

RF Exposure Report

Product Information

EUT : MAIrobotics Gatekeeper
Model Number : Gatekeeper
Model Declaration : NA
Test Model : Gatekeeper
Power Supply : DC 3.8V by adapter
Hardware version : V1.0
Software version : V1.0
Sample ID : TZ201201885-2# &TZ201201885-4#

Bluetooth

Bluetooth Version : V5.0+EDR
Channel Number : 79 Channels for Bluetooth BR/EDR(DSS)
: 40 Channels for BLE (DTS)
Modulation Technology : GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth BR/EDR (DSS)
: GFSK for BLE (DTS)
Data Rates : Bluetooth BR/EDR (DSS): 1/2/3Mbps
: BLE (DTS): 1Mbps
Antenna Type And Gain : Internal Antenna :
0.5dBi

WiFi

WLAN : Supported IEEE 802.11a/b/g/n
IEEE 802.11b:2412-2462MHz
IEEE 802.11g:2412-2462MHz
IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz
WLAN FCC Operation Frequency : IEEE 802.11n HT40: 2422-2452MHz /5190-5230MHz
IEEE 802.11a: 5180-5240MHz
IEEE 802.11ac VHT20: 5180-5240MHz
IEEE 802.11ac VHT40: 5190-5230MHz
IEEE 802.11ac VHT80: 5210MHz
WLAN Modulation Technology : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type And Gain : Internal Antenna :
: 0.5dBi(Max.), for TX/RX (WLAN 2.4G Band)
0.5dBi(Max.), for TX/RX (WLAN 5.2G Band)

Note: Antenna position refer to EUT Photos.

2. Evaluation Method and Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc. "

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{(\text{min. test separation distance, mm})} \right] \cdot [\sqrt{f} \text{ (GHz)}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where:}$$

- f (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- 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 f) in section 4.1 is applied to determine SAR test exclusion.

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:

1) $\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{(\text{min. test separation distance, mm})} \right] \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg, for test separation distances } \leq 50 \text{ mm;}$

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.

3. Antenna Information

This Product can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Description	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 1	WiFi/BT Antenna	Internal Antenna	2400 MHz – 2500 MHz	0.5 dBi
			5150 MHz – 5250 MHz	0.5 dBi

4. Conducted Power

2.4G Band:

Bluetooth(BDR+EDR)

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	4.98
	39	2441	4.93
	78	2480	4.66
$\pi/4$ -DQPSK	00	2402	5.16
	39	2441	5.00
	78	2480	3.92
8-DPSK	00	2402	5.14
	39	2441	5.11
	78	2480	4.13

Bluetooth(BLE)

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	-8.34
	19	2440	-7.79
	39	2480	-7.9

WiFi 2.4GHz Band

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)
IEEE 802.11b	1	2412	14.57
	6	2437	13.05
	11	2462	14.24
IEEE 802.11g	1	2412	10.19
	6	2437	9.65
	11	2462	10.44
IEEE 802.11n HT20	1	2412	10.05
	6	2437	8.81
	11	2462	9.80
IEEE 802.11n HT40	3	2422	9.93
	6	2437	10.58
	9	2452	9.94

5G Band
UNII-1 Band

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)
11A	36	5180	11.43
	40	5200	11.77
	48	5240	12.05
11N20SISO	36	5180	11.19
	40	5200	11.10
	48	5240	11.87
11N40SISO	36	5190	8.16
	40	5230	8.26
11AC20SISO	48	5180	7.28
	38	5200	7.81
	46	5240	8.64
11AC40SISO	38	5190	7.91
	46	5230	8.26
11AC80SISO	42	5210	7.73

5. Manufacturing Tolerance

Bluetooth(BDR+EDR)

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.5	4.5	4.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ -DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.5	4.5	4.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.5	4.5	4.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0

Bluetooth(BLE)

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-8.0	-8.0	-8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

WiFi 2.4GHz Band

IEEE 802.11b (Maximum)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Maximum)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	9.5	9.5	9.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Maximum)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	9.5	9.5	9.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Maximum)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	10.0	10.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

UNII-1 Band

IEEE 802.11a (Maximum)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.5	11.5	11.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Maximum)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.5	11.5	11.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Maximum)			
Channel	Channel 38	Channel 46	--
Target (dBm)	8.0	8.0	--
Tolerance $\pm$ (dB)	1.0	1.0	--
IEEE 802.11ac VHT20 (Maximum)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Maximum)			
Channel	Channel 38	Channel 46	--
Target (dBm)	8.0	8.0	--
Tolerance $\pm$ (dB)	1.0	1.0	--
IEEE 802.11ac VHT80 (Maximum)			
Channel	Channel 42	--	--
Target (dBm)	8.0	--	--
Tolerance $\pm$ (dB)	1.0	--	--

6. Evaluation Results

Bluetooth(BDR+EDR)

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
GFSK	5.5	3.548	2.45	25	0.222	3.000	Yes
$\pi/4$ -DQPSK	5.5	3.548	2.45	25	0.222	3.000	Yes
8-DPSK	5.5	3.548	2.45	25	0.222	3.000	Yes

Bluetooth(BLE)

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
GFSK	-7.0	0.200	2.45	25	0.012	3	Yes

WiFi 2.4GHz Band

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
IEEE 802.11b	15.0	31.623	2.45	25	1.980	3	Yes
IEEE 802.11g	10.5	11.220	2.45	25	0.702	3	Yes
IEEE 802.11n HT20	10.5	11.220	2.45	25	0.702	3	Yes
IEEE 802.11n HT40	11.0	12.589	2.45	25	0.788	3	Yes

UNII-1 Band

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
IEEE 802.11a	12.5	17.783	5.20	25	1.622	3	Yes
IEEE 802.11n HT20	12.5	17.783	5.20	25	1.622	3	Yes
IEEE 802.11n HT40	9.0	7.943	5.20	25	0.725	3	Yes
IEEE 802.11ac VHT20	9.0	7.943	5.20	25	0.725	3	Yes
IEEE 802.11ac VHT40	9.0	7.943	5.20	25	0.725	3	Yes
IEEE 802.11ac VHT80	9.0	7.943	5.20	25	0.725	3	Yes

Remark:

1. Output power including tune-up tolerance;
2. When the minimum test separation distance is < 25 mm, a distance of 25 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

7. Simultaneous Transmission for SAR Exclusion

N/A

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06..

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