

Fastenal Company RF Exposure Exhibit

SCOPE OF WORK

EMC TESTING – RFID Reader, Model Tested: 922194627

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104468298MPK-012

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**RF Exposure Exhibit
(mobile devices)**

Report Number: 104468298MPK-012

Project Number: G104468298

Issue Date: February 25, 2021

Product Designation: RFID Reader

Model Tested: 922194627

FCC ID: 2APK7-922194627V10

IC: 23979-92219462710

to

47CFR 2.1091

RSS-102 Issue 5

for

Fastenal Company

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Report No. 104468298MPK-012	
Equipment Under Test:	RFID Reader
Trade Name:	Fastenal Company
Model(s) Tested:	922194627
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Applicable Regulation:	47CFR 2.1091 RSS-102 Issue 5

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1.0 RF Exposure Summary

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

2.0 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).				

3.0 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 RFID Reader, Model: 922194627 consists of one LoRa radio and one RFID radio.

3.3 Maximum RF Power

RFID Reader, Model: 922194627 :

Frequency Range (MHz)	Max Output Power (dBm)	Antenna Gain ¹ (dBi)	EIRP (dBm)	Note
923.3 – 927.5 (Lora)	18.21	5.1	23.31	Output power was taken from report # 104468298MPK-003

Frequency Range (MHz)	Max Output Power (dBm)	Antenna Gain ¹ (dBi)	EIRP (dBm)	Note
902.7 – 927.2 (RFID)	12.32	5.5	17.82	Output power was taken from report # 104468298MPK-004

¹As declared by the manufacturer.

3.4 RF Exposure Calculation

3.4.1 RF Exposure calculation for LoRa, RFID Reader, Model: 922194627 :

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (W/m ²) @20 cm	RSS Limit (W/m ²)	Results
923.3 - 927.5	23.31	214.289	0.4263	2.784	Complies

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm ²) @20 cm	FCC Limit (mW/cm ²)	Results
923.3 - 927.5	23.31	214.289	0.0426	0.616	Complies

3.4.2 RF Exposure calculation for RFID, RFID Reader, Model: 922194627 :

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (W/m ²) @20 cm	RSS Limit (W/m ²)	Results
902.7 – 927.2	17.82	60.534	0.1204	2.741	Complies

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm ²) @20 cm	FCC Limit (mW/cm ²)	Results
902.7 – 927.2	17.82	60.534	0.0120	0.602	Complies

3.4.3 RF Exposure calculation for simultaneous operation:

Band	Max Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	# of simultaneous Channels ON	Total EIRP	
					W	dBm
923.3 – 927.5	18.21	5.1	23.31	1	0.214	23.31
902.7 – 927.2	12.32	5.5	17.82	1	0.061	17.82
Totals:				2	0.275	24.39

The highest simultaneous power measured power is +24.39dBm or 0.275W.

For FCC, Power Density = 0.055 mW/ cm², which is below the worst-case FCC limit of 0.602mWatts/ cm².

For ISED, Power Density = 0.55 W/ m², which is below the worst-case RSS limit of 2.741Watts/ m².

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/ G104468298	AC	KV	February 25, 2021	Original document