

Maximum Permissible Exposure Report

1. Product Information

EUT	: AllSafe Gateway
Test Model	: TBUDW
Power Supply	: For AC Adapter: Input: 100-240V, 50/60Hz, 0.5A Max Output: DC 5V, 3A
Hardware Version	: v1.3
Software Version	: v6.0.24
Bluetooth	:
Frequency Range	: 2402MHz ~ 2480MHz
Channel Number	: 79 channels for Bluetooth V5.0(BDR/EDR) 40 channels for Bluetooth V5.0(BT LE)
Channel Spacing	: 1MHz for Bluetooth V5.0 (BDR/EDR) 2MHz for Bluetooth V5.0(BT LE)
Modulation Type	: GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0 (BDR/EDR) GFSK for Bluetooth V5.0 (BT LE)
Bluetooth Version	: V5.0
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz-2462MHz
Channel Spacing	: 5MHz
Channel Number	: 11 channels for 20MHz bandwidth (2412~2462MHz) 7 channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	: IEEE 802.11b: DSSS (CCK,DQPSK,DBPSK); IEEE 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
WIFI 5GWLAN (U-NI-1)	:
Frequency Range	: 5180MHz-5240MHz 4 channels for 20MHz bandwidth (5180-5240MHz)
Channel Number	: 2 channels for 40MHz bandwidth (5190~5230MHz) 1 channels for 80MHz bandwidth (5210MHz)
Modulation Type	: IEEE 802.11a/n/ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
WIFI 5GWLAN (U-NI-2A)	:
Frequency Range	: 5260MHz-5320MHz 4 channels for 20MHz bandwidth (5260-5320MHz)
Channel Number	: 2 channels for 40MHz bandwidth (5270~5310MHz) 1 channels for 80MHz bandwidth (5290MHz)
Modulation Type	: IEEE 802.11a/n/ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
WIFI 5GWLAN (U-NI-2C)	:
Frequency Range	: 5500MHz-5700MHz 11 channels for 20MHz bandwidth (5500-5700MHz)
Channel Number	: 5 channels for 40MHz bandwidth (5510~5670MHz) 1 channels for 80MHz bandwidth (5530MHz)
Modulation Type	: IEEE 802.11a/n/ac: OFDM (64QAM, 16QAM, QPSK, BPSK)

WIFI 5GWLAN (U-NI-3) :

Frequency Range	: 5745MHz-5825MHz 5 channels for 20MHz bandwidth (5745-5825MHz)
Channel Number	: 2 channels for 40MHz bandwidth (5755~5795MHz) 1 channels for 80MHz bandwidth (5775MHz)
Modulation Type	: IEEE 802.11a/n/ac: OFDM (64QAM, 16QAM, QPSK, BPSK) one Internal Antenna for WiFi and Bluetooth, and another External Antenna for Bluetooth(BT LE)
Antenna Description	: ANT0 used for WIFI/Bluetooth TX/RX, 3.5dBi (Max.) for 2.4G and 2.3dBi (Max.) for 5GHz Band; ANT1 used for Bluetooth(BT LE) 2.0dBi (Max.)
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

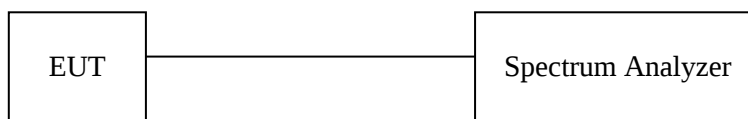
5. Antenna Information

TBUDW can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna	Bluetooth	External Antenna	2.4GHz – 2.5 GHz	2.0 dBi
Antenna	Bluetooth/WLAN	Internal Antenna	2.4GHz – 2.5 GHz/5GHz	3.5dBi (Max.) for 2.4G and 2.3dBi (Max.) for 5GHz Band;

6. Conducted Power

6.1 Test Setup Block Diagram



6.2 Test Procedure

- 1) The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the Block diagram;
- 2) Reading peak power.

