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RF Exposure Exhibit

EUT Name: Osborne IFC

Model Nos.: KI-00B401

CFR Part 1.1310 and RSS 102

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Contents

1   *Maximum Permissible Exposure*

1.1   *Test Methodology*

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. 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.

1.2   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/cm2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3-1.34	614	1.63	*(100)	6
1.34-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
30-1500	…	…	F/300	6
1500-100000	…	…	1.0	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
30-1500	…	…	F(MHz)/1500MHz	30
1500-100000	…	…	1.0	30

F = Frequency in MHz   *=Plane wave equivalent density
 As per FCC KDB   limit 9KHz to 0.3MHz are same as limit at 0.3MHz

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1.2.1   EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit at the maximum power for RFID KI-00B401. EUT transmits at 134.2 KHz into loop antenna 24cmx 25cm Antenna manufactured by Osborne Industries. Model Number is KR-FDE750.

1.2.2   Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the 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. So, this device is classified as a **Mobile Device**.

1.3   Test Results

1.3.1   Antenna details

The transmitting antenna is loop antenna 22cmx 19cm Antenna manufactured by Osborne Industries, antenna Model Number KR-FDE750. Maximum current in the loop   as per manufacturer 350 mA.

Number turns 32. Total current in loop 32x 0.35= 11.2 Amps

1.3.2   Output Power into Antenna & RF Exposure value at distance 20cm:

The following equation uses the law of Biot Savart for a circular current loop to obtain the magnetic induction, B, at a distance away from the center of the loop.

$$B_Z = \frac{\mu_0}{4\pi} \frac{2\pi R^2 I}{\left(z^2 + R^2\right)^{3/2}}$$

Simplified form of this Equation

$$B = \frac{\mu_0 i r^2}{2(r^2 + x^2)^{3/2}}$$

where

μ_0 is the permeability constant (1.26 x 10^{-6} H/m)
i is the current flowing in the loop (in amps)
r is the radius of the loop (in meters)
x is the distance, on axis, from the center of the current loop (in meters)

The following equation converts the magnetic induction to magnetic field.

For KI-00B401   induced magnetic field calculated as

B = 0.000063974 Tesla or 0.63974 Gauss

The following equation converts the magnetic induction to magnetic field.

$$H = \frac{B}{\mu_0} = \frac{ir^2}{2(r^2 + x^2)^{3/2}}$$

For calculation H filed worst case highest dimension the loop was used. The radius of the loop was taken as 11cm.

H field at cm the antenna

At 20cm with r= 11cm

11.2 X 0.0121/ 2 (0.0121+0.04) $^{3/2}$

= 5.69 A/m this is above limit of 1.63 A/m

Calculating the distance at which Magnetic field strength reaches 1.63A/m using the same equation

x was found to be 0.3464 meters

The antenna is required to be at least 35cm from all personnel at all times.

The Limits for General Population / Uncontrolled Exposure Magnetic field strength limit of 1.63 A/m at 0.3MHz was extended to the Transmitter frequency of 134.2MHz.

As stated, the EUT was found to be compliant to the requirements of the test standard(s).