tested for: GE Mining Industrea Mining Technology

Date of Issue: 11 November 2016

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FCC Maximum Permissible Exposure (MPE) Calculation

EMC Technologies Report No. M160206-3

Issue Date: 11 November 2016

1.0 GENERAL INFORMATION

Report Number:	M160206-3
Test Sample:	Collison Avoidance System Node
Model:	CAS-GPS NODE
Part Number:	PROD1052-LF2
FCC ID:	YIY-PROD10522
Equipment Type:	Intentional Radiator (Transceiver)
Manufacturer:	GE Mining Industrea Mining Technology
Address:	3 Co-Wyn Close, Fountaindale, NSW, 2258, Australia
Phone:	+612 4336 1800
Contact:	Neil Mosley
Email:	neil.mosley@ge.com
Test Standard/s:	447498 D01 General RF Exposure Guidance v06
Calculation Summary:	A MPE calculation was performed according to 47CFR2.1091 for the Collison Avoidance System Node, model CAS-GPS NODE. The maximum percentage of MPE limit occurring at the minimum separation distance from the device was **9.8%**.
Test Date:	11 November 2016
Test Officer:	Mahan Ghassempouri EMC/EMR/SAR/Wireless Engineer M.Sc. in Telecommunication
Authorised Signatory:	Chris Zombolas Managing Director EMC Technologies

2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device assessed was a Collision Avoidance System Node, Model: CAS-GPS NODE. It included a transmitter operating at 920 MHz for Vehicle to Vehicle (V2V) communication, a Bluetooth transmitter at 2.4 GHz band and a ranging RF component (TOF) operating at 2.4 GHz band (spatial diversity antenna design). Transmit parameters are shown in table 1 and were provided by the customer. Refer to Appendix 1 for a reproduction of the specification sheet.

Table 1: DUT Parameters

Transmitter	Frequency (MHz)	Power (W)	Antenna Gain (dBi)	X-position (cm)	Y-position (cm)
1	920	0.1	3.32	0	2.5
2	2441	0.1	2	4	2.5
3	2441	0.01	1	-1.5	1

The X and Y coordinates are the location of the transmitters on the sample PCB with 0,0 being the PCB centre.

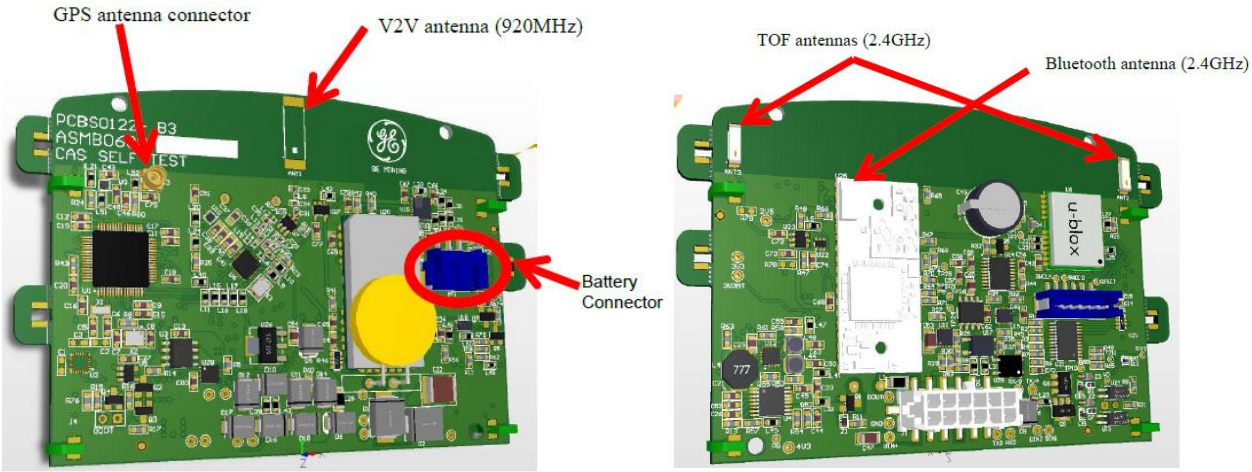

Figure 1: Location of transmitting antennas

2.2 Limits

As specified in table 1B of 47 CFR 1.1310 limits for occupational/controlled exposure and general public/uncontrolled exposure are as follows:

Frequency (MHz)	Power Density (mW/cm^2)
General public/Uncontrolled	
1500-100000	1
Occupational/Controlled	
1500-100000	5

2.3 Device Category

According to the manufacturer declaration and based on DUT intended use, it was considered a Mobile device.

For purposes of 47 CFR 2.1091, a mobile device was defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres was normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term “fixed location” means that the device was physically secured at one location and was not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that could be easily re-located, such as wireless devices associated with a personal computer, were considered to be mobile devices if they met the 20 centimetre separation requirement.

3.0 Method of Calculation

Calculation was done according to KDB 447498 D01 v06 and using excel sheet provided by FCC at http://transition.fcc.gov/oet/ea/presentations/files/oct05/MPE-mobile.xls

4.0 Calculation Results

Calculation results are shown in below table and graphical presentation of %MPE Contour is shown in Figure **2**.