6.3 Conducted Power Results

<BT LE> Ant1

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	6.281
	19	2440	6.991
	39	2480	6.495

<WLAN 2.4GHz Conducted Power> Ant0

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11b	1	2412	13.1
	6	2437	13.1
	13	2472	13.0
IEEE 802.11g	1	2412	13.1
	6	2437	13.2
	13	2472	13.3
IEEE 802.11n HT20	1	2412	12.6
	6	2437	12.7
	13	2472	12.7
IEEE 802.11n HT40	1	2412	13.3
	11	2462	11.5

<WLAN 5GHz U-NI-1 Conducted Power> Ant0

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power(dBm) Ant0
IEEE 802.1a	36	5180	14.3
	40	5200	14.4
	48	5240	14.4
IEEE 802.11n HT20	36	5180	9.4
	40	5200	11.2
	48	5240	11.2
IEEE 802.11n HT40	38	5190	13.2
	46	5230	14.2
IEEE 802.11ac VHT80	42	5210	11.5

<WLAN 5GHz U-NI-2A Conducted Power> Ant0

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power(dBm) Ant0
IEEE 802.1a	52	5260	14.5
	56	5280	14.2
	64	5320	14.0
IEEE 802.11n HT20	52	5260	11.1
	56	5280	10.9
	64	5320	13.5
IEEE 802.11n HT40	54	5270	14.3
	62	5310	13.9
IEEE 802.11ac VHT80	58	5290	11.3

<WLAN 5GHz U-NI-2C Conducted Power> Ant0

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm) Ant0
IEEE 802.1a	100	5500	9.7
	116	5580	9.8
	140	5700	9.3
IEEE 802.11n HT20	100	5500	9.3
	116	5580	8.1
	140	5700	7.7
IEEE 802.11n HT40	102	5510	13.2
	110	5550	9.3
	134	5670	12.1
IEEE 802.11ac VHT80	106	5530	10.7
	122	5610	13.1

<WLAN 5GHz U-NI-3 Conducted Power> Ant0

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power(dBm) Ant0
IEEE 802.1a	149	5745	11.4
	157	5785	11.5
	165	5825	12.2
IEEE 802.11n HT20	149	5745	11.9
	157	5785	12.1
	165	5825	12.3
IEEE 802.11n HT40	151	5755	12.9
	159	5795	13.1
IEEE 802.11ac VHT80	155	5775	13.1

<BT Conducted Power> Ant0

Mode	channel	Frequency (MHz)	Conducted Peak output power (dBm)
GFSK - BT LE	0	2402	2.4
	19	2440	2.0
	39	2480	1.1
GFSK	0	2402	4.9
	39	2441	4.2
	78	2480	3.6
$\pi/4$ -DQPSK	0	2402	1.0
	39	2441	0.3
	78	2480	-0.4
8DPSK	0	2402	1.5
	39	2441	0.8
	78	2480	0.2

7. Manufacturing Tolerance

<BT LE> Ant1

GFSK (Peak)

Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	6.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

WiFi 2.4G Ant0

Ant0

IEEE 802.11b (Peak)

Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11g (Peak)

Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11n HT20 (Peak)

Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11n HT40 (Peak)

Channel	Channel 1	Channel 11
Target (dBm)	13.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0

WLAN 5GHz U-NI-1 Ant0

Ant0

IEEE 802.11a (Average)

Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11n HT20 (Average)

Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	9.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11n HT40 (Average)

Channel	Channel 38	Channel 46
Target (dBm)	13.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0

IEEE 802.11ac VHT80 (Average)

Channel	Channel 42
Target (dBm)	11.0
Tolerance $\pm$ (dB)	1.0

WLAN 5GHz U-NI-2A Ant0

Ant0			
IEEE 802.11a (Average)			
Channel	Channel 52	Channel 56	Channel 64
Target (dBm)	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 52	Channel 56	Channel 64
Target (dBm)	11.0	10.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n(40MHz) (Average)			
Channel	Channel 54		Channel 62
Target (dBm)	14.0		13.0
Tolerance ±(dB)	1.0		1.0
IEEE 802.11ac(80MHz) Average)			
Channel	Channel 58		
Target (dBm)	11.0		
Tolerance ±(dB)	1.0		

