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Date: **October 26, 2015**

RF exposure analysis for the equipment* Central Body Controller *(FCC ID: 2AEIM-1031503; IC: 20098-1031503)

1. Introduction

The device **Central Body Controller** (FCC ID: **2AEIM-1031503; IC: 20098-1031503**) contains the vehicle passive and RKE entry functions, Charge Port Handle receive functions, and other body electronics functions. It contains a 2.4GHz radio which operates in BlueTooth Low Energy mode (BTLE), a 22 KHz transmitter and a 315 MHz receiver and is designed to be installed in and used in mobile exposure conditions.

The antennas used for this device must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

2. MPE exposure limits

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm^2)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 5, section 4, titled “RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)”:

Frequency Range (MHz)	Power density (W/m^2)	Reference Period (minutes)
300 – 6000	$0.02619 f^{0.6834}$	6
6000 - 15000	10	6
15000 - 150000	10	$616000/ f^{1.2}$

Using the equation $S = \frac{PG}{4\pi R^2}$ to calculate the exposure to electromagnetic fields

where: S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Compliance with FCC and IC maximum permissive exposure limits is demonstrated based on the following calculations.

3. Standalone operation analysis:

Mode	Frequency Range (MHz)	CONDUCTED OUTPUT POWER (dBm)	CONDUCTED OUTPUT POWER (mW)	Antenna gain (dBi)	Antenna gain (numerical)	Duty cycle (%)	Evaluation distance (cm)	Power density (mW/cm^2)	FCC/IC MPE limit (mW/cm^2)	MPE RATIO
Bluetooth	2402-2480	0,55	1,135	3	2,00	100%	20	0,0005	0,5469	0,0008
							∑ of MPE ratios:	0,0008	<	1

Under all conditions the equipment complies with the FCC/IC MPE limits and the maximum MPE ratio obtained is 0,0008.

4. Standalone operation analysis: Co-location analysis

4.1. Co-location with other transmitter in mobile exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05r01, 7.2:

> *Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0.*

As the maximum calculated MPE ratio for the device is **0,0008**, the product can be co-located with other antennas providing that the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density is ≤ **1.0 – 0,0008 = 0,9992.**

4.2. Co-location with other transmitter in mixed mobile and portable host platform exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05r01, 7.2:

> *When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.*
>
> - *The [∑ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [∑ of MPE ratios] is ≤ 1.0.*
> - *The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the [∑ of MPE ratios] is ≤ 1.0.*

As the maximum calculated MPE ratio for the device is **0,0008**, the equipment can be co-located with other transmitters in a mixed mobile and portable conditions providing that the exposure of the co-located transmitter complies with:

- The [∑ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [∑ of MPE ratios] is ≤ 1.0 – **0,0008** = **0,9992**

OR

- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the [∑ of MPE ratios] is ≤ 1.0 – **0,0008** = **0,9992**

Sincerely,

P.A.

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