Shenzhen Toby Technology Co., Ltd.

Maximum Permissible Exposure Evaluation

FCC ID: 2AUDF-DB325A

IC: 29207-DB325A

1. Client Information

Applicant	:	Shenzhen ADDX Innovation Technology co., LTD.
Address	:	NO. 2013, Building 9B-3. Shenzhen Bay, Technology and Ecological Park, Nanshan District, shenzhen, China
Manufacturer	:	Shenzhen ADDX Innovation Technology co., LTD.
Address	:	NO. 2013, Building 9B-3. Shenzhen Bay, Technology and Ecological Park, Nanshan District, shenzhen, China

2. General Description of EUT

EUT Name	:	Smart Battery Video Doorbell	
Models No.	:	DB3, ER04353	
HVIN	:	DB325A	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name.	
Sample ID	:	HC-C-202411-0215-01-01-1#&HC-C-202411-0215-01-01-2#	
Product Description	:	Operation Frequency:	SRD: 433.92MHz Bluetooth LE 5.0: 2402MHz~2480MHz 802.11b/g/n(HT20): 2412MHz~2462MHz
Power Rating	:	Input: DC 5V/1.5A DC 3.7V by 4500mAh 16.65Wh Rechargeable Li-ion battery	
Software Version	:	V1.9.7	
Hardware Version	:	DB325_C01_V2	
Connecting I/O Port(S)	:	Please refer to the User's Manual	
Remark	:	the MPE report used the EUT-2(HC-C-202411-0215-01-01-2#).	

TB-RF-073-3.0

3. Method of Measurement for FCC

3.1 Antenna Gain:

Antenna	Brand	Model Name	Type	Antenna Gain(dBi)
Bluetooth	N/A	N/A	PCB	-2.12

Antenna	Brand	Model Name	Type	Antenna Gain(dBi)
2.4G WIFI	N/A	N/A	FPC	3.82

Antenna	Brand	Model Name	Type	Antenna Gain(dBi)
433.92Mhz	N/A	N/A	Spring	-1.38

3.2 EUT Operation Condition:

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

3.3 Exposure Evaluation:

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=(PG)/4\pi R^2$$

Where

S: power density

P: power input to the antenna

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

3.4 Simultaneous transmission MPE Considerations

According to KDB447498: All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. 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 the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

This means that:

∑ of MPE ratios ≤ 1.0

3.5 Standalone MPE Evaluation:

Mode	**N$_{TX}$**	**Conducted Power(max) (dBm)**	**Turn-up Power (dB)**	**Max tune up power (dBm) [P]**	**ANT Gain (dBi) [G]**	**Distance (cm) [R]**	**Power Density (mW/cm^2) [S]**
Bluetooth LE Worst Maximum MPE Result							
BLE-1M	1	-2.277	-2±1	-1	-2.12	20	0.000097
BLE-2M	1	-2.391	-2±1	-1	-2.12	20	0.000097

Note:

N$_{TX}$= Number of Transmit Antennas

RF Output power specifies that Maximum Conducted Peak Output Power.

Mode	**N$_{TX}$**	**Conducted Power(max) (dBm)**	**Turn-up Power (dB)**	**Max tune up power (dBm) [P]**	**ANT Gain (dBi) [G]**	**Distance (cm) [R]**	**Power Density (mW/cm^2) [S]**
2.4G WiFi Worst Maximum MPE Result							
802.11b	1	15.16	15±1	16	3.82	20	0.01909
802.11g	1	13.49	13±1	14	3.82	20	0.01204
802.11n20	1	12.29	12±1	13	3.82	20	0.00957

Note:

N$_{TX}$= Number of Transmit Antennas

RF Output power specifies that Maximum Conducted Output Power.

Frequency (MHz)	Max. Output Power (dBuV/m)	Max. Output Power (dBm)	Turn-up Power Tolerance (dB)	Max power of tune up tolerance (dBm)	ANT Gain (dBi) [G]	Distance (cm) [R]	Power Density (mW/cm^2) [S]	Limit of Power Density (mW/cm^2) [S]
433.92MHz	74.40	-25.56	-25±1	-24	-1.38	20	0.00000058	0.28928

Note: For conducted measurements below 1000 MHz, the field strength shall be computed as specified in item d), and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6dB shall be added for frequencies below 30MHz.

$$E = EIRP - 20\log d + 104.8$$

where

E is the electric field strength in dBµV/m
$EIRP$ is the equivalent isotropically radiated power in dBm
d is the specified measurement distance in m

