RF Exposure Exhibit

EUT Name: Power Line Coordinator and Power Guardian

Model No.: P105467& 390-850 FCC ID: QPS01007; IC: 22326-01007

CFR 47 Part 15.247 & RSS -247

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Report/Issue Date: September 3, 2019

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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 PowerLine Coordinator™ is a rugged and reliable communication device that serves as an intermediary between the Smart Wires Field Devices (SWFDs) for power flow control and the PowerLine Gateway™. It is responsible for managing the ISM mesh and communication with the PowerLine Gateway for control and status reporting. The communication with the PowerLine Gateway is done via a proprietary and secure protocol over TCP/IP. The PowerLine Coordinator is an important component of the Smart Wires' End-to-End

(E2E) Communication and Control System that enables the utility to seamlessly commission, observe, control, and maintain the overall Smart Wires' solution.

Smart Wires Guardian technology increases transmission line reactance by injecting magnetizing reactance in series with the line.

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

PowerLine Coordinator

Uses FHSS Frequency range 902.4 to 926.944MHz

RF Output 19.48 dBm See Test Report # 104059097MPK-001

Antenna(s) & Gain: External Antenna, Gain: 5.0dBi, see test report 104059097MPK-001, page 6

Type of modulation: FHSS 2-FSK

Number of Channel(s): 64

1.3.2 Mobile Configuration

PowerLine Coordinator

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		# of simultaneous Channels ON	Total EIRP	
				dBm	W		W	dBm
902.4 – 926.944MHz	FHSS	19.48	5.0	24.48	0.280	1	0.280	24.48
					Totals:	1	**0.280**	**24.48**

Calculating the Power Density at 20cm: The highest simultaneous power measured power is 19.48dBm and EIRP is +24.48dBm or 0.280W.

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd= EIRP/(1600π)

Pd = (280) / (1600π) = 0.0056mW/ cm^2, which is below the limit. Limit is 1.0mWatts/ cm^2

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

1.3.3 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = 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).