

Maximum Permissible Exposure Report

1. Product Information

FCC ID: 2AEZA-SENTRYPRO

EUT : Smart Doorbell

Test Model : Sentry Pro

Serial Model No. : /

Model Declaration : /

Power Supply : Input: DC 5V/AC 24V

Bluetooth

Frequency Range : 2402MHz-2480MHz

Bluetooth Version : V4.0

Bluetooth Channel Number : 40 channels for Bluetooth V4.0 (BT LE)

Bluetooth Channel Spacing : 2MHz for Bluetooth V4.0 (BT LE)

Bluetooth Modulation Type : GFSK for Bluetooth V4.0 (BT LE)

Antenna Description : Ceramic Antenna, 3dBi(Max.)

Hardware Version : DR0002_BLE_P06

Software Version : CC2541_ML-FPM-013_FP0001_V1.0.0.1

2.4G WLAN

Frequency Range : 2412 – 2462 MHz

Channel Number : 11 Channels for 20MHz bandwidth (2412~2462MHz)
7 Channels for 40MHz bandwidth (2422~2452MHz)

Channel Spacing : 5MHz

Modulation Type : IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)
IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)

Antenna Description : FPC Antenna, 3dBi(Max.)

Hardware Version : DR0002_MAIN_P06

Software Version : 3516EV300_IMX307_DR0002_V1.0.2.2

SRD(915MHz)

Channel Number : 1

Modulation Technology : FSK

Antenna Description : Spring Antenna, 1dBi(Max.)

Hardware Version : DR0002_Sub_1g_P05

Software Version : CC1310F64_915_DR0002_1.0.0.1

Exposure category : General population/uncontrolled environment

EUT Type : Production Unit

Device Type : Mobile Device

2. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for 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 modelled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3. Limit

3.1 Refer Evaluation Method

[ANSI C95.1-2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz.

[FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE Calculation Method

Predication of MPE limit at a given distance

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 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

5. Antenna Information

Sentry Pro can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Antenna	Ceramic Antenna	2400 MHz –2500 MHz	3 dBi	BT Antenna
Antenna	FPC Antenna	2400 MHz –2500 MHz	3 dBi	WIFI Antenna

6. Conducted Power

[BLE Max Conducted Power]

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	-1.772
	19	2440	-2.591
	39	2480	-3.282

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
IEEE 802.11b	1	2412	7.36
	6	2437	7.46
	11	2462	8.69
IEEE 802.11g	1	2412	10.94
	6	2437	9.91
	11	2462	9.06
IEEE 802.11n HT20	1	2412	11.09
	6	2437	10.07
	11	2462	9.17
IEEE 802.11n HT40	3	2422	10.83
	6	2437	10.19
	9	2452	9.59

7. Measurement Results

BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-1.0	-2.0	-3.0
Tolerance \pm (dB)	1.0	1.0	1.0

2.4GWIFI

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	7.0	7.0	8.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.0	9.0	9.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			

Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	10.0	9.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	10.0	10.0	9.0
Tolerance \pm (dB)	1.0	1.0	1.0

8. Evaluation Results

8.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

BLE

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
GFSK	0.0	1.0000	3.0	0.0004	1.0000

2.4GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
IEEE 802.11b	9.0	7.9433	3.0	0.0032	1.0000
IEEE 802.11g	11.0	12.5893	3.0	0.0050	1.0000
IEEE 802.11n HT20	12.0	15.8489	3.0	0.0063	1.0000
IEEE 802.11n HT40	11.0	12.5893	3.0	0.0050	1.0000

Remark:

1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. $MPE \text{ values} = PG/4\pi R^2$

8.2 Simultaneous Transmission MPE

The EUT equipped with one BT module and one WLAN module. Each module has its own antenna and they can transmit at the same time. So need consider simultaneous transmission.

According to KDB447498 D01 General RF Exposure Guidance v06 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

Σ of MPE ratios ≤ 1.0

Simultaneous Transmission MPE			
Mode	Σ MPE ratios (mW/cm ²)	Limit (mW/cm ²)	Results
BT + WLAN	0.0067	1.0000	Pass

9. Conclusion

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

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