

Analysis Report

The Equipment Under Test (EUT), is a BIT Bitzee Interactive Hamsterball which contains two 2.4GHz Transceivers. One transceiver locates on the rotor while the other one locates on the stator. For both portions, the sample supplied operated on 4 channels, normally at 2420MHz, 2435MHz, 2450MHz and 2465 MHz .

The EUT is powered by 3 x 1.5V AA batteries. After switching on the EUT, the rotor will keep rotating and the LED on the rotor keeps flashing. The fast moving LEDs create an image based on which buttons are pressed.

Antenna Gain: 0 dBi

Rotor Portion

Frequency Range: 2420 MHz, 2435 MHz, 2450 MHz and 2465 MHz, 4 channels

Nominal rated field strength: 72.3dB μ V/m (peak)

Maximum allowed field strength of production tolerance: +/-3dB

Stator Portion

Frequency Range: 2420 MHz, 2435 MHz, 2450 MHz and 2465 MHz, 4 channels

Nominal rated field strength: 84.3dB μ V/m (peak)

Maximum allowed field strength of production tolerance: +/-3dB

According to the KDB447498 D01 v06:

For Rotor portion:

Radiated Power (maximum)
= 75.3 dB μ V/m (0.0102 mW)

For Stator portion:

Radiated Power (maximum)
= 87.3 dB μ V/m (0.162 mW)

The SAR Exclusion Threshold Level:

= $3.0 * (\text{min. test separation distance, mm}) / \text{sqrt}(\text{freq. in GHz})$
= $3.0 * 5 / \text{sqrt}(2.480)$ mW
= 9.53 mW

Since the above conducted output power is well below the SAR Exclusion threshold level, so the EUT is considered to comply with SAR requirement without testing.

Simultaneous Transmission SAR exclusion considerations

Since the 2.4GHz and Bluetooth transmitters of this device may operate simultaneously, simultaneous transmission analysis is required. Per KDB447498 D01 v06, simultaneous transmission SAR test exclusion can be applied when the sum of 1-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit ($\leq 1.6\text{W/kg}$). When the standalone SAR test exclusion is applied, the standalone 1-g SAR must be estimated according to the following equation,

$$\text{Estimated SAR} = (\sqrt{F(\text{GHz})} / 7.5) \times (P_{\text{max}} / TD)$$

where

$F(\text{GHz})$ is the RF channel transmit frequency in GHz

P_{max} is the max. power of channel, including tune-up tolerance, mW

TD is the min. test separation distance, mm

For rotor operation,

Maximum Peak Conducted Power of this device = 0.0102 mW (75.3dB μ V/m)

Therefore, the Estimated SAR will be determined as follow,

$$\begin{aligned} \text{Estimated SAR} &= (\sqrt{F(\text{GHz})} / 7.5) \times (P_{\text{max}} / TD) \\ &= \mathbf{0.000426 \text{ W/kg}} \end{aligned}$$

where $P_{\text{max}} = 0.0102 \text{ mW}$, $TD = 5 \text{ mm}$ and $F(\text{GHz}) = 2.465 \text{ GHz}$

For stator operation,

Maximum Peak Conducted Power of this device = 0.161 mW (87.3dB μ V/m)

Therefore, the Estimated SAR will be determined as follow,

$$\begin{aligned} \text{Estimated SAR} &= (\sqrt{F(\text{GHz})} / 7.5) \times (P_{\text{max}} / TD) \\ &= \mathbf{0.00675 \text{ W/kg}} \end{aligned}$$

where $P_{\text{max}} = 0.161 \text{ mW}$, $TD = 5 \text{ mm}$ and $F(\text{GHz}) = 2.465 \text{ GHz}$

Simultaneous Transmission Analysis

2.4GHz SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simultaneous SAR Required
0.000426	0.00675	0.00717	No

Conclusion

Since the above summed SAR result for all simultaneous transmission conditions were below the SAR limit (1.6 W/kg), SAR evaluation for simultaneous transmission configuration is not required.