

Intragrain Technologies, Inc **RF Exposure Exhibit**

SCOPE OF WORK

EMC TESTING – BIN-SENSE Live Master Unit, Model: 106101

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**RF Exposure Exhibit
(mobile devices)**

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Product Designation: BIN-SENSE Live Master Unit

Model Tested: 106101

FCC ID: 2AUTY-106103MU-V06

to

47CFR 2.1091

RSS-102 Issue 5

for

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Report No. 104915573MPK-004	
Equipment Under Test:	BIN-SENSE Live Master Unit
Trade Name:	Intragrain Technologies, Inc
Model(s) Tested:	106101
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Applicable Regulation:	47CFR 2.1091 RSS-102 Issue 5

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RF Exposure Summary

Test	Reference FCC	Reference Industry Canada	Result
Radio frequency Radiation Exposure Evaluation	47 CFR§2.1091	RSS-102 Issue 5	Complies

1.0 RF Exposure Limits

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limits for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and RSS-102 are followed.

2.1 FCC Limits

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3 – 3.0	614	1.63	*100	6
3.0 – 30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300 - 1500	...	...	F/300	6
1500 - 100,000	...	...	5	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3 – 1.34	614	1.63	*100	30
1.34 – 30	824/f	2.19/f	*180/f ²	30
30 – 300	27.5	0.073	0.2	30
300 - 1500	...	...	F/1500	30
1500 - 100,000	...	...	1.0	30

F = Frequency in MHz

* = plane wave equivalent density

2.2 Industry Canada Limits

According to RSS-102, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range	Electric Field	Magnetic Field	Power Density	Reference Period
(MHz)	(V/m rms)	(A/m rms)	(W/m ²)	(minutes)
0.003-10	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f ^{0.5}	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}
Note: f is frequency in MHz. * Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

2.0 Test Results (Mobile Configuration)

3.1 Classification

Radio is installed inside a mobile host device. The antenna of the product, under normal use condition, is at least 20 cm away from the body of the user and accessible to the end user. Warning statement to the user for keeping at least 20 cm or more separation distance with the antenna should be included in user's manual.

3.2 EIRP calculations

The BIN-SENSE Live Master Unit, Model: 106101 consists of 2 radios: Zigbee 2.4GHz & an approved cellular module (FCC ID: XPY1EIQ24NN).

3.3 Maximum RF Power

Frequency Range (MHz)	RF Output (dBm)	Antenna Gain ¹ (dBi)	Note
Zigbee 2410 – 2465	18.73	7.00	Conducted power measurements were taken from Report # 104915573MPK-001.
WCDMA 1900	23.50 ²	-0.80	Information taken from FCC ID: XPY1EIQ24NN

¹As declared by the manufacturer. Antenna gains below 0 are considered as 0 dBi.

²Highest power was used.

3.4 RF Exposure Calculation

3.4.1 RF Exposure calculation for 2.4GHz Zigbee

Calculations for this report are based on highest power measured.

Radio	Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm ²) @20 cm	FCC Limit (mW/m ²)	Results
Zigbee	2410 - 2465	25.73	374.1106	0.0745	1.0000	Complies

Radio	Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (W/m ²) @20 cm	RSS Limit (W/m ²)	Results
Zigbee	2410 - 2465	25.73	374.1106	0.7446	5.3630	Complies

3.4.2 Worst Case RF Exposure Calculation - Zigbee + WCDMA 1900 Cellular (Simultaneous Transmission)

Calculations for this report are based on highest power measured.

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm ²) @20 cm	FCC Limit (mW/cm ²)	MPE Ratio	Sum of MPE Ratios
1850 – 1915 WCDMA 1900	24.30	269.1535	0.0536	1.0000	0.0536	0.1280
2410 – 2465 Zigbee	25.73	374.1106	0.0745	1.0000	0.0745	

Frequency Range (MHz)	EIRP1 (dBm)	EIRP (mW)	Power Density (W/m ²) @20 cm	RSS Limit (W/m ²)	MPE Ratio	Sum of MPE Ratios
1850 – 1915 WCDMA 1900	24.30	269.1535	0.5357	4.4803	0.1196	0.2584
2410 – 2465 Zigbee	25.73	374.1106	0.7446	5.3630	0.1388	

The summation of the MPE ratio is less than 1, therefore, the EUT complies for the MPE requirement of simultaneous transmission.

Appendix A: Power Density Calculation

The Power Density can be calculated using the formula

$$S = \text{EIRP} / 4\pi D^2$$

Where: S is Power Density in mW/cm²

D is the distance from the antenna in cm.

4.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0/G104915573	AS	KV	March 02, 2022	Original document