

RF Exposure Exhibit

EUT Name: Modular Card Reader with Proximity Sensor

Model No.: 1494712-00004 FCC ID: 2AQ8B-1494712; IC: 24390-1494712

CFR 47 Part 15.247 & RSS -247

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1 Test Methodology

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

1.1 RF Exposure Limit

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				
300 - 1500	F/300	6
1500 - 100,000	5	6
(B)Limits For General Population / Uncontrolled Exposure				
300 - 1500	F/1500	6
1500 - 100,000	1.0	30

F = Frequency in MHz

1.2 EUT Operating Condition

Fastenal Company supplied the following description of the EUT:

The software provided by manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually. Software provided enables to transmit on multi channels simultaneously.

1.2.1 Classification

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

1.3 Test Results

1.3.1 Antenna Gain

Device uses frequency range 2402 to 2480MHz

RF Output 4.5dBm See Test Report # 103632772MPK-001

Antenna(s) & Gain: Internal Antenna, Gain: -1.8dBi, see test report 103632772MPK-001, page 6

Type of modulation: DTS

Number of Channel(s): 40

1.3.2 Mobile Configuration

Calculations for this report are based on highest power measured for each band.

Band	Mode	Max Output Power dBm	Antenna gain (Max) dBi	EIRP/ERP	
				dBm	W
2402 – 2480MHz	DTS	4.5	-1.8	4.5	0.0028

Antenna gains below 0 are considered as 0dBi

Calculating the Power Density at 20cm:

Using the Friss transmission formula, the EIRP is $P_{out} * G$, and R is 20cm.

$P_d = EIRP / (1600\pi)$

$P_d = (2.8) / (1600\pi) = 0.00055 \text{ mW/cm}^2$, which is below the limit. Limit is 1.0 mWatts/cm^2

complies with mobile device requirements of Power density limit of 1.0 mWatts/cm^2 at 20cm.

1.3.3 Sample Calculation

The Friss transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where;

P_d = power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi \approx 3.1416$

R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).