RF Exposure Exhibit

EUT Name:	PUSH BUTTON HWR-D
FCC ID:	OG3-HWRPUSH
IC ID:	10447A-HWRPUSH
Rule Part:	CFR 47 Part 15.247
Report Issue Date:	January 4, 2019

Prepared For:	***Prepared by:***
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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

As instructed by the manufacturer, the EUT's power setting was set to 0 dBm on the low, middle and high frequencies/channels.

1.2.1 Classification

EUT is a mobile 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 Technical Product Description

Information presented below from Test Report 103479767MPK-014B; Page 6:

Applicant	Grundfos Holding A/S
Marketing Name	Push Button HWR-D
FCC Identifier	OG3-HWRPUSH
IC Identifier	10447A-HWRPUSH
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	14.84 dBm
Antenna(s) & Gain	Internal Antenna, Peak Gain: 2 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	39
Applicant Name & Address	Grundfos Holding A/S Poul Due Jensens Vej 7 8850 Bjerringbro Denmark

1.3.2 Calculating the Power Density at 20cm

EUT Frequency Range	Mode	Max Power Output		Peak Antenna Gain		EIRP	
		dBm	mW	dBi	Numerical	dBi	mW
2402-2480 MHz	BLE	14.84	30.48	2.00	1.58	16.84	48.31

Calculating the Power Density (Pd) at 20cm

Using the Friss transmission formula to solve for Power Density (Pd):

$Pd = (Pout*G) / (4*\pi*R^2)$

Pout = 30.48 mW

G = 1.58 Numerical Value

$\pi \approx 3.1416$

R = 20 cm

The highest EIRP (Pout*G) power measured power is 16.84 dBi or 48.31 mW.

Pd = 48.31 / 5024

Pd = 0.0096 mW/cm^2 or 0.096 W/m^2

The device COMPLIES with mobile device requirements of Power density limit of 1.0mW/ 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).