So: EIRP=E+20log3-104.8-(4.7 or 6)

Remark:

1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.
4. Only the worst power was evaluated for each wireless function

3.6 Conclusion:

As specified in Table 1B of 47 CFR 1.1310- Limits for Maximum Permissible Exposure (MPE),

Limits for General Population/ Uncontrolled Exposure

Frequency Range (MHz)	Power density (mW/ cm^2)
300-1,500	F/1500
1,500-100,000	1.0

3.7 Summary simultaneous transmission information

The sample supports three antennas for Bluetooth, WLAN and 433MHz.
The Bluetooth, WLAN and 433MHz can transmit simultaneous.
The Bluetooth, WLAN and 433MHz with three different Antenna.
According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑ of MPE ratios ≤ 1.0

3.8 Summary simultaneous transmission results

Bluetooth + 2.4G WIFI + 433MHz Maximum Simultaneous transmission MPE Ratios is

0.000097+0.01909+0.000002=0.019189≤1.0

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

4. Method of Measurement for IC

4.1. Applicable Standard

Radio Standards Specification 102, issue 6, Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands), sets out the requirements and measurement techniques for evaluating radio frequency exposure compliance of radio communication apparatus designed to be used within the vicinity of the human body.

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

4.2. Evaluation Method and Limit

According to RSS-102 §5 Table 7, RF field strength and power density limits for devices used by the
general public (uncontrolled environment)

Frequency range (MHz)	Electric field (V_{RMS}/m)	Magnetic field (A_{RMS}/m)	Power density (W/m²)	Reference period (minutes)
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\, f^{0.3417}$	$0.008335\, f^{0.3417}$	$0.02619\, f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\, f^{0.5}$	$4.21 \times 10^{-4}\, f^{0.5}$	$6.67 \times 10^{-5}\, f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

Frequency Band	f(MHz)	Limit of Power Density (W/m²)
Bluetooth LE	2402	5.35
2.4G WLAN	2412	5.37
SRD	433.92	1.66

Note: Limit=$0.02619 f^{0.6834}$ (where f is in MHz).
The f in the limit is the frequency of the lowest Channel.

4.3. Calculation Formula

Prediction of power density at the distance of the applicable MPE limit:
$S=PG/4\pi R^2$=Power density(in appropriate units, e.g W/m^2）

P=power input to antenna (in appropriate units, e.g W）
G=power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R=distance to the center of radiation of the antenna(in appropriate units, e.g m）

Simultaneous transmission MPE Considerations

According to KDB447498: All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. 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 the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.
This means that:
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4.4 Standalone MPE Evaluation:

Bluetooth LE Worst Maximum MPE Result								
Mode	**N$_{TX}$**	**Conducted Power(max) (dBm)**	**Turn-up Power (dB)**	**Max tune up power (dBm) [P]**	**ANT Gain (dBi) [G]**	**Distance (m) [R]**	**Power Density (W/m^2) [S]**	**Limit of Power Density (W/m^2) [S]**
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Note:
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2.4G WiFi Worst Maximum MPE Result								
Mode	**N$_{TX}$**	**Conducted Power(max) (dBm)**	**Turn-up Power (dB)**	**Max tune up power (dBm) [P]**	**ANT Gain (dBi) [G]**	**Distance (m) [R]**	**Power Density (W/m^2) [S]**	**Limit of Power Density (W/m^2) [S]**
802.11b	1	15.16	15±1	16	3.82	0.2	0.1909	5.37
802.11g	1	13.49	13±1	14	3.82	0.2	0.1204	5.37
802.11n20	1	12.29	12±1	13	3.82	0.2	0.0957	5.37

Note:
N$_{TX}$= Number of Transmit Antennas
RF Output power specifies that Maximum Conducted Output Power.

Frequency (MHz)	**Max. Output Power (dBuV/m)**	**Max. Output Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**ANT Gain (dBi) [G]**	**Distance (m) [R]**	**Power Density (W/m^2) [S]**	**Limit of Power Density (W/m^2) [S]**
433.92MHz	74.40	-25.56	-25±1	-24	-1.38	0.2	0.0000058	1.66

Note: For conducted measurements below 1000 MHz, the field strength shall be computed as specified in item d), and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6dB shall be added for frequencies below 30MHz.

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Remark:
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4.6 Summary simultaneous transmission results

Bluetooth + 2.4G WIFI + 433MHz Maximum Simultaneous transmission MPE Ratios is **0.00018131+0.03554935+0.00000349=0.03573415≤1.0**

-----END OF THE REPORT-----