RF Exposure Evaluation

Product:	Bumper Car
Model no.:	ERV-I, BCU1, BCU2, BCU3, BCU4, BCU5, BCU6, BCU7, BCU8, BCU9, BCU10, ERV-II, ERV-III, ERV-IV, ERV-V, ERV-VI, ERV-VII, ERV-VIII, ERV-IX, ERV-X, ERV1, ERV2, ERV3, ERV4, ERV5, ERV6, ERV7, ERV8, ERV9, ERV10
FCC ID:	2A3NW-ERV-I
Rating:	Supplied by 12VDC Li-ion Rechargeable Battery 7Ah Charged by 12.0Vdc, 1.0A external adapter
RF Transmission Frequency:	2402MHz-2480MHz for BT 2405MHz-2479MHz for 2.4G Hopping
Modulation:	BT: GFSK, π/4-DQPSK, 8DPSK 2.4G Hopping: GFSK
Antenna Type:	PCB Antenna
Max Antenna Gain:	BT: -0.58dBi 2.4G Hopping: 0dBi
Description of the EUT:	EUT is a Bumper Car with Bluetooth and 2.4G Hopping function which operated at 2.4GHz.
Reference Report	68.940.23.0078.01 68.940.23.0079.01

1. Limit and Guidelines on Exposure to Electromagnetic Fields for Standalone SAR test exclusion

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06 4.3.1(a)
For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]
[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation25
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

1.1 Calculation method

[(max. power of` channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0

For Bluetooth
Radiated Power + tune up tolerance =-3.34 dBm=0.46 mW
Distance = 5 mm
f = 2.402 GHz

[0.46/5] * SQRT(2.402) =0.14
0.14< 3.0

For 2.4G Hopping Transmitter (2405-2479MHz)

According to ANSI C63.10-2013 (G.2 Field strength approach (linear terms)),

$$\mathrm{EIRP} = p_t \times g_t = (E \times d)^2 / 30 \qquad \text{(G.1)}$$

where

p_t is the transmitter output power in watts
g_t is the numeric gain of the transmitting antenna (dimensionless)
E is the electric field strength in V/m
d is the measurement distance in meters (m)

$$\mathrm{ERP} = \mathrm{EIRP}/1.64 = (E \times d)^2 / (30 \times 1.64) = (E \times d)^2 / 49.2 \qquad \text{(G.2)}$$

where all terms are as previously defined.

Field Strength (E_{Meas}):	53.13 (dBuV/m) (f=2440MHz)
Measurement Distance(d_{Meas}):	3 (m)
Equivalent Isotropically Radiated Power(EIRP):	-42.1dBm 0.000062 (mW)

Radiated Power + tune up tolerance = 0.000062 mW
Distance = 5 mm
f = 2.44 GHz

[0.000062/5] * SQRT(2.44) =0.00002
0.00002< 3.0

Therefore, excluded from standalone SAR testing.

2. Limit and Guidelines on Exposure to Electromagnetic Fields for Simultaneous transmission SAR test exclusion

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06 4.3.2(b)
When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)/x] W/kg, for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

This SAR estimation formula has been considered in conjunction with the SAR Test Exclusion Thresholds to result in substantially conservative SAR values of ≤ 0.4 W/kg.

2.1 Calculation method

For Bluetooth
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)/x] W/kg ≤ 0.4

Radiated Power + tune up tolerance =-3.34 dBm=0.46 mW
Distance = 5 mm
f = 2.402 GHz

[0.463/5] * SQRT(2.402)/7.5 =0.01915 W/kg
0.01915 W/kg < 0.4 W/kg

For 2.4G Hopping

According to ANSI C63.10-2013 (G.2 Field strength approach (linear terms)),

$$\mathrm{EIRP} = p_t \times g_t = (E \times d)^2 / 30 \qquad \text{(G.1)}$$

where

p_t is the transmitter output power in watts
g_t is the numeric gain of the transmitting antenna (dimensionless)
E is the electric field strength in V/m
d is the measurement distance in meters (m)

$$\mathrm{ERP} = \mathrm{EIRP}/1.64 = (E \times d)^2 / (30 \times 1.64) = (E \times d)^2 / 49.2 \qquad \text{(G.2)}$$

where all terms are as previously defined.

Field Strength (E_{Meas}):	53.13(dBuV/m) (f=2440MHz)
Measurement Distance(d_{Meas}):	3 (m)
Equivalent Isotropically Radiated Power(EIRP):	-42.03dBm 0.000063 (mW)

Radiated Power + tune up tolerance = 0.000063 mW
Distance = 5 mm
f = 2.44 GHz

[0.000063/5] * SQRT(2.44) /7.5=0.0000026 W/kg
0.0000026 W/kg < 0.4 W/kg

For the Sum total (Bluetooth and 2.4G Hopping)

0.01915 W/kg +0.0000026 W/kg = 0.0191526 W/kg < 0.4 W/kg

Therefore, excluded from simultaneous SAR testing.

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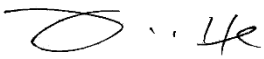
Reviewed by:



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