MPE Calculations

Control4 Model: C4-HC250-BL

FCC ID: R33C4HC250
IC ID: 7848A-C4HC250

11734 South Election Road, Ste. 200 | Salt Lake City, Utah 84020 | www.control4.com | 801.523.3100 phone | 801.523.3199 fax

1.0 SCOPE:

This Report Demonstrates Evaluation and Compliance to the following standards:

1. **Code of Federal Regulations Title 47, Volume 1, Section 1.1310.**
2. **Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) - RSS-102 Issue 3**

2.0 REVISION LEVEL:

DATE	COMMENTS	REVISION
10/10/08	Created.	1.0
08/16/10	Added RSS-102 references	2.0

3.0 REFERANCE DOCUMENTS:

(A) Limits for Maximum Permissible Exposure (MPE). Code of Federal Regulations Title 47, Volume 1, Section 1.1310.
(B) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. OET Bulletin 67 Edition 97-01.
(C) Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) - RSS-102 Issue 3

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4.0 CALCULATIONS:

The C4-HC250-BL contains 2 Transceiver's (802.11 b/g/n & Zigbee). Below are the MPE calculations for both Transceiver's.

802.11 b/g/n Transceiver

The following worst case emissions was calculated by using Method 1 below

Method 1: Based on a PPt (Peak Power Total) measurement of the total power into the antenna and the worst case antenna gain.

Effective/Equivalent Isotropic Radiated Power [EIRP] dBm = Total power into the antenna [dBm] + antenna gain [dBi]
To convert the values from dBm to mW
$mW = 10^{dBm/10}$

Total power into the antenna (dBm) = 19.2
Antenna gain (dBi) = 0.04
EIRP (dBM) = 19.24
EIRP (mW) = 83.95 worst case while in the Wi-Fi "G" mode

Method 2: Based on the radiated field strength measurement at 3 meters [at a calibrated OATS site, maximizing the antenna polarity and height]

After obtaining the EIRP, the Power density is calculated and compared against the FCC and IC limits.

S_{FCC} = Power density in *mW/cm^2* for FCC
$S_{FCC} = EIRP/4\pi \cdot R^2$
EIRP = Equivalent isotropically radiated power 83.95 *mW*
R = Distance to the center of radiation of the antenna *20 cm*
S_{FCC} = 0.017 mW/cm^2

S_{FCC} Limit = 1.0 mW/cm^2

S_{IC} = Power density in *W/m^2* for IC
$S_{IC} = EIRP/4\pi \cdot R^2$
EIRP = Equivalent isotropically radiated power in watts 0.0839 *W*
R = Distance to the center of radiation of the antenna *0.2 m*
S_{IC} = 0.167 W/m^2

S_{IC} Limit = 10 *W/m^2* for IC

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Zigbee Transceiver

The following worst case emissions was calculated by using Method 1 below

Method 1: Based on a PPt (Peak Power Total) measurement of the total power into the antenna and the worst case antenna gain.

Effective/Equivalent Isotropic Radiated Power [EIRP] dBm = Total power into the antenna [dBm] + antenna gain [dBi]
To convert the values from dBm to mW
$mW = 10^{dBm/10}$

Total power into the antenna (dBm) = 15.4
Antenna gain (dBi) = 0.03
EIRP (dBM) = 15.43
EIRP (mW) = 34.91 worst case power level at 3 and amplifier gain to 10

Method 2: Based on the radiated field strength measurement at 3 meters [at a calibrated OATS site, maximizing the antenna polarity and height]

After obtaining the EIRP, the Power density is calculated and compared against the FCC and IC limits.

S_{FCC} = Power density in *mW/cm^2* for FCC
$S_{FCC} = EIRP/4\pi \cdot R^2$
EIRP = Equivalent isotropically radiated power 34.9 *mW*
R = Distance to the center of radiation of the antenna *20 cm*
S_{FCC} = 0.007 mW/cm^2

S_{FCC} Limit = 1.0 mW/cm^2

S_{IC} = Power density in *W/m^2* for IC
$S_{IC} = EIRP/4\pi \cdot R^2$
EIRP = Equivalent isotropically radiated power in watts 0.0349 *W*
R = Distance to the center of radiation of the antenna *0.2 m*
S_{IC} = 0.069 W/m^2

S_{IC} Limit = 10 *W/m^2* for IC

5.0 CONCLUSION:

1. **Based upon the limits for Maximum Permissible Exposure (MPE) given in Table 1 of reference document (A) as 1mW/cm^2, this device falls under the required limits.**
2. **Based upon the limits given in section 4.2 of the reference document (C) as 10W/m^2, this device falls under the required limits.**

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