Antenna No.	Total	1	2	3
Frequency (MHz)	-	920	2441	2441
Power (W)	0.210	0.100	0.100	0.010
Antenna Gain (dBi)	-	3.32	2.00	1.00
EIRP (W)	0.390	0.215	0.158	0.013
X (cm)	-	0.0	4.0	-1.5
Y (cm)	-	2.5	2.5	1.0
MPE General public/Uncontrolled Limit (mW/cm^2)	-	0.61	1.00	1.00
Max % of MPE limit	**9.8**	7.0	3.2	0.3

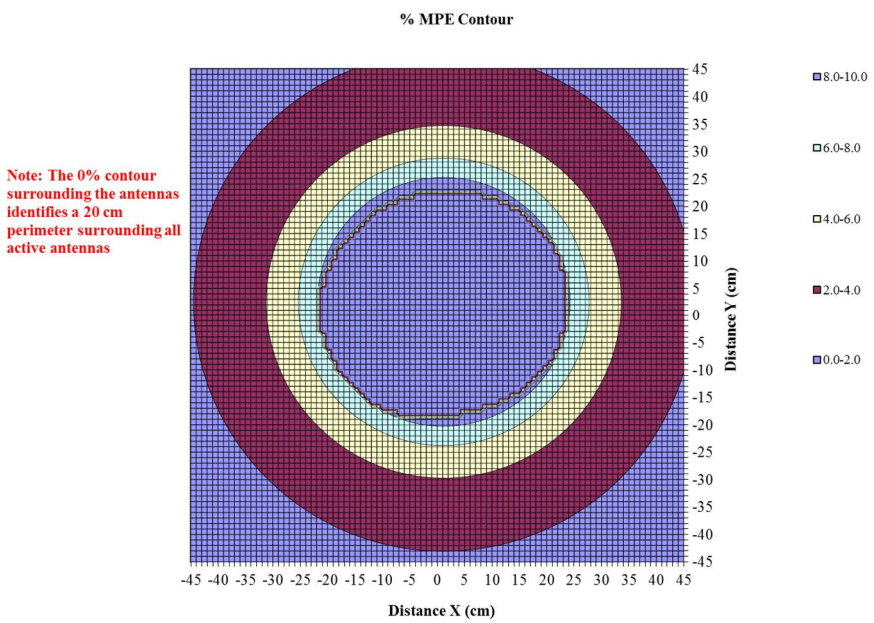

Figure 2: % MPE Contour for basic application without external antenna

Maximum percentage of MPE limit considering simultaneous transmission is **9.8%** occurring at minimum separation distance.

APPENDIX 1
Sample specifications as provided by the customer

GE Mining
Industrea
Mining Technology

CAS-SURFACE

CAS-GPS Node

Collision Avoidance System

SPECIFICATIONS

Packaging	Robust IP66 sealed enclosure with robust cable & connector. UV resistant black Acetal
GPS	Multi-GNSS. GPS, GLONASS, Galileo and QZSS compatible. Horizontal accuracy ± 2.5m * * (CEP, 50%, 24 hours static, -130 dBm, > 6 SVs)
V2V radio	REGION 1 (South Africa, Europe) 869.525 MHz Digital radio 100mW transmit power. 148 kbps data rate. (74 kHz symbol rate, 2 bits/ symbol), Single channel, 4GFSK Modulation (4 Gaussian Frequency Shift Keying, 12.6 kHz inner deviation). 576 bits per packet (288 symbols). 3800 µs packet duration. >320 ms packet repetition period. Duty cycle < 10%. (1.19%) 250 kHz -30dBm RF bandwidth. Spectrum Opportunity Detection 'listen-before-talk' mode of operation 1.67dBi nominal gain integral antenna. ERC 70-03 (G1.3 Wide Band Transmission) ITU emission code: F1DDT. REGION 2 (Brazil, Chile, Indonesia, USA, Canada, Australia, Mexico) 920 MHz Digital radio. 100mW transmit power. 1000 kbps data rate. (500 kHz symbol rate, 2 bits/ symbol), Single channel, 4GFSK Modulation (4 Gaussian Frequency Shift Keying, 125 kHz inner deviation). 960 bits per packet (490 symbols). 980 µs packet duration. 320ms packet repetition period. Duty cycle < 1%. (0.3%). 965 kHz 6dB RF bandwidth. Spectrum Opportunity Detection 'listen-before-talk' mode of operation 3.32dBi nominal gain integral antenna.
Ranging RF	2.4GHz IEEE 802.15.4a 0-250m, ±2m accuracy 100mW transmit power Spatial Diversity antenna design 2dBi nominal gain Integral antenna
Digital Output	Optional - 1 × configurable source / sink output Vin / GND @ 400mA/700mA Max
Digital Input	2 × inputs Common Ground (3.3 - 36Vdc Tolerant @30mA)
CAN interface	J1939 support, 250kbps
Serial interface	RS232 or RS485
***Bluetooth*® wireless technology**	Bluetooth v4.0 low energy & classic Bluetooth. 10mW transmit power 1.0dBi nominal gain Integral antenna
Internal Battery	Battery type: Li-Ion, 3.7V, 4800mAh, UN38.3 Certification 28hrs operation (GPS+V2V active) 24hrs operation (GPS+V2V+Ranging RF active) 8hrs charge time
Power Supply Input Voltage	12 / 24Vdc nominal, reverse polarity protected, ISO 7637-2 Level III compliant
Typical power consumption for 24V/12V input	30 mA/50 mA for CAS-GPS Node (200 mA/400 mA when charging backup battery)

CAS-GPS Node Technical Specification Specifications are subject to change Revision: A Dec 2015