WLAN 5GHz U-NI-2C Ant0

Ant0			
IEEE 802.11a (Average)			
Channel	Channel 100	Channel 116	Channel 140
Target (dBm)	9.0	9.0	9.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 100	Channel 116	Channel 140
Target (dBm)	9.0	8.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 102	Channel 110	Channel 134
Target (dBm)	13.0	9.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 106	Channel 122	
Target (dBm)	10.0	13.0	
Tolerance $\pm$ (dB)	1.0	1.0	

WLAN 5GHz U-NI-3 Ant0

Ant0			
IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151		Channel 159
Target (dBm)	12.0		13.0
Tolerance ±(dB)	1.0		1.0
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155		
Target (dBm)	13.0		
Tolerance ±(dB)	1.0		

Bluetooth Ant0

BT LE-GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	2.0	2.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.0	4.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
$\pi/4$DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	0.0	-1.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	0.0	0.0
Tolerance ±(dB)	1.0	1.0	1.0

8. Measurement 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.

[BT LE-ANT 1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	7.0	5.0119	2.0	1.5849	0.0016	1.0000

[BT -ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BT LE-GFSK	3.0	1.9953	3.5	2.2387	0.0009	1.0000
GFSK	5.0	3.1623	3.5	2.2387	0.0014	1.0000
$\pi/4$ DQPSK	2.0	1.5849	3.5	2.2387	0.0007	1.0000
8DPSK	2.0	1.5849	3.5	2.2387	0.0007	1.0000

[2.4GWLAN-ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	14.0	25.1189	3.5	2.2387	0.0112	1.0000
IEEE 802.11g	14.0	25.1189	3.5	2.2387	0.0112	1.0000
IEEE 802.11n HT20	13.0	19.9526	3.5	2.2387	0.0089	1.0000
IEEE 802.11n HT40	14.0	25.1189	3.5	2.2387	0.0112	1.0000

[5.2GWLAN-ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	15.0	31.6228	3.5	2.2387	0.0141	1.0000
IEEE 802.11n HT20	12.0	15.8489	3.5	2.2387	0.0071	1.0000
IEEE 802.11n HT40	15.0	31.6228	3.5	2.2387	0.0141	1.0000
IEEE 802.11ac VHT80	12.0	15.8489	3.5	2.2387	0.0071	1.0000

[5.3GWLAN-ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	15.0	31.6228	3.5	2.2387	0.0141	1.0000
IEEE 802.11n HT20	14.0	25.1189	3.5	2.2387	0.0112	1.0000
IEEE 802.11n HT40	15.0	31.6228	3.5	2.2387	0.0141	1.0000
IEEE 802.11ac VHT80	11.0	12.5893	3.5	2.2387	0.0056	1.0000

[5.5G WLAN-ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	10.0	10.0000	3.5	2.2387	0.0045	1.0000
IEEE 802.11n HT20	10.0	10.0000	3.5	2.2387	0.0045	1.0000
IEEE 802.11n HT40	14.0	25.1189	3.5	2.2387	0.0112	1.0000
IEEE 802.11ac VHT80	14.0	25.1189	3.5	2.2387	0.0112	1.0000

[5.8G WLAN-ANT 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	13.0	19.9526	3.5	2.2387	0.0089	1.0000
IEEE 802.11n HT20	13.0	19.9526	3.5	2.2387	0.0089	1.0000
IEEE 802.11n HT40	14.0	25.1189	3.5	2.2387	0.0112	1.0000
IEEE 802.11ac VHT80	14.0	25.1189	3.5	2.2387	0.0112	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8.2 Simultaneous Transmission MPE

The EUT equipped with one Internal Antenna for WiFi and Bluetooth, and another External Antenna for Bluetooth(BT LE) has two antennas need consider simultaneous transmission, All module 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;

$\sum$ of MPE ratios ≤ 1.0

Simultaneous Transmission MPE				
BT LE-ANT 1	5.2G WLAN-ANT 0	$\sum$ MPE ratios	Limit	Results
0.0016	0.0141	0.0157	